STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
3100 Port of Benton Blvd • Richland, WA 99354 • 509-372-7950
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February 19, 2020 20-NWP-028

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Richland, Washington 99352

Ty Blackford, President and CEO
CH2M HILL Plateau Remediation Company
PO Box 1600, MSIN: A7-01
Richland, Washington 99352

Re: Transmittal of Agency Initiated Draft Permit Modification 8C.2020.2D of the *Hanford Facility Resource Conservation and Recovery Act Permit, Dangerous Waste Portion, Revision 8C, for the Treatment, Storage, and Disposal of Dangerous Waste*, Part III, Operating Unit Group 10, Waste Treatment and Immobilization Plant (WTP Permit), WA7890008967

Reference: See page 3

Dear Addressees:

This letter transmits the Department of Ecology's (Ecology) proposed draft permit modification 8C.2020.2D to the Part III, Operating Unit Group 10, Waste Treatment and Immobilization Plant, of the *Hanford Facility Resource Conservation and Recovery Act Permit, Dangerous Waste Portion, Revision 8C, for the Treatment, Storage, and Disposal of Dangerous Waste*.

The Permittees are the United States Department of Energy – Office of River Protection as owner/operator and Bechtel National, Inc. as co-operator.

Ecology received Package WTP-002, with letter 19-ECD-0066 REISSUE (Reference), and accepts the package for inclusion into an Agency Initiated Permit Modification. The WTP-002 Package includes the draft Preliminary Risk Assessment and associated documents to be incorporated into the WTP Permit, completing Interim Compliance Schedule Item EMF-9.

The proposed Agency Initiated Modification focuses on the draft *Pre-Demonstration Test Risk Assessment for the Hanford Tank Waste Treatment and Immobilization Plant* for Ecology review, as required by Permit Condition III.10.C.11.b and Interim Compliance Schedule Item EMF-9 of the WTP Permit.

The draft Risk Assessment Work Plan for the Direct Feed Low Activity Waste Configuration and the Pre-Demonstration Test Risk Assessment for the Hanford Tank Waste Treatment and Immobilization Plant used the best available information with approved models, including the United States Environmental Protection Agency combustion risk assessment guidance and conservative exposure scenarios and assumptions.

Ecology will hold a 45-day public comment period from February 24, 2020 through April 9, 2020, as required by Washington Administrative Code 173-303-840(3)(d) for a draft permit modification. A public hearing is not scheduled, but Ecology will consider holding one if there is enough interest.

Before making any final permitting decisions, Ecology will consider all comments received during the public comment period for the draft permit modification.

The proposed draft permit modification is on the enclosed DVD and is also available on Ecology's website at: https://ecology.wa.gov/Waste-Toxics/Nuclear-waste/Public-comment-periods.

Copies of the DVD are also available at the Hanford Public Information Repositories in Richland, Spokane, and Seattle, Washington, as well as Portland, Oregon. A hard copy and DVD is also on file at the locations listed below:

Department of Ecology
Nuclear Waste Program
3100 Port of Benton Boulevard
Richland, Washington 99354

United States Department of Energy
Administrative Record
2440 Stevens Center Place
Richland, Washington 99354

Individuals can request copies of the DVD by contacting Ecology's Resource Center at (509) 372-7950.

If there are any questions, please contact Annette Carlson, Dangerous Waste Permitting Project Manager, at annette.carlson@ecy.wa.gov or (509) 372-7897, or Mandy Jones, Permit Coordinator, at mandy.jones@ecy.wa.gov or (509) 372-7916.

Sincerely,

Stephanie Schleif

Stephanie Schleif
Deputy Program Manager
Nuclear Waste Program

ac/ag
Enclosure

cc: See page 3

Reference: Letter 19-ECD-0066 REISSUE, dated August 29, 2019, "Reissue - Submittal of Hanford Facility Resource Conservation and Recovery Act Package WTP-002 for the Preliminary Risk Assessment for the Hanford Tank Waste Treatment and Immobilization Plant"

cc electronic w/o enc:

Dave Bartus, EPA
David Einan, EPA
Mary Beth Burandt, USDOE-ORP
Lori Huffman, USDOE-ORP
Christopher Kemp, USDOE-ORP
Glyn Trenchard, USDOE-ORP
Duane Carter, USDOE-RL
Joe Franco, USDOE-RL
Mostafa Kamal, USDOE-RL
Tony McKarns, USDOE-RL
Lori Fritz, BNI
Brian Ponte, BNI
Felice Presti, BNI
Brittany Sparks, BNI
Bob Bullock, CHPRC
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Eric Van Mason, WRPS
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Suzanne Dahl, Ecology
Mandy Jones, Ecology
Stephanie Schleif, Ecology
Dan Thompson, Ecology

cc w/enc, DVD:

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Brittany Sparks, BNI
Mason Murphy, CTUIR
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Rex Buck, Jr., Wanapum
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Susan Leckband, HAB
Ken Niles, ODOE
John Fowler, ACHP
Robin Priddy, BCAA
Matthew Drumheller, USACE
Trevor Fox, USFW
Mike Livingston, WDFW
John Martell, WDOH
John Wiesman, WDOH
Randy Treadwell, WSDA
Allyson Brooks, WSDAHP
Cindy Preston, WSDNR
BNI Correspondence Control
CHPRC Correspondence Control
Environmental Portal
Gonzaga University Foley Center Library
Hanford Facility Operating Record
MSA Correspondence Control
PNNL Correspondence Control
Portland State University Library, Government Information
University of Washington Suzzallo Library, Government Publications
USDOE-ORP Correspondence Control
USDOE Public Reading Room, CIC
USDOE-RL Correspondence Control
USEPA Region 10 Hanford Field Office Correspondence Control
WRPS Correspondence Control

cc w/enc, DVD and hard copy:

Hanford Administrative Record: Hanford Site-wide Permit
NWP Central File

Waste Treatment and Immobilization Plant Risk Assessment Permit Modification

Public comment period

February 24 - April 9, 2020

Please submit comments

Electronically (preferred) via:

http://nw.ecology.commentinput.com/?id=F6msi

By U.S. Mail, or hand-delivery:

Daina McFadden
3100 Port of Benton Blvd
Richland WA 99354

Public hearing

A public hearing is not scheduled, but if there is enough interest, we will consider holding one. To request a hearing or for more information, contact:

Daina McFadden
509-372-7950
Hanford@ecy.wa.gov

Special accommodations

To request ADA accommodation including materials in a format for the visually impaired, call Ecology at 360-407-6831 or visit https://ecology.wa.gov/accessibility.

People with impaired hearing may call Washington Relay Service at 711.

People with speech disability may call TTY at 877-833-6341.

Public comment invited

The Washington State Department of Ecology (Ecology) is proposing an agency-initiated permit modification to the Hanford Facility Resource Conservation and Recovery Act Permit, Revision 8C.

The proposed changes affect the dangerous waste portion for the *Treatment, Storage, and Disposal of Dangerous Waste for the Waste Treatment and Immobilization Plant*, located in Part III, Operating Unit Group 10 (Permit).

The Waste Treatment Plant (WTP) is located on the Hanford Site in southeastern Washington. The plant will immobilize in glass (vitrify) 56-million gallons of dangerous radioactive and chemical waste currently stored in 177 underground storage tanks at Hanford.

The permittees are:

U.S. Department of Energy, Office of River Protection
P.O. Box 450
Richland, Washington 99352

Bechtel National, Inc.
2435 Stevens Center Place
Richland, Washington 99354

Ecology invites you to comment on the Preliminary Risk Assessment Permit Modification (8C.2020.2D), February 24 through April 9, 2020.

The proposed changes incorporate the draft Preliminary Risk Assessment and the Risk Assessment Work Plan for the Direct Feed Low-Activity Waste (DFLAW) configuration.

Risk Assessment Work Plan Supplements 2 through 5 would also be updated for incorporation into the Permit.

Background

WTP includes multiple facilities: Analytical Laboratory (Lab), Low-Activity Waste (LAW) Facility, High-Level Waste (HLW) Facility, Pretreatment Facility (PTF), Effluent Management Facility (EMF), and Balance of Facilities (BOF).

WTP will operate in two processing configurations. For near-term operations, WTP will operate in the DFLAW configuration, which requires the Lab, LAW, and EMF to become operational first to process the low-activity waste from tank farms.

In the DFLAW configuration, the waste is pretreated to remove cesium and solids before the waste is sent to the LAW facility. In this configuration, the pretreated waste will bypass the PTF and be fed directly from the tank farms to the LAW facility. The LAW facility is where the low-activity fraction of the waste will be solidified by vitrification.

The liquid effluents generated in the LAW facility and the Lab are transferred and treated at EMF, which will reduce the effluent volume by evaporation. WTP will later operate in the baseline configuration when the PTF and the High-Level Waste Facility become operational.

These draft documents will support revisions to Appendix 6.2, Risk Assessment Work Plan and Appendix 6.3, Pre-Demonstration Test Risk Assessment Report as required by Interim Compliance Schedule Item number EMF-9, and WTP Unit specific permit conditions III.10.C.11.a and III.10.C.11.b.

In 2015, Ecology provided the draft WTP Risk Assessment Work Plan and associated supplements for public review; however, the Direct Feed Low-Activity Waste configuration was not addressed in the document at that time. Since 2015, the WTP Permit has been modified to include the DFLAW configuration.

Proposed Changes

This permit modification will update and add new documents to the WTP portion of the Permit to support the Risk Assessment for the DFLAW configuration. Updates to the documents in Appendix 6.2 of the WTP portion of the Permit are necessary to ensure the DFLAW configuration has been adequately analyzed and reviewed through the Risk Assessment Work Plan.

This permit modification also provides the draft *Pre-Demonstration Test Risk Assessment for the Hanford Tank Waste Treatment and Immobilization Plant* for Ecology review, as required by Permit Condition III.10.C.11.b and Interim Compliance Schedule EMF-9 of the WTP portion of the Permit.

The draft Risk Assessment Work Plan for the Direct Feed Low Activity Waste Configuration and the Pre-Demonstration Test Risk Assessment for the Hanford Tank Waste Treatment and Immobilization Plant use the best available information, approved models, U.S. Environmental Protection Agency combustion risk assessment guidance, and conservative exposure scenarios and assumptions.

The following draft documents will be provided to support this agency-initiated permit modification to the WTP portion of the Permit:

New Documents:

- Pre-Demonstration Test Risk Assessment for the Hanford Tank Waste Treatment and Immobilization Plant

Risk Assessment Work Plan for the Direct Feed Low-Activity Waste Configuration Revised Documents:

- Emissions Study for the Hanford Tank Waste Treatment and Immobilization Plant
- Cell Emissions Estimate
- Chemical Parameters and Toxicological Inputs for the Environmental Risk Assessment for the Hanford Tank Waste Treatment and Immobilization Plant
- Hanford Tank Waste Treatment and Immobilization Plant Risk Assessment Air Quality Modeling Protocol

Reviewing the proposed changes

Ecology invites to you to review and comment on this proposed agency initiated modification to Appendix 6.2, Risk Assessment Work Plan and Appendix 6.3, Pre-Demonstration Test Risk Assessment Report, of the WTP Permit. See Page 1 for comment period dates and information on how to submit comments.

Copies of the application for the proposed permit and supporting documentation will be available during the public comment period online at Ecology's website at https://www.ecology.wa.gov/Waste-Toxics/Nuclear-waste/Public-comment-periods. The documents will also be available at the Hanford Public Information Repositories listed on the last page.

Ecology will consider and respond to all significant comments received during the public comment period. We will document our responses and issue a response to comments document when we make our final permitting decision.

Figure 1 Effluent Management Facility

Nuclear Waste Program
3100 Port of Benton Blvd
Richland, WA 99354

Hanford's Information Repositories and Document Review Locations

Washington

Richland
Ecology Nuclear Waste Program
Resource Center
3100 Port of Benton Blvd.
Richland, WA 99354
509-372-7950

U.S. Department of Energy
Administrative Record
2440 Stevens Drive, Room 1101
Richland, WA 99354
509-376-2530

Washington State University Tri-Cities
Department of Energy Reading Room
2770 Crimson Way, Room 101L
Richland, WA 99354
509-375-7443

Seattle
University of Washington
Suzzallo Library
P.O. Box 352900
Seattle, WA 98195
206-543-5597

Spokane
Gonzaga University
Foley Center
502 E Boone Avenue
Spokane, WA 99258
509-313-6110

Oregon

Portland
Portland State University
Millar Library
1875 SW Park Avenue
Portland, OR 97207
503-725-4542

DEPARTMENT OF
ECOLOGY
State of Washington

STATEMENT OF BASIS

Proposed Permit Modification to Part III of the *Hanford Facility Resource Conservation and Recovery Act Permit, Dangerous Waste Portion, Revision 8C, for the Treatment, Storage, and Disposal of Dangerous Waste,* WA7890008967, Operating Unit Group 10, Waste Treatment and Immobilization Plant

February 2020

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STATEMENT OF BASIS

Proposed Permit Modification to Part III of the *Hanford Facility Resource Conservation and Recovery Act Permit, Dangerous Waste Portion, Revision 8C, for the Treatment, Storage, and Disposal of Dangerous Waste*, WA7890008967, Operating Unit Group 10, Waste Treatment and Immobilization Plant

PERMITTEES

United States Department of Energy
Office of River Protection
(Owner/Operator)
P.O. Box 450, MSIN H6-60
Richland, Washington 99352

Bechtel National, Inc.
2435 Stevens Center Place
Richland, Washington 99354

The Washington State Department of Ecology (Ecology) developed this Statement of Basis in accordance with the requirements of Washington Administrative Code (WAC) 173-303-840(2)(f). Its purpose is to discuss the proposed draft permit modification to Part III of the *Hanford Facility Resource Conservation and Recovery Act Permit, Dangerous Waste Portion, Revision 8C, for the Treatment, Storage, and Disposal of Dangerous Waste* (hereafter called the Hanford Site-wide Permit).

This proposed draft permit modification will add the following documents to Operating Unit Group 10, Waste Treatment and Immobilization Plant (WTP), Part III of the Hanford Site-wide Permit: the Pre-Demonstration Test Risk Assessment for the Hanford Tank Waste Treatment and Immobilization Plant and the Risk Assessment Work Plan for the Direct Feed Low-Activity Waste (DFLAW) Configuration. The Proposed modification will also add revisions to documents already incorporated in the WTP Permit.

This Statement of Basis is divided into five sections:

1.0 Hanford Facility Dangerous Waste Permit (Site-Wide Permit) Background
2.0 WTP Permitting Process
3.0 WTP Operating Unit Group Description
4.0 Agency-initiated Permit Modification Process for the WTP Operating Unit Group
5.0 Procedures for Reaching a Final Decision on the Draft Permit Modification

1.0 Hanford Facility Dangerous Waste Permit (Site-wide Permit) Background

Ecology's Nuclear Waste Program (NWP) oversees management of dangerous waste within the State by writing permits to regulate its treatment, storage, and disposal.

Ecology has the authority to regulate dangerous waste and the dangerous waste components of mixed (radioactive and dangerous) waste, under 70.105 RCW and WAC 173-303. The Hanford Site-wide Permit has requirements for the treatment, storage, and disposal of dangerous and mixed waste at Hanford. Ecology does not regulate waste that is solely radioactive. The U.S. Department of Energy (USDOE) has the exclusive authority to regulate radioactive materials and radioactive waste at Hanford.

Ecology first issued the Hanford Site-wide Permit in 1994. Since 1994, the permit has been modified many times to incorporate changes or updates and to incorporate and closeout several Dangerous Waste Management Units (DWMUs).

The Hanford Site-wide Permit provides standard and general facility conditions as well as unit group conditions for the operation, closure, and post-closure care of mixed and dangerous waste Treatment, Storage, and Disposal (TSD) Units at Hanford. These TSDs are administratively grouped into operating, closure, or post-closure unit groups in the Hanford Site-wide Permit. Each unit group may contain one or more DWMU.

The Hanford Site-wide Permit is organized as follows:

Part I	Standard Conditions.
Part II	General Facility Conditions.
Part III	Operating Units.
Part IV	Corrective Action for Past Practice Units.
Part V	Closure Units.
Part VI	Post-Closure Units.

2.0 WTP PERMITTING PROCESS

We are using a phased (or stepped) approach to permit the WTP TSD Unit. The initiation of the phased permitting to support WTP was completed on September 25, 2002, with issuance of a final Dangerous Waste Permit allowing construction of the Low-Activity Waste (LAW) Facility, Pretreatment Facility (PTF), High-Level Waste Facility (HLW), Analytical Laboratory (LAB) Facility, and Balance of Facilities (BOF). The initial issuance of the WTP Permit supported the Baseline Configuration of the Facility. In the Baseline Configuration, the PTF and the HLW Facility will be used to support the treatment of high-level waste from the double-shell tanks. Tank waste will be sent directly from the Tank Farms to the PTF where it will be pretreated and sent to either the HLW Facility or the LAW Facility, depending on the waste characterization. In the future, the Permittees will provide Ecology with updated information in support of the Baseline Configuration. Ecology will review permit documents and design and provide them for public review and eventual incorporation into the WTP Permit. The current Consent Decree Milestone to start operations at PTF and HLW is 2033.

Since 2002 the Permittees have been submitting design documents and other information for Ecology approval as written in the Interim Compliance Schedules. The WTP Interim Compliance Schedules require that the Permittees provide Ecology additional detailed information and design documents to support construction and operations of regulated portions of the WTP Dangerous Waste Management Units.

In 2016 Ecology agreed through Consent Decree milestones to operate a portion of the WTP Facility under the Direct Feed Low-Activity Waste configuration, allowing operations of only the LAW, LAB, Effluent Management Facility (EMF), and BOF, while portions of the Baseline Configuration would remain in the construction phase.

To prepare for the DFLAW operations, Ecology has been actively incorporating permit documents and design into the WTP Permit. To reflect this new path forward, the WTP Permit includes language to reflect an operating and construction permit.

To support the anticipated startup of operations in the DFLAW Configuration the Permittees have been submitting documentation as required in the Interim Compliance Schedule for LAW, LAB, EMF, and BOF. These Interim Compliance Schedule Items require updating portions of the Dangerous Waste Permit Application to include operational language in permit conditions and chapters. With this permit modification, the Preliminary Risk Assessment and Risk Assessment Work Plan for DFLAW will be incorporated into the WTP Permit. This submittal from the permittees completes Interim Compliance Schedule Item EMF-9.

When all of the required permitting steps are completed, the WTP TSD Unit will comply with all the applicable requirements of WAC 173-303. Then, after receiving written permission from Ecology, the Permittees can begin treatment and storage of dangerous and mixed waste at the WTP under both the DFLAW and Baseline Configurations.

3.0 WTP OPERATING UNIT GROUP DESCRIPTION

The WTP includes multiple facilities: LAB, LAW Facility, HLW Facility, PTF, EMF, and BOF.

The WTP will be operated in two processing configurations. For near-term operations, WTP will be operated in the DFLAW configuration requiring the LAB, LAW, EMF, and BOF to become operational first to process the low-activity waste from tank farms.

In the DFLAW configuration, the waste is pretreated to remove cesium and solids before the waste is sent to the LAW facility. In this configuration, the pretreated waste will bypass the PTF and be fed directly from the tank farms to the LAW facility. The LAW facility is where the low-activity fraction of the waste will be solidified by vitrification.

The liquid effluents generated in the LAW facility and the LAB are transferred and treated at EMF, which will reduce the effluent volume by evaporation. WTP will later be operated in the Baseline Configuration when the PTF and the HLW Facility become operational.

4.0 AGENCY-INITIATED PERMIT MODIFICATION PROCESS FOR THE WTP OPERATING UNIT GROUP

Proposed Modification to Part III of the Hanford Site-wide Permit

The draft documents for public review will support revisions to Appendix 6.2, "Risk Assessment Work Plan," and Appendix 6.3, "Pre-Demonstration Test Risk Assessment Report," as required by Interim Compliance Schedule Item number EMF-9, and WTP Unit specific permit conditions III.10.C.11.a and III.10.C.11.b. Specifically, the following documents are proposed to be incorporated into the permit:

- Pre-Demonstration Test Risk Assessment for the Hanford Tank Waste Treatment and Immobilization Plant.
- Risk Assessment Work Plan for the Direct Feed Low-Activity Waste Configuration.

The following revised documents are proposed to be updated in the permit:

- Emissions Study for the Hanford Tank Waste Treatment and Immobilization Plant.
- Cell Emissions Estimate.
- Chemical Parameters and Toxicological Inputs for the Environmental Risk Assessment for the Hanford Tank Waste Treatment and Immobilization Plant.
- Hanford Tank Waste Treatment and Immobilization Plant Risk Assessment Air Quality Modeling Protocol.

The Preliminary Risk Assessment will provide an estimate of human health and ecological receptor risk based on engineering estimates of emissions from WTP units. The Final Risk Assessment will be conducted following collection of data from performance demonstration testing of WTP units, where estimated emission rates will be supplemented with the actual emissions results of the demonstration tests. The receptor exposure timelines evaluated in the preliminary risk assessment report are consistent with the timelines presented on Figure 7-3 of the DFLAW risk assessment work plan (24590-WTP-RPT-ENV-18-003) and on Figure 7-7 of the baseline risk assessment work plan (24590-WTP-RPT-ENV-14-002).

The DOE and Ecology have long discussed how best to assess the cumulative impacts of contamination sources across the Central Plateau. It is Ecology's expectation that a cumulative risk assessment be developed that combines the impacts or results from the operations of the DFLAW Configuration and the future operations of Baseline Configuration.

In 2015, Ecology provided the draft WTP Risk Assessment Work Plan and associated supplements for public review; however, the Direct Feed Low-Activity Waste configuration was not addressed in the document at that time. Since 2015, the WTP Permit has been modified to include the DFLAW configuration.

5.0 PROCEDURES FOR REACHING A FINAL DECISION ON THE DRAFT PERMIT MODIFICATION

The Washington State Dangerous Waste Regulations in WAC 173-303-830 describe the types of changes or modifications that may be made to a Dangerous Waste Permit issued by Ecology.

This draft permit modification was prepared according to the procedures in WAC 173-303-830(4)(d). As required by WAC 173-303-830(4)(d), draft permits issued by Ecology will have at least a 45-day public comment period. The public comment period for this draft permit will be February 24 through April 9, 2020.

Comments must be post-marked, received by e-mail, or hand-delivered no later than close of business (5:00 p.m. PST) April 9, 2020.

Direct all comments to (electronic preferred):

Daina McFadden

Washington State Department of Ecology
3100 Port of Benton Boulevard
Richland, Washington 99354

http://nw.ecology.commentinput.com/?id=F6msi

Ecology will consider and respond to all written comments on this draft permit modification that are submitted by the April 9, 2020 deadline. At the completion of the 45-day public comment period Ecology will make a final permitting decision. If the final decision is to issue the permit, Ecology will issue a final permit for Part III of the Hanford Site-wide Permit, Operating Unit Group 10, Waste Treatment and Immobilization Plant. If the final decision includes substantial changes to the draft permit modification because of public comment, Ecology will consider initiating a new public comment period.

A public hearing is not scheduled, but if there is enough interest Ecology will consider holding one.

To request a hearing, or for more information, contact:

Daina McFadden
Washington State Department of Ecology
(509) 372-7950

E-mail address: hanford@ecy.wa.gov

Ecology will also issue a Response to Comments document to the Permittees and the public upon issuance of the final permit. The final permit modification may be appealed within 30 days after issuance. If there is no appeal, the permit will be effective 30 days following issuance.

Copies of the following documents for Part III, Operating Unit Group 10, WTP are available for review at the Hanford Public Information Repositories locations listed below.

For additional information call (509) 372-7950 or e-mail hanford@ecy.wa.gov.

Hanford Public Information Repositories and Administrative Records

Richland, Washington

Ecology Nuclear Waste Program Resource Center
3100 Port of Benton Blvd. Richland, WA 99354
509-372-7950

U.S. Department of Energy Administrative Record
2440 Stevens Drive, Room 1101 Richland, WA 99354
509-376-2530

Washington State University Tri-Cities
Department of Energy Reading Room
2770 Crimson Way, Room 101L Richland, WA 99354
509-375-7443

Other Locations:

Portland

Portland State University
Branford Price Millar Library
1875 Southwest Park Avenue
Portland, Oregon 97201
(503) 725-4542

Spokane

Gonzaga University
Foley Center
502 East Boone Avenue
Spokane, Washington 99258
(509) 313-6110

Seattle

University of Washington Suzzallo Library
P.O. Box 352900
4000 15th Avenue Northeast
Seattle, Washington 98195
(206) 543-5597

Information on the proposed permit modification is also available online at http://www.ecy.wa.gov/programs/nwp/commentperiods.htm. If special accommodations are needed for public comment, contact Ecology's Nuclear Waste Program at (509) 372-7950.

WASTE TREATMENT AND IMMOBILIZATION PLANT
CHANGE CONTROL LOG

Change Control Logs ensure that changes to this unit are performed in a methodical, controlled, coordinated, and transparent manner. Each unit addendum will have a "**Last Modification Date**" which represents the last date the portion of the unit has been modified. The "**Modification Number**" represents Ecology's method for tracking the different versions of the permit. This log will serve as an up to date record of modifications and version history of the unit.

Last modification to Waste Treatment and Immobilization Plant **October 29, 2019**

Chapters	Last Modification Date	Modification Number
Unit-Specific Conditions	10/29/2019	24590-LAW-PCN-ENV-19-003 (8C.2019.Q4)
1.0 Part A Form	07/01/2019	8C.2019.2F
2.0 Topographic Map	09/05/2017	8C.2017.6F
3.0 Waste Analysis Plan	06/2011	
3A Waste Treatment Plant Waste Analysis Plan	12/6/2018	24590-WTP-PCN-ENV-18-012 (8C.2018.Q4)
3B Quality Assurance Project Plan for Waste Analysis Plan	09/05/2017	8C.2017.6F
4.0 Process Information	07/01/2019	8C.2019.2F
4A Figures and Drawings	09/05/2017	8C.2017.6F
4C Compliance with Uniform Building Code Seismic Design Requirements	11/17/2008	
4D Pretreatment Facility	10/01/2018	24590-WTP-PCN-ENV-18-003 (8C.2018.Q4)
4E Low-Activity Waste Vitrification Facility	12/7/2018	24590-WTP-PCN-ENV-18-001 (8C.2018.Q4)
4F High-Level Waste Vitrification Facility	10/01/2018	24590-WTP-PCN-ENV-18-003 (8C.2018.Q4)
4G Direct-Feed Low-Activity Waste (Effluent Management Facility)	05/17/2018	8C.2018.2F
4H Analytical Laboratory	03/22/2019	24590-WTP-PCN-ENV-18-013 (8C.2019.Q1)
4I Balance of Facilities	07/01/2019	8C.2019.2F
5.0 Reserved		
6.0 Procedures to Prevent Hazards	09/05/2017	8C.2017.6F
6A Inspection Plan	04/05/2018	8C.2018.1F
7.0 Contingency Plan	04/30/2019	24590-WTP-PCN-ENV-19-001 (8C.2019.Q2)
8.0 Personnel Training	04/05/2018	8C.2018.1F
9.0 Reserved		

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Chapters	Last Modification Date	Modification Number
10.0 Reserved		
11.0 Closure Plan	09/05/2017	8C.2017.6F
11A Sampling and Analysis Plan for Closure of WTP Facility	05/23/2016	8C.2016.Q1
12.0 Reporting and Recordkeeping	08/2011	
Appendices	**Last Modification Date**	**Modification Number**
Appendices 1: WTP Interim Compliance Schedule	06/12/2019	24590-WTP-PCN-ENV-19-002 (8C.2019.Q2)
Appendices 2: Critical Systems for the WTP	09/05/2017	8C.2017.6F
Appendices 3: Reserved		
Appendices 4: Reserved		
Appendices 5: Reserved		
Appendices 6: Risk Assessment	01/28/2016	8C.2016.1F
Appendices 7: WTP Documents Applicable to all Regulated Areas	07/01/2019	8C.2019.2F
Appendices 8: Pretreatment Facility	07/06/2017	8C.2017.2F
Appendices 9: Low-Activity Waste Building	10/29/2019	24590-LAW-PCN-ENV-19-003 (8C.2019.Q4)
Appendices 10: High-Level Waste Building	02/01/2018	8C.2017.Q4
Appendices 11: Laboratory Building	06/13/2019	24590-LAB-PCN-ENV-19-001 (8C.2019.Q2)
Appendices 12: Balance of Facilities	07/06/2017	8C.2017.2F
Appendices 13: Effluent Management Facility	08/29/2019	24590-BOF-PCN-ENV-19-002 (8C.2019.Q3)

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WASTE TREATMENT AND IMMOBILIZATION PLANT
PART III, OPERATING UNIT GROUP 10 – SPECIFIC CONDITIONS

CHANGE CONTROL LOG

Change Control Logs ensure that changes to this unit are performed in a methodical, controlled, coordinated, and transparent manner. Each unit addendum will have its own change control log with a modification history table. The "**Modification Number**" represents Ecology's method for tracking the different versions of the permit. This log will serve as an up to date record of modifications and version history of the unit.

Modification History Table

Modification Date	Modification Number
10/22/2019	24590-BOF-PCN-ENV-19-005 (8C.2019.Q4)
07/01/2019	8C.2019.2F
03/22/2019	24590-WTP-PCN-ENV-18-013 (8C.2019.Q1)
01/31/2019	24590-WTP-PCN-ENV-18-011 (8C.2019.Q1)
12/7/2018	24590-WTP-PCN-ENV-18-001 (8C.2018.Q4)
10/16/2018	24590-LAW-PCN-ENV-18-005 (8C.2018.Q4)
09/13/2018	24590-LAW-PCN-ENV-17-013 (8C.2018.Q3)
08/30/2018	8C.2018.3F
06/08/2018	24590-LAW-PCN-ENV-17-006 (8C.2018.Q2)
06/07/2018	24590-WTP-PCN-ENV-18-002 (8C.2018.Q2)
05/18/2018	24590-LAW-PCN-ENV-17-012 (8C.2018.Q2)
05/17/2018	8C.2018.2F
05/15/2018	24590-LAB-PCN-ENV-14-001 (8C.2018.Q2)
04/05/2018	8C.2018.1F
03/08/2018	24590-LAW-PCN-ENV-16-008 (8C.2018.Q1)
03/06/2018	24590-LAW-PCN-ENV-17-005 (8C.2018.Q1)
02/14/2018	24590-LAW-PCN-ENV-17-011 (8C.2018.Q1)
02/01/2018	8C.2017.Q4
11/28/2017	8C.2017.8F
11/01/2017	8C.2017.Q3
09/05/2017	8C.2017.6F
07/06/2017	8C.2017.2F
03/01/2017	8C.2016.Q4
12/15/2016	8C.2016.Q3
12/1/2016	8C.2016.7F

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PART III, OPERATING UNIT GROUP 10 – SPECIFIC CONDITIONS
WASTE TREATMENT AND IMMOBILIZATION PLANT

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PART III, OPERATING UNIT GROUP 10 – SPECIFIC CONDITIONS WASTE TREATMENT AND IMMOBILIZATION PLANT

The Waste Treatment and Immobilization Plant (WTP) is the operating treatment and storage unit designed to treat the mixed (radioactive and dangerous) waste currently stored in underground tanks at the Hanford Site. Once the mixed waste is received at the WTP, it will be separated into high-level and Low-Activity Waste (LAW) streams in the Pretreatment (PT) Building. The waste streams are then transferred to either the High-Level Waste (HLW) Building or the LAW Building, mixed with glass forming additives and heated to 950-1250°C in melters, and then poured into containers. As the containerized waste cools, it is immobilized in the glass matrix. Once the waste is immobilized, the container is finished (i.e. provided with a lid and decontaminated), and then transported from the WTP for disposal.

III.10.A COMPLIANCE WITH APPROVED PERMIT

The Permittees shall comply with all requirements set forth in the Hanford Facility Resource Conservation and Recovery Act (RCRA) Dangerous Waste Permit including all approved modification. All chapters, subsection, files, tables, addendums, and appendices included in the following Unit-Specific Conditions are enforceable in their entirety. In the event that a Unit-Specific Condition conflicts with Permit Conditions in Parts I or II of this Permit, the Unit-Specific Conditions shall prevail.

Where information regarding treatment, management, and disposal of the radioactive source, byproduct material, special nuclear material (as defined by the *Atomic Energy Act of 1954*, as amended) and/or the radionuclide component of mixed waste has been incorporated into this permit, it is not incorporated for the purpose of regulating the radiation hazards of such components under the authority of this permit and chapter 70.105 Revised Code of Washington (RCW). In the event of any conflict between Permit Condition III.10.A and any statement relating to the regulation of source, special nuclear, and byproduct material contained in portions of the permit application that are incorporated into this permit, Permit Condition III.10.A will prevail.

<u>OPERATING UNIT GROUP 10</u>

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Chapter 3	Waste Analysis Plan
Appendix 3A	Waste Treatment Plant Waste Analysis Plan
Appendix 3B	Quality Assurance Project Plan for Waste Analysis Plan
Chapter 4	Process Information
Chapter 4A	Engineering Figures
Chapter 4C	§RPP-WTP Compliance with Uniform Building Code Seismic Design
Chapter 4D	Pretreatment Facility (PTF)
Chapter 4E	Low-Activity Waste (LAW) Vitrification Facility
Chapter 4F	High-Level Waste (HLW) Vitrification Facility
Chapter 4G	Direct-Feed Low-Activity Waste (Effluent Management Facility)
Chapter 4H	Analytical Laboratory (LAB)

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Chapter 6	Procedures to Prevent Hazards
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Appendix 6.0, §6.2.5	Supplement 5 – Hanford Tank Waste Treatment and Immobilization Plant Risk Assessment Air Quality Modeling Protocol
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FACILITY-SPECIFIC DEFINITIONS

The following definitions are specific to the WTP Unit:

Ash: refers to the Particulate Matter (PM) that will be measured in the off-gas during the Environmental Performance Demonstration Test (EPDT) in accordance with U.S. Environmental Protection Agency (EPA) Method 5. The regulatory limit for ash is established in III.10.H.1.b.ii.

Batch: refers to waste staged in one Double Shell Tank (DST) designated as mixed waste for transfer to the WTP Unit for treatment.

Continuous monitoring system: means using a device which continuously samples the regulated parameter specified on Permit Tables III.10.H.F, III.10.I.F, III.10.J.F, and III.10.K.F, with the exception of pressure, without interruption, evaluates the detector response at least once every fifteen (15) seconds and computes and records the average value at least every sixty (60) seconds, except during allowable periods of calibration and except as defined otherwise by the Continuous Emissions Monitoring System (CEMS) Performance Specifications in Appendix B, 40 Code of Federal Regulations (CFR) Part 60. For the parameter pressure, the term "Continuous Monitoring System" (CMS) means using a device that continuously samples the pressure without interruption and evaluates the detector response without averaging at least once each second and records the value at least every sixty (60) seconds.

Cascade event: means when additional waste feed cut-off parameter set points deviate outside the limits specified in Permit Tables III.10.H.F, III.10.I.F, III.10.J.F, and III.10.K.F after waste feed is cut-off, but while waste or waste residues are being managed in HLW and LAW.

Critical System: as applied to determining whether a Permit Modification is required, means those specific portions of a Treatment, Storage, and Disposal (TSD) unit's structure, or equipment, whose failure could lead to the release of dangerous waste into the environment, and/or systems which include processes which treat, transfer, store, or dispose of regulated wastes. A list identifying the critical systems for the WTP is included in Appendix 2.

Dangerous and/or mixed waste management unit: means dangerous and/or mixed waste management units, areas, systems, and sub-systems as detailed in Permit Tables III.10.D.A, III.10.E.A through D, III.10.F.A, III.10.G.A, III.10.H.A, III.10.I.A, III.10.J.A, III.10.K.A, III.10.M.A, and III.10.E.R through III.10.E.T.

Demonstration Test (DT): test conducted to show compliance with performance standards applicable to the LAW and HLW melters, also referred to as the EPDT.

Dioxin/furan and dioxins and furans: means tetra-, penta-, hexa-, hepta-, and octa-chlorinated dibenzo dioxins and furans.

Effluent Management Facility (EMF) Vitrification System: is defined as specified on Permit Tables III.10.M.A and III.10.E.R through III.10.E.T.

HLW Vitrification System: is defined as specified on Permit Tables III.10.J.A and B, and III.10.K.A and B.

Hourly rolling average (HRA): will mean the arithmetic mean of the sixty (60) most recent one-minute readings recorded by the CMS.

LAW Vitrification System: is defined as specified on Permit Tables III.10.H.A and B, and III.10.I.A and B.

Mode of operation: means operation of the LAW Vitrification System or the HLW Vitrification System within set limits for each operating parameter specified in Permit Tables III.10.H.D and F (for LAW) and Permit Tables III.10.I.D and F (for HLW).

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One-minute average: means the average of detector responses calculated at least every sixty (60) seconds from responses obtained at least every fifteen (15) seconds.

Permittees: means the United States Department of Energy (DOE) (owner/operator) and Bechtel National, Inc. (Co-operator).

Pretreatment Plant Miscellaneous Unit Systems: is defined as specified on Permit Tables III.10.G.A and B.

Primary sump: means any pit or reservoir that meets the Washington Administrative Code (WAC) 173-303-040 definition of "tank," and those troughs/trenches connected to it, that serve to collect dangerous/hazardous waste, deliberately introduced from treatment activities for transport to TSD facilities. Primary sumps are equipped with an additional liner, leak detector, and waste removal capability. A typical primary sum design is shown in Figure 4A-128 in Chapter 4A.

Rolling average: means the average of all one-minute averages over the averaging period.

Secondary sump: means any pit or reservoir that meets the WAC 173-303-040 definition of "tank," and those troughs/trenches connected to it, that serve to collect dangerous/hazardous waste from spills, leaks, overflows, or decontamination activities for transport to TSD facilities.

Secondary mixed waste stream: means treatment residues and materials derived from the treatment of mixed waste which continue to designate as a dangerous, extremely hazardous, or acutely hazardous waste and contains a radioactive component.

Simulant: a material used during the shakedown, demonstration test, and post-demonstration testing described in the EPDT in Appendix 9.15 which serves as a required surrogate for Tank Farm Waste.

Standard Operating Procedure (SOP): will mean a written description of the procedures by which a process, equipment, etc. will be operated. An SOP may be written by the manufacturer and/or the Permittees.

Successful completion of the demonstration test: will mean operations including a minimum of three test runs without significant interruptions (i.e., once initiated, each test run must be continuous, and the samples have been preserved and maintained intact, and one in which sampling of exhaust gas was representative of the LAW Vitrification System or HLW Vitrification System Operations, whichever is applicable, and adequate to achieve evaluation of Principal Organic Dangerous Constituents (PODCs) destruction and removal efficiency (DRE) to 99.99%).

Toxic Equivalents (TEQ): refer to the sum of the weighted potencies of 7 polychlorinated dibenso-p-dioxins (PCDDs), 10 polychlorinated dibensofurans (PCDFs), and 12 dioxin-like (coplanar) polychlorinated biphenyl (PCBs), relative to a reference compound, 2, 3, 7, 8 – tetrachlorodibenzo-p-dioxin (2, 3, 7, 8 – TCDD).

Pre-process: means prior to introduction into a dangerous or mixed waste management unit at the WTP Unit.

In-process: means duration of a waste in a dangerous or mixed waste management unit at the WTP Unit.

Post-process: means prior to the introduction into a subsequent dangerous or mixed waste management unit at the WTP Unit or prior to shipment from the WTP Unit.

Receipt of dangerous and/or mixed waste: for the purpose of this Permit, this term generally refers to the receipt of Tank Farm Waste but other materials that are processed (e.g. listed spiking materials) may also require proper management as dangerous waste based on characterization.

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Vendor information: means documentation prepared by a vendor (e.g., catalog cut sheets) for plant items that are routinely manufactured and stocked by vendors (i.e., items that are considered "off the shelf") and are not being procured in accordance with Permittees' engineering drawings and specifications. Documentation such as catalog cut sheets will be annotated to specify selected items which meet Permittees procurement requirements equipment specification. Documentation associated with "one of a kind", custom items, and commercial grade items (e.g., bulk pipe, valves) that will be procured in accordance with the Permittees engineering drawings and specifications is not considered vendor information. Changes to the drawings and specifications may require a permit modification.

Vitrification System Shutdown: means emergency and planned shutdowns of the vitrification system as defined in the operating procedure(s).

Vitrification System Startup: means startup of the vitrification system as defined in operating procedure(s).

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FACILITY-SPECIFIC ACRONYMS

The following acronyms are specific to the WTP Unit:

AWFCO	Automatic Waste Feed Cut-off
CDR	Construction Deficiency Report
CEMS	Continuous Emissions Monitoring System
CMS	Continuous Monitoring System
CNP	Cesium Nitric Acid Recovery Process System
CRP	Cesium Resin Addition Process System
CPE	Cathodic Protection Electrical System
CXP	Cesium Ion Exchange Process System
DEP	Direct Feed LAW EMF Process System
DFETP	Dioxin and Furan Emission Test Plan
DRE	Destruction and Removal Efficiency
Dscf	Dry standard cubic feet
DT	Demonstration Test
EMF	Effluent Management Facility
EPDT	Environmental Performance Demonstration Test
ERP	Emergency Response Plan
FEP	Waste Feed Evaporation Process System
FRP	Waste Feed Receipt Process System
HCP	HLW Concentrate Receipt Process System
HDH	HLW Canister Decontamination Handling System
HEH	HLW Canister Export Handling System
HEME	High Efficiency Mist Eliminator
HEPA	High Efficiency Particulate Air Filter
HFH	HLW Filter Cave Handling System
HFP	HLW Melter Feed Process System
HLP	HLW Lag Storage and Feed Blending Process System
HLW	High-level Waste
HMH	HLW Melter Handling System
HMP	HLW Melter Process System
HOP	HLW Vit Primary Offgas Treatment System
HPH	HLW Canister Pour Handling System
HSH	HLW Melter Cave Support Handling System
IHLW	Immobilized High-Level Waste (Glass)
ILAW	Immobilized Low-Activity Waste (Glass)
IQRPE	Independent, qualified, registered, professional engineer
LAB	WTP Laboratory Building
LAW	Low Activity Waste
LCP	LAW Concentrate Receipt Process System
LEH	LAW Container Export Handling System

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LFH	LAW Canister Finishing Handling System
LFP	LAW Melter Feed Process System
LMH	LAW Melter Handling System
LMP	LAW Melter Process System
LOP	LAW Primary Offgas Process System
LPH	LAW Container Pour Handling System
LSH	LAW Melter Equipment Support Handling System
LSM	Locally Shielded Melter
LVP	LAW Secondary Offgas/Vessel Vent Process System
NCR	Nonconformance Report
PFH	Pretreatment Filter Cave Handling System
PIH	Pretreatment In-Cell Handling System
PJV	Pulse Jet Ventilation System
PODC	Principal Organic Dangerous Constituents
PTF	Pretreatment Building
PVP	Pretreatment Vessel Vent Process System
PVV	Process Vessel Vent System
PWD	Plant Wash and Disposal System
RDP	Spent Resin and Dewatering Process System
RDTP	Revised Demonstration Test Plan
RLD	Radioactive Liquid Waste Disposal System
RPP-WTP	River Protection Project-Waste Treatment Plant
RWH	Radioactive Solid Waste Handling System
SBS	Submerged Bed Scrubber
TCP	Treated LAW Evaporation Process System
TLP	Treated LAW Evaporation System
TOC	Total Organic Carbon
TXP	Technetium Ion Exchange Process System
TEP	Technetium Eluant Recovery Process System
UFP	Ultrafiltration Process System
WESP	Wet Electrostatic Precipitator
WTP	River Protection Project – Waste Treatment and Immobilization Project (also known as the Waste Treatment Plant and Vitrification Plant)
6% Mo	Six Percent Molybdenum Alloy
304L	ASTM A240 Grade 304L Stainless Steel
316L	ASTM A240 Grade 316L Stainless Steel

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III.10.A COMPLIANCE WITH APPROVED PERMIT

III.10.B STANDARD CONDITIONS AND GENERAL FACILITY CONDITIONS

In addition to the conditions in this chapter, the Permittees must comply with all the applicable portions of the Dangerous Waste Permit for the Hanford Facility. In the event that a Unit-Specific Condition for the WTP Unit in Permit Conditions III.10.C through III.10.M conflicts with a general condition in Permit Conditions I and II of this permit, the Unit-Specific Condition will apply to the WTP Unit.

III.10.C UNIT-SPECIFIC CONDITIONS FOR THE WTP UNIT

III.10.C.1 RESERVED

III.10.C.2 General Waste Management

III.10.C.2.a Treatment or storage of dangerous waste or mixed waste in any new or modified portion of the facility may commence when the Permittees have submitted to Department of Ecology (Ecology), by certified mail, or hand delivery, a letter signed by the Permittees and a registered professional engineer stating that the facility has been constructed or modified in compliance with the Permit in accordance with WAC 173-303-810(14)(a); and

III.10.C.2.a.i The Permittee has received a Permit modification approval pursuant to Permit Conditions III.10.C.2.e and III.10.C.2.f, or III.10.C.2.g, and

III.10.C.2.a.ii Ecology has inspected the modified or newly constructed facility and finds it is in compliance with the conditions of the Permit, or

III.10.C.2.a.iii Within fifteen days, of the date of submission of the Permittees' letter, Ecology has not notified the Permittees of intent to inspect.

III.10.C.2.b The Permittees are authorized to accept the dangerous and/or mixed waste specified in Operating Unit Group 10, Chapter 1, "Part A Form," and Chapter 3, "Waste Analysis Plan" (WAP).

III.10.C.2.c All dangerous and/or mixed waste must be managed only in areas authorized for dangerous and/or mixed waste management under the Permit conditions, except as allowed under WAC 173-303-200. The authorized dangerous and/or mixed waste management areas of the WTP Unit are specified in Conditions III.10.D through III.10.M.

III.10.C.2.d Dangerous and/or mixed waste may be transferred from dangerous waste management units within the WTP operating unit to an on-site dangerous waste management unit or an off-site permitted TSD Facility using the manifest/tracking system required by Permit Condition II.N.

III.10.C.2.e Permit modifications pursuant to this Permit for dangerous and/or mixed waste at the request of the Permittees must be done according to the three tiered modification system specified in WAC 173-303-830(4) and Condition I.C.3. The Permit modification request must include page changes to the Permit, attachments, and permit application supporting documentation necessary to incorporate the proposed permit modification.

III.10.C.2.f In addition to other requirements in WAC 173-303-830, within forty-five (45) days of a permit change (i.e., permit modification) being put into effect or approved, the Permittees will provide copies of the Permit attachments to incorporate the change (if not already reflected in the change pages submitted in the original permit modification request). This submittal does not require re-certification in accordance with WAC 173-303-810(13).

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III.10.C.2.g Permit modifications pursuant to Operating Unit Group 10, Appendix 1.0 will be prepared and issued pursuant to WAC 173-303-830(3)(a)(ii) and WAC 173-303-840.

III.10.C.2.h The Permittees must complete Compliance Schedule interim requirements as specified in Operating Unit Group 10, Appendix 1.0. If an interim requirement is not completed as specified, the Permittees will, within 14 days, notify Ecology in writing of its non-compliance. The notification will include the following:

III.10.C.2.h.i A description of any portion of the interim requirement completed;

III.10.C.2.h.ii Summaries of any problems affecting timely completion of the interim requirement;

III.10.C.2.h.iii A description of the plans for completing the remaining portion of the interim requirement, including any alternatives;

III.10.C.2.h.iv Projected interim requirement completion date.

III.10.C.2.i RESERVED

III.10.C.2.j RESERVED

III.10.C.2.k RESERVED

III.10.C.2.l During demonstration testing of the LAW Vitrification System and HLW Vitrification System, pursuant to Permit Sections III.10.H and J, processing of materials in the LAW and HLW Vitrification Systems that would designate as dangerous waste are fully subject to the requirements of this Permit, excluding the glass formers and simulant, transferred from the melter feed system as identified in Tables III.10.H.A and III.10.J.A, respectively. This exclusion does not apply to mixed waste.

III.10.C.2.m The Facility Owner will ensure WTP input is provided to the risk budget tool developed in accordance with Permit Condition III.11.I.5.

III.10.C.2.n The Permittees will submit the following reports, based on the August 2006 mass balance submitted to Ecology (DOE Letter 06-ESQ-081), for Ecology's review and comment/resolution. Updated information to the August 2006 Mass Balance may be used if available and mutually agreed upon by the Permittees and Ecology. The reports will describe all of the treatment approaches identified in Permit Conditions III.10.C.2.n.i through III.10.C.2.n.v, and will be included in the Administrative Record.

III.10.C.2.n.i By June 30, 2010, the Permittees will perform an assessment that projects mixed waste constituents and the concentrations that are expected to be contained in each secondary mixed waste stream anticipated to be generated;

III.10.C.2.n.ii By June 30, 2010, the Permittees will identify appropriate Land Disposal Restrictions (LDR) treatment standards for each mixed waste stream identified in Permit Condition III.10.C.2.n.i;

III.10.C.2.n.iii By June 30, 2010, the Permittees will identify which mixed waste streams that, from a qualitative risk perspective, reasonably may cause or may significantly contribute to an exceedance of applicable environmental standards at a disposal facility; and

III.10.C.2.n.iv By June 30, 2010, the Permittees will, for the mixed waste streams identified in Permit Condition III.10.C.2.n.iii, identify potential treatment approaches that mitigate their environmental impacts;

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III.10.C.2.n.v By December 31, 2015, or 12 months prior to cold commissioning of the facility producing the waste, whichever is earlier, the Permittees will, for the mixed waste streams identified in Permit Condition III.10.C.2.n.iii, select appropriate treatment approaches that mitigate their environmental impacts.

III.10.C.2.o The facility owner will evaluate all waste streams generated at the WTP for potential exceedances of applicable environmental standards and will ensure all mixed and dangerous waste streams generated at the WTP will not cause an exceedance of applicable environmental standards at an appropriate disposal facility on-site and is subject to the following requirements:

III.10.C.2.o.i Immobilized Low-Activity Waste (ILAW) glass will be engineered to be compliant with the disposal facility Waste Acceptance Criteria (WAC). The waste feed and ILAW glass recipes will be verified to be compliant with the permitted glass formulations (including planning for pertinent operating parameters) prior to vitrification.

III.10.C.2.o.ii Treatment methods for secondary waste streams projected to be generated by the WTP that are slated for disposal at the Hanford Site will be engineered to ensure that treated secondary wastes will comply with the on-site disposal facility WAC and applicable LDRs prior to generation. Prior to treatment, secondary wastes must be evaluated to ensure that selected treatment methods are still appropriate and continue to comply with the on-site disposal facility WAC and applicable LDRs; and

III.10.C.2.o.iii On a case-by-case basis, for any WTP mixed waste that does not meet the WAC for the disposal facility, Ecology will approve or deny acceptance of that waste into the disposal facility. This decision will be based on the disposal facility's WAC and compliance with WAC 173-303-140.

III.10.C.3 Waste Analysis

III.10.C.3.a RESERVED

III.10.C.3.b RESERVED

III.10.C.3.c The Permittees are responsible for obtaining accurate information for each waste stream. Inaccurate waste analysis information provided by the generating site (or unit) is not a defense for noncompliance by the Permittees with conditions of this Permit.

III.10.C.3.d Records and results of waste analyses conducted under the WAP will be maintained in accordance with Permit Condition II.I.1. The WTP Unit operating record will include, but not be limited to, information requirements for monitoring in Permit Conditions I.E.10.

III.10.C.3.e Prior to the initial receipt of dangerous and/or mixed waste in the WTP Unit, the Permittees will submit to Ecology for review and approval a revised WAP and Quality Assurance Program Plan (QAPP) pursuant to Conditions III.10.C.2.e and III.10.C.2.f, and the Compliance Schedule in Operating Unit Group 10, Appendix 1.0. The revised WAP and QAPP will include:

III.10.C.3.e.i All the elements listed in WAC 173-303-300(5), and Permit Condition II.D.1.

III.10.C.3.e.ii Requirements that characterization will be performed on the waste feed prior to transfer to the WTP Unit in conformance with the regulatory data quality objectives identified in the Regulatory Data Quality Objective (DQO) Optimization Report (24590-WTP-RPT-MGT-04-001, Rev 0), or any other parameters, and the rational for selecting these parameters. Requirements that the following analyses, at a minimum,

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will be conducted on each new batch prior to waste transfer to the WTP Unit, in accordance with the methods under WAC 173-303-110: Ammonia, pH, metals, organic acids, mercury, cyanide, volatiles, semi-volatiles, PCBs/pesticides, anions, Total Organic Carbon (TOC), and compatibility (American Society for Testing and Materials [ASTM] Method D5058-90). For the purposes of this Permit Condition, a "new batch" is one that has been sampled and analyzed in accordance with the Regulatory DQO Optimization Report (24590-WTP-RPT-MGT-04-001, Rev 0), and has received no further additions. Further additions require the Permittees to resample and reanalyze, unless an exception is approved by Ecology on a case-by-case basis. Only mixed waste meeting the definition of "new batch", or granted an exception as discussed above, are authorized for transfer to the WTP Unit. Water additions for the purposes of waste transfer are not considered additions for the purposes of this Permit Condition.

III.10.C.3.e.iii Identify and include operating parameters to be monitored/controlled and limitations for these parameters for pre-process, in-process, and post-process operations addressing on a unit specific basis treatment effectiveness, as specified in Tables III.10.E.E through H and S, III.10.G.C, III.10.H.C, III.10.I.C, III.10.J.C, III.10.K.C, waste compatibility, safe operation, and compatibility with unit materials of construction. Amend the sampling, analysis, and Quality Assurance/Quality Control (QA/QC) procedures to include these parameters and the monitoring frequency.

III.10.C.3.e.iv Requirements that the Permittees will, for Type I (primary) sumps if liquids are detected, and for Type II (secondary) sumps, as defined in Operating Unit Group 10, Chapter 4, if liquid levels are outside normal operating parameters, either collect the liquid and return to the treatment process, or designate the sump contents for proper management and disposal prior to removal.

III.10.C.3.e.v For ILAW containers and Immobilized High-Level Waste (IHLW) canisters, a description of the procedures used for removal of mixed dangerous waste from exterior container surfaces, including a description of how contamination removal will be measured.

III.10.C.3.e.vi Requirement that wastes generated at the WTP Unit meet the receiving authorized TSD Facility waste acceptance criteria prior to a waste stream transfer.

III.10.C.3.e.vii The frequency with which analysis of each waste will be reviewed, or repeated, to ensure that the analysis is accurate and current, including requirements and criteria for reevaluation of the sampling and analysis frequency for all waste streams.

III.10.C.3.e.viii Documentation demonstrating methods for obtaining samples of wastes are representative as discussed in WAC 173-303-110(2).

III.10.C.3.e.ix Where applicable, the methods for meeting the additional waste analysis requirements for specific waste management methods, as specified in WAC 173-303-140(4), 173-303-395(1), 173-303-630 through 173-303-695.

III.10.C.3.e.x For waste transferred from other permitted TSDs, the procedures for confirming that each dangerous waste received matches the identity of the waste specified on the accompanying waste profile documentation. This includes the procedure for identifying each waste movement at the facility.

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III.10.C.4 Recordkeeping

III.10.C.4.a The unit specific portion of the Hanford Facility Operating Record will include the documentation specified in Permit Attachment 6, Permit Condition II.I, (applicable to the WTP Unit), and other documentation specified in Operating Unit Group 10. Permit Attachment 6 provides a list of required records, and the methods of submittal for the facility and each unit group.

III.10.C.5 Procedure to Prevent Hazards

III.10.C.5.a The Permittees will design, construct, and operate the WTP Unit in compliance with Operating Unit Group 10, Chapter 6, Section 6.1.

III.10.C.5.b The WTP Unit fire protection systems will be constructed to the applicable codes listed in Operating Unit Group 10, Chapter 6, Section 6.3.1.4. Prior to the initial receipt of dangerous and/or mixed waste in the WTP Unit, the Permittees will update Operating Unit Group 10, Chapter 6, Sections 6.3, 6.4, and 6.5 to be consistent with design details, and resubmit for approval as a permit modification pursuant to Permit Conditions III.10.C.2.e and III.10.C.2.f, and Operating Unit Group 10, Appendix 1.0. In addition to the stand-by diesel generator for the LAW and HLW melters, updated Section 6.4.4 will include descriptions of the essential loads and critical systems supplied with back-up, un-interruptible, and standby power.

III.10.C.5.c The Permittees will inspect the WTP Unit to prevent malfunctions and deterioration, operator errors, and discharges that may cause or lead to the release of dangerous waste constituents to the environment, or a threat to human health. Inspections must be conducted in accordance with the WTP Unit Inspection Plan, Operating Unit Group 10, Chapter 6, Section 6.2, and Chapter 6A. Prior to the receipt of dangerous and/or mixed waste in the WTP Unit, the Permittees will update and resubmit to Ecology for review and approval Chapter 6, Section 6.2 and the Inspection Plan in Chapter 6A as a permit modification pursuant to Permit Conditions III.10.C.2.e and III.10.C.2.f, and Compliance Schedule in Operating Unit Group 10, Appendix 1.0. The revised schedule will include, but not be limited to the requirements in WAC 173-303-320(2) and III.10.C.5.c.i through v below.

III.10.C.5.c.i Detailed dangerous and/or mixed waste management unit specific and general inspection schedules and description of procedures pursuant to WAC 173-303-395(1)(d), 173-303-630(6), 173-303-640(4)(a)(i) and (6), 173-303-670(7)(b) in accordance with 173-303-680(3), and 173-303-695. The inspection schedule will be presented in the form of a table that includes a description of the inspection requirements, inspection frequency, and types of problems to look for during the inspections.

III.10.C.5.c.ii The proposed locations (scaled drawing with layout) and capabilities of camera(s) (i.e., zoom angles, field of view, etc.) to be used for remote inspections.

III.10.C.5.c.iii Schedule and program description for performing integrity assessments as specified in Permit Conditions III.10.E.9.e.i, III.10.G.10.e.i, III.10.H.5.e.i, III.10.I.1.a.v, III.10.J.5.e.i, and III.10.K.1.a.v.

III.10.C.5.c.iv Inspection schedules for leak detection system and control instrumentation to include, but not limited to, valves pressure devices, flow devices, measuring devices, as specified in Permit Conditions III.10.E.9.e.xi, III.10.F.3.c, and III.10.G.10.e.xii, and Permit Conditions III.10.H.5.f.xvi, and III.10.J.5.f.xvi.

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III.10.C.5.c.v Inspection schedule will include inspections for all dangerous and/or mixed waste management units specified in Permit Sections III.10.D, E, F, G, H, I, J, and K.

III.10.C.5.d The Permittees will equip the WTP Unit with the equipment specified in Operating Unit Group 10, Chapter 6, as required by Permit Condition II.B.1.

III.10.C.5.e The Permittees will test and maintain the equipment specified in Operating Unit Group 10, Chapter 6 and Chapter 6A, as necessary, to assure proper operation in the event of emergency.

III.10.C.5.f The Permittees will maintain access to communications or alarms as provided in the Contingency Plan, Operating Unit Group 10, Chapter 7 and Permit Condition II.B.2.

III.10.C.6 Contingency Plan

III.10.C.6.a The Permittees will immediately carry out applicable provisions of Permit Condition II.A.1 and the Contingency Plan, Operating Unit Group 10, Chapter 7 whenever there is a release of dangerous and/or mixed waste or dangerous waste constituents, or other emergency circumstance, any of which threatens human health or the environment.

III.10.C.6.b Prior to the initial receipt of dangerous and/or mixed waste in the WTP Unit, the Permittees will update the Contingency Plan, Operating Unit Group 10, Chapter 7, to be consistent with design details and WAC 173-303-350(3), incorporated by reference, and resubmit as a permit modification pursuant to Permit Conditions III.10.C.2.e and III.10.C.2.f, in compliance with WAC 173-303-350(5)(c), and Operating Unit Group 10, Appendix 1.0.

III.10.C.6.c After initial receipt of dangerous and/or mixed waste in the WTP Unit, the Permittees will review and amend, if necessary, the applicable portions of the Contingency Plan, Operating Unit Group 10, Chapter 7 in accordance with the provision of WAC 173-303-350(5). Chapter 7 will be amended as a permit modification pursuant to Permit Conditions III.10.C.2.e and III.10.C.2.f.

III.10.C.6.d RESERVED

III.10.C.6.e RESERVED

III.10.C.7 Personnel Training

III.10.C.7.a Prior to the initial receipt of dangerous and/or mixed waste in the WTP Unit, the Permittees will update and resubmit, to Ecology for review and approval, the Training Program description in Operating Unit Group 10, Chapter 8 as a permit modification pursuant to Permit Conditions III.10.C.2.e and III.10.C.2.f, and Compliance Schedule in Operating Unit Group 10, Appendix 1.0. The revised Training Program description will include but not be limited to:

III.10.C.7.a.i Detailed unit specific and general Training Program descriptions as required to demonstrate compliance with WAC 173-303-330 and to include:

III.10.C.7.a.i.A Job titles and descriptions for each dangerous waste management position (e.g. waste designator, waste operator, laboratory technician, etc.);

III.10.C.7.a.i.B Outline of the training program updated to discuss initial, refresher, and on-the-job training; correlated to each dangerous waste management position;

III.10.C.7.a.i.C Table 8-1 in Operating Unit Group 10, Chapter 8, updated to include the type and amount of introductory, refresher, and on-the-job training required for each dangerous waste management position [WAC 173-303-806(4)(a)(xii)].

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III.10.C.7.a.ii Sufficient detail to document that the training and qualification program for all categories of personnel whose activities may reasonably be expected to directly affect emissions from the LAW, HLW, and EMF Systems, except control room operators, is appropriately consistent with 40 CFR 63.1206(c)(6)(ii), and for control room operators, is appropriately consistent with 40 CFR 63.1206(c)(6)(i) and 63.1206(c)(6)(iii) through 63.1206(c)(6)(vi). [WAC 173-303-680(2)]

III.10.C.7.b The Permittees will ensure that the LAW, HLW, and EMF Systems are operated and maintained, at all times, by persons who are trained and qualified to perform these and any other duties that may reasonably be expected to directly affect emissions from the LAW, HLW, and EMF Systems. [WAC 173-303-680(2)]

III.10.C.7.c The Permittees will conduct personnel training in accordance with the approved description of the WTP Dangerous Waste Training Plan, Operating Unit Group 10, Chapter 8, pursuant to WAC 173-303-330. The Permittees will maintain documents in accordance with Permit Condition II.C.1 and WAC 173-303-330(2) and (3).

III.10.C.7.d RESERVED

III.10.C.7.e The Permittees will submit, under separate cover, the actual detailed WTP Dangerous Waste Training Plan in accordance with the Compliance Schedule in Operating Unit Group 10, Appendix 1.0. The WTP Dangerous Waste Training Plan will be reviewed for compliance with the outline of the training program in Operating Unit Group 10, Chapter 8 and requirements of WAC 173-303-330. The Training Plan will be incorporated into the Administrative Record.

III.10.C.8 Closure

III.10.C.8.a The Permittees must conduct closure of the WTP Unit according to the Closure Plan in Operating Unit Group 10, Chapter 11, and Permit Condition III.10.C.8. The Closure Plan will be modified according to provisions of Permit Condition I.C.3.

III.10.C.8.b Prior to initial receipt of dangerous and/or mixed waste in the WTP Unit, the Permittees will update and resubmit the Closure Plan, Operating Unit Group 10, Chapter 11 for approval as a permit modification pursuant to Permit Condition III.10.C.2.g, to be consistent with design details and schedule described in Operating Unit Group 10, Appendix 1.0. The updated Closure Plan must be consistent with the closure performance standards specified in WAC 173-303-610(2)(a)-(b), WAC 173-340 and, in addition for Containment Buildings, consistent with 40 CFR 264.1102(b) as referenced by WAC 173-303-695.

III.10.C.8.c The Permittees will submit, for Ecology review and approval, an update to the Closure Plan, Operating Unit Group 10, Chapter 11, including all documentation required by Permit Condition II.D, within one hundred eighty (180) days prior to commencing partial closure, as a permit modification pursuant to Permit Conditions III.10.C.2.e and III.10.C.2.f.

III.10.C.8.d One hundred eighty (180) days prior to commencing final closure of Operating Unit Group 10, the Permittees must submit to Ecology, for review and approval, a revised Closure Plan, including all documentation required by Permit Condition II.D, as a permit modification pursuant to Permit Conditions III.10.C.2.e and III.10.C.2.f.

III.10.C.8.e RESERVED

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III.10.C.8.f To achieve clean closure, the Permittees will remove dangerous waste, dangerous waste constituents, and dangerous waste residues throughout the closing unit and throughout any areas affected by releases from the closing unit to concentrations that do not exceed numeric cleanup levels determined using residential exposure assumptions according to the Model Toxics Control Act (MTCA) Regulations, Chapter 173-340 WAC and all structures, equipment, bases, liners, and other materials containing or contaminated with dangerous waste, constituents, or residues have met specific waste removal and decontamination standards approved by Ecology, in accordance with WAC 173-303-610(2)(b)(i)-(ii).

III.10.C.8.g RESERVED

III.10.C.8.h Documentation supporting the Independent Registered Professional Engineer's certification of closure must be submitted to Ecology with the closure certification required by WAC 173-303-610(6). In addition to the items in Operating Unit Group 10, Chapter 11, the documentation must include the following and other information Ecology may request.

III.10.C.8.h.i Sampling procedures that were followed;

III.10.C.8.h.ii Soil and concrete locations that were sampled;

III.10.C.8.h.iii Sample labeling and handling procedures that were followed, including chain of custody procedures;

III.10.C.8.h.iv Description of procedures that were followed to decontaminate concrete or metal to meet the clean closure standards approved by Ecology, in accordance with the closure performance standards of WAC 173-303-610(2)(a)(ii) and in a manner that minimizes or eliminates post-closure escape of dangerous waste constituents, or to achieve a "clean debris surface" as specified in 40 CFR 268.45, Table 1, concrete surfaces, as incorporated by reference in WAC 173-303-140. [WAC 173-303-610(2)(b)(ii)]

III.10.C.8.h.v Laboratory and field data, including supporting QA/QC summary;

III.10.C.8.h.vi Report that summarizes closure activities;

III.10.C.8.h.vii Copy of all field notes taken by the independent registered professional engineer; and

III.10.C.8.h.viii Copy of all contamination survey results.

III.10.C.9 Critical Systems

III.10.C.9.a The WTP Unit critical systems, as defined in the definition section of Operating Unit 10 and are identified in Operating Unit Group 10, Appendix 2.0.

III.10.C.9.b As the design proceeds, Ecology will modify this Permit for reasons described in the WAC 173-303-830(3) to add additional systems to the Critical Systems in Operating Unit Group 10, Appendix 2.0.

III.10.C.9.c The Permittees will conduct all construction subject to this Permit in accordance with the approved designs, plans, and specifications that are required by this Permit, except as specified in Conditions III.10.C.9.d or III.10.C.9.e. For purposes of Conditions III.10.C.9.d and III.10.C.9.e, the Ecology representative will be an Ecology construction inspector, project manager, or other designated representative of Ecology.

III.10.C.9.d The Permittees will submit a nonconformance report (NCR) or construction deficiency report (CDR) to the Ecology representative (s), as applicable, within seven (7) calendar days of the Permittees becoming aware of incorporation of minor nonconformance or construction deficiency from the approved designs, plans, and specifications into the

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construction of critical systems, as defined in the Hanford Site-wide Permit definition section. Such minor nonconformance or construction deficiency will be defined, for the purposes of this Permit Condition, as nonconformance or construction deficiency that is necessary to accommodate proper construction and the substitution or the use of equivalent or superior materials or equipment that do not substantially alter the Permit Conditions or reduce the capacity of the facility to protect human health or the environment. Such minor nonconformance or construction deficiency will not be considered a modification of this Permit. If Ecology determines that the nonconformance or construction deficiency is not minor, it will notify the Permittees in writing that a permit modification is required for the deviation and whether prior approval is required from Ecology before work proceeds which affect the nonconforming or construction deficiency item.

III.10.C.9.e The Permittees will formally document, with a NCR or CDR, as applicable, incorporation of minor nonconformance or construction deficiency from the approved designs, plans, and specifications into the construction of non-critical systems subject to this Permit. Such minor nonconformance or construction deficiency will not be considered a modification of this Permit. All NCRs and CDRs will be maintained in the WTP Unit Operating Record and will be made available to Ecology upon request or during the course of an inspection. If Ecology determines that the nonconformance or construction deficiency is not minor, it will notify the Permittees in writing that a permit modification is required for the deviation and whether prior approval is required from Ecology before work proceeds which affect the nonconforming or construction deficiency item.

III.10.C.9.f For each Critical System identified in Operating Unit Group 10, Appendix 2.0, the Permittees will submit to Ecology for review and approval, following the schedule in Operating Unit Group 10, Appendix 1.0, the information identified in Permit Conditions III.10.D.10, III.10.E.9, III.10.F.7, III.10.G.10, III.10.H.5, III.10.J.5, and III.10.M.9. Information Ecology determines to incorporate into the Permit will follow the Permit Condition III.10.C.2.g process, unless stated otherwise within the specific permit condition. Information Ecology determines necessary to support design basis will be incorporated into the Administrative Record.

III.10.C.9.g Upon completion of the WTP Unit construction subject to this Permit, the Permittees will produce as-built drawings of the project which incorporate the design and construction modifications resulting from all change documentation as well as modifications made pursuant to Permit Conditions III.10.C.2.e, III.10.C.2.f, and III.10.C.2.g. The Permittees will place the as-built drawings into the operating record within twelve (12) months of completing construction.

III.10.C.9.h The Permittees will formally document changes to approved designs, plans, and specifications with design change documentation [e.g., Design Change Notice (DCN), Field Change Request (FCR), Field Change Notice (FCN), Specification Change Notice (SCN), and Supplier Deviation Disposition Request (SDDR)]. All design change documentation will be maintained in the WTP Unit-specific Operating Record and will be made available to Ecology upon request or during the course of an inspection. For any design change documentation affecting any critical systems, the Permittees will provide copies to Ecology within seven (7) calendar days. Identification of critical systems will be included by the Permittees in each WTP Unit-specific dangerous waste permit application, closure plan, or permit modification, as appropriate. If Ecology determines that the design change is not minor, it will notify the Permittees in writing that a permit modification is required for the design change and whether prior approval is required from Ecology before work affected by the design change may proceed.

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III.10.C.9.i Ventilation system duct work is not required to be doubly contained within the WTP Unit. However, upon discovery of accumulation of liquids within the duct work, a compliance plan will be submitted within sixty (60) days of discovery to correct the problem.

III.10.C.10 Equivalent Materials

III.10.C.10.a If certain equipment, materials, and administrative information (such as names, phone numbers, addresses, formatting) are specified in this Permit, the Permittees may use equivalent or superior substitutes. Use of such equivalent or superior items within the limits (e.g., ranges, tolerances, and alternatives) already clearly specified in sufficient detail in Operating Unit Group 10, are not considered a Permit modification. However, the Permittees must place documentation of the substitution, accompanied by a narrative explanation and the date the substitution became effective in the operating record within seven (7) days of putting the substitution into effect, and submit documentation of the substitution to Ecology, for approval. Upon review of the documentation of the substitution, if deemed necessary, Ecology may require the Permittees to submit a permit modification in accordance with Permit Conditions III.10.C.2.e and III.10.C.2.f.

III.10.C.10.b If Ecology determines that a substitution was not equivalent to the original, they will notify the Permittees that the Permittees' claim of equivalency has been denied, of the reasons for the denial, and that the original material or equipment must be used. If the product substitution is denied, the Permittees will comply with the original approved product specification, find an acceptable substitution, or apply for a permit modification in accordance with Permit Conditions III.10.C.2.e and III.10.C.2.f.

III.10.C.11 Risk Assessment

III.10.C.11.a The Permittees will submit a permit modification pursuant to Permit Conditions III.10.C.2.e and III.10.C.2.f, in accordance with Operating Unit Group 10, Appendix 1.0, to Ecology to incorporate revisions to the Environmental Risk Assessment Work Plan, Appendix 6.1. The revised document will be submitted for incorporation into Appendix 6.2 as the Final Risk Assessment Workplan. The Permittee will make revisions in consultation with Ecology to address the comments documented in Operating Unit Group 10, Appendix 6.1 and updated to address the following:

III.10.C.11.a.i EPA guidance for performance of Human Health and Ecological Risk Assessments for Hazardous Waste Combustion Facilities current at the time of the submittal, assuming both residential and non-residential use scenarios;

III.10.C.11.a.ii Toxicity data current at the time of the submittal;

III.10.C.11.a.iii Compounds newly identified or updated emissions data from current waste characterization and emission testing;

III.10.C.11.a.iv Air modeling updated to include stack gas parameters based on most current emissions testing and WTP Unit design;

III.10.C.11.a.v Physical/transport properties of constituents, current at the time of the submittal;

III.10.C.11.a.vi Process Description based on most current WTP Unit design;

III.10.C.11.a.vii Emissions data and all supporting calculations based on most current WTP Unit; and

III.10.C.11.a.viii Update of receptor locations based on land use or land use zoning changes, if any.

III.10.C.11.b Prior to initial receipt of dangerous and/or mixed waste in the WTP Unit, the Permittees will submit for Ecology review and approval as a permit modification pursuant to Permit Conditions III.10.C.2.e and III.10.C.2.f, a Pre-Demonstration Test Risk Assessment

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Report as Appendix 6.3. The Pre-Demonstration Test Risk Assessment Report will address and include the following:

III.10.C.11.b.i Direct and indirect human health and ecological risk assessments performed pursuant to the Final Risk Assessment Work Plan in Permit Condition III.10.C.11.a.

III.10.C.11.b.ii Submittal of projected stack emissions data for Tables III.10.G.D, III.10.H.E, and III.10.J.E and;

III.10.C.11.b.iii Submittal of the Basis and Assumptions (for incorporation into Appendix 6.3) for these emissions, including but not limited to, projected operating conditions, feed-rates, and treatment effectiveness, consistent with information provided and approved pursuant to Permit Conditions III.10.G.6, III.10.G.10, III.10.H.1, III.10.H.5, III.10.J.1, and III.10.J.5.

III.10.C.11.c Within ninety (90) days of Ecology approval of the Demonstration Report(s) submitted pursuant to Permit Condition III.10.H.3.d.i, the Permittees will submit a Final Risk Assessment Report as Operating Unit Group 10, Appendix 6.4, incorporating the emission test results from the Demonstration Report(s). The Final Risk Assessment Report will be prepared in accordance with the Final Risk Assessment Work Plan in Appendix 6.2, (as approved pursuant to Permit Condition III.10.C.11.a), except the following updates are hereby incorporated. The Permittees will also submit with this Final Risk Assessment Report, Permit Tables III.10.G.D and III.10.I.E and Operating Unit Group 10, Appendix 6.4 (Basis and Assumptions) updated to incorporate the emissions data from this Final Risk Assessment Report(s), as a permit modification pursuant to Permit Conditions III.10.C.2.e and III.10.C.2.f.

III.10.C.11.c.i Toxicity data current at the time of the submittal;

III.10.C.11.c.ii Compounds newly identified or updated emissions data from current waste characterization and emission testing;

III.10.C.11.c.iii Air modeling updated to include stack gas parameters based on most current emissions testing;

III.10.C.11.c.iv Physical/transport properties of constituents current at the time of the submittal;

III.10.C.11.c.v Update of receptor locations based on land use or land use zoning changes, if any;

III.10.C.11.c.vi Process description based on current WTP Unit design;

III.10.C.11.c.vii Emissions data and all supporting calculations based on current WTP Unit; and

III.10.C.11.c.viii Data from final risk assessment report pursuant to Permit Condition III.10.C.11.d, if available first, or simultaneously.

III.10.C.11.d Within ninety (90) days of Ecology approval of the Demonstration Report(s) submitted pursuant to Permit Condition III.10.J.3.d.i, the Permittees will submit a Final Risk Assessment Report as Operating Unit Group 10, Appendix 6.4, incorporating the emission test results from the Demonstration Report(s). The Final Risk Assessment Report will be prepared in accordance with the Final Risk Assessment Work Plan in Appendix 6.2, (as approved by Ecology pursuant to Permit Condition III.10.C.11.a), except the following updates are hereby incorporated. The Permittees will also submit with this Final Risk Assessment Report, Permit Tables III.10.G.D and III.10.K.E and Operating Unit Group 10, Appendix 6.4 (Basis and Assumptions) updated to incorporate the emissions data from this Final Risk Assessment Report, as a permit modification pursuant to Permit Conditions III.10.C.2.e and III.10.C.2.f.

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III.10.C.11.d.i Toxicity data current at the time of the submittal;

III.10.C.11.d.ii Compounds newly identified or updated emissions data from current waste characterization and emission testing;

III.10.C.11.d.iii Air modeling updated to include stack gas parameters based on most current emissions testing;

III.10.C.11.d.iv Physical/transport properties of constituents current at the time of the submittal;

III.10.C.11.d.v Update of receptor locations based on land use or land use zoning changes, if any;

III.10.C.11.d.vi Process description based on current WTP Unit design;

III.10.C.11.d.vii Emissions data and all supporting calculations based on current WTP Unit; and

III.10.C.11.d.viii Data from final risk assessment report pursuant to Permit Condition III.10.C.11.c, if available first, or simultaneously.

III.10.C.11.e The Final Risk Assessment Report(s) required by Permit Conditions III.10.C.11.c and III.10.C.11.d may be combined, or provided separately, as appropriate.

III.10.C.12 RESERVED

III.10.C.13 Remote Data Access

Onsite, unrestricted, twenty-four (24) hour access to key WTP Unit operating data and emissions monitoring data will be provided to Ecology. This onsite, unrestricted access will include providing and maintaining for Ecology only use a computer terminal and printer with access to key WTP Unit operating data bases and emissions monitoring data bases. This terminal will be equipped with all necessary software and hardware to monitor, retrieve, and trend this data. Additional remote access will be provided on Ecology request if security concerns can be addressed.

III.10.C.14 Interim Period of Operation during Post Demonstration Test Period prior to receiving Ecology approval of the complete Demonstration Test Reports and the Final Risk Assessment Report

III.10.C.14.a During this Interim Period of Operation, the Permittees are authorized to treat dangerous waste and mixed waste feed meeting the waste acceptance criteria of the WAP in Chapter 3, subject to the following conditions:

III.10.C.14.a.i RESERVED

III.10.C.14.a.ii Obtain receipt of Ecology's approval for the HLW Vitrification System according to Permit condition III.10.J.3.d.iii, prior to receiving dangerous or mixed waste feed into the HLW Vitrification System

III.10.C.14.a.iii Accept and treat up to 3 million gallons of Hanford tank waste feed in WTP.

III.10.C.15 Support Systems

III.10.C.15.a Mechanical Handling Systems

III.10.C.15.a.i The Permittees will submit to Ecology, pursuant to Permit Condition III.10.C.9.f, in accordance with the Compliance Schedule, as specified in Operating Unit Group 10, Appendix 1.0, engineering information as specified below, for incorporation into Appendices 9.6, 9.10, 10.6, and 10.10, or into the Administrative Record where noted.

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A. System Descriptions for each Mechanical Handling system identified in Permit Table III.10.C.A, for incorporation into the Administrative Record (Compliance Schedule Item 36).

B. Mechanical Handling Diagrams and Mechanical Handling Data Sheets for the following pieces of equipment (Compliance Schedule Item 37):

a. HDH-CRN-00005
b. HEH-CRN-00003
c. HPH-CRN-00001
d. HPH-CRN-00002
e. HSH-CRN-00001
f. HSH-CRN-00014
g. LEH-CRN-00003
h. LPH-CRN-00002
i. HEH-CRN-00001

C. Permit Condition III.10.C.15.a does not require:

a. Additional submittals beyond those described in Permit Condition III.10.C.15.a;
b. Independent, Qualified, Registered Professional Engineer (IQRPE) reports for equipment identified in III.10.C.15.a.i(B);
c. Installation inspections for equipment identified in III.10.C.15.a.i(B); and
d. Other inspection, verification, operability, maintenance, or records management beyond that which is specified elsewhere in this permit, for equipment identified in III.10.C.15.a.i(B), or by Conditions III.10.C.15.a.ii and III.10.C.15.a.iii.

III.10.C.15.a.ii The Permittees will submit to Ecology, pursuant to Permit Condition III.10.C.9.f, prior to initial receipt of dangerous waste and/or mixed waste in the WTP Unit, engineering information as identified below for incorporation into Appendices 9.13, 9.18, 10.13, and 10.18.

A. Equipment instrument logic narrative description related to safe operation of equipment covered by III.10.C.15.a.i(B), including but not limited to allowed travel path for bridge and trolley, upper and lower hook travel limits, two-blocking prevention, hook load limits, wire rope misreeling, and overspeed protection (Compliance Schedule Item 38).

B. Descriptions of operational procedures demonstrating appropriate controls and practices are in place to ensure equipment covered by III.10.C.15.a.i(B) will be operated in a safe and reliable manner that will not result in damage to regulated tank systems, miscellaneous unit systems, or canisters of vitrified waste (Compliance Schedule Item 39).

III.10.C.15.a.iii Prior to initial receipt of dangerous and/or mixed waste in the WTP Unit, the Permittees will submit to Ecology, pursuant to Permit Condition III.10.C.9.f, the following for incorporation into Chapter 4: Updated Narrative Description and figures for all Mechanical Handling Systems identified in Permit Table III.10.C.A, to include but not limited to travel path, fail safe conditions, fail safe logic control, safety features and controls that minimize the potential for release of dangerous/mixed waste during normal operations, and lifting and/or load capabilities of each crane specified in III.10.C.15.a.i(B).

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Tables III.10.C.A – Mechanical Handling Systems

Pretreatment Building	
Pretreatment Filter Cave Handling System	PFH
Pretreatment In-Cell Handling System	PIH
Radioactive Solid Waste Handling System	RWH
Low-Activity Waste Building	
Radioactive Solid Waste Handling System	RWH
LAW Melter Equipment Support Handling System	LSH
LAW Container Pour Handling System	LPH
LAW Container Finishing Handling System	LFH
LAW Melter Handling System	LMH
LAW Canister Export Handling System	LEH
High-Level Waste Building	
HLW Melter Cave Support Handling System	HSH
HLW Canister Export Handling System	HEH
HLW Filter Cave Handling System	HFH
HLW Canister Pour Handling System	HPH
HLW Canister Decontamination Handling System	HDH
HLW Melter Handling System	HMH
Radioactive Solid Waste Handling System	RWH

III.10.C.16 Secondary Containment Devices

III.10.C.16.a According to WAC 173-303-640(4)(d), WTP tank systems and miscellaneous units, regulated as tank systems in accordance with WAC 173-303-680, may utilize secondary containment that include one or more of the following devices;

- A liner (external to the tank).
- A vault installed with chemical resistant water stops at all joints, in compliance with WAC 173-303-640(4)(e)(ii)(C), and an impermeable interior coating or lining that is compatible with the stored waste and will prevent the migration of waste into the concrete, in compliance with WAC 173-303-640(4)(e)(ii)(D).
- A double walled tank.
- An equivalent device approved by the department.

III.10.C.16.a.i Special protective coating systems, as defined in the *Engineering Specification for Field Applied Special Protective Coatings for Secondary Containment Areas* and incorporated into Appendix 7.7, have been approved by Ecology for use as equivalent devices on a case-by-case basis, allowable under WAC 173-303-640(4)(d)(iv).

III.10.C.16.a.ii The secondary containment areas located in Table III.10.C.B are approved to use special protective coating systems as an equivalent device.

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III.10.C.16.a.iii Approved special protective coating systems satisfy containment requirements found in Permit Conditions III.10.E.5.h, III.10.G.5.i, III.10.H.1.a.xxii, III.10.I.1.a.xv, and III.10.K.1.a.xvi.

III.10.C.16.a.iv Fully welded stainless steel liners or chemical resistant water stops are not required when an equivalent device is approved for use, with the exception of concrete secondary containment for regulated tanks located in outdoor areas, which must be provided with chemical resistant water stops when the approved special protective coating system is used.

III.10.C.16.a.v Fully welded stainless steel liners are considered a liner external to the tank (otherwise defined as an external liner system), as described in WAC 173-303-640(4)(d)(i) and are designed and operated in accordance with WAC 173-303-640(4)(e)(i).

III.10.C.16.a.vi Revisions to Table III.10.C.B will be submitted to Ecology for review and approval pursuant to Permit Conditions III.10.C.2.e and III.10.C.2.f.

Table III.10.C.B – Secondary Containment Locations Approved for Equivalent Device Use

Row Number	Room Number	Room/Area Description	Building	Elevation (feet)	Additional Requirements
1.	P-0105	Bulge area	PTF	0	Daily visual inspection[c]
2.	P-0105A	Bulge area	PTF	0	Daily visual inspection[c]
3.	P-0105B	Bulge area	PTF	0	Daily visual inspection[c]
4.	P-0105C	Bulge area	PTF	0	Daily visual inspection[c]
5.	P-B005	Fire water collection pit	PTF	-19	Daily visual inspection[c]
6.	P-0304	Waste feed evaporation room	PTF	56	Daily visual inspection[c]
7.	P-0325	Treated LAW evaporation room	PTF	56	Daily visual inspection[c]
8.	P-0320	Ion exchange evaporator	PTF	56	Daily visual inspection[c]
9.	P-0430	CNP evaporator condenser room	PTF	77	Portable, impermeable berm[a] Daily visual inspection[c]
10.	P-0110F	CXP C3/C5 process enclosure	PTF	0	Portable, impermeable berm[a] Continuous leak detection[b]
11.	P-0110H	TLP C3/C5 process enclosure	PTF	0	Portable, impermeable berm[a] Continuous leak detection[b]
12.	P-0116A	TCP C3/C5 process enclosure	PTF	0	Portable, impermeable berm[a] Continuous leak detection[b]

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Table III.10.C.B – Secondary Containment Locations Approved for Equivalent Device Use

Row Number	Room Number	Room/Area Description	Building	Elevation (feet)	Additional Requirements
13.	L-0218	Caustic scrubber blow down pump room	LAW	28	Daily visual inspection[c]
14.	L-0304F	Caustic scrubber (LVP-SCB-0001) area	LAW	48	Daily visual inspection[c]
15.	H-B039A	Bogie maintenance/canister rinse room	HLW	-21	Daily visual inspection[c]

Footnotes:

[a] Requires the use of a portable, impermeable berm or a similar device at the base of all doors.

[b] Requires the use of continuous leak detection, in accordance with Permit Conditions III.10.E.5.b and III.10.G.5.c.

[c] Inspections of all secondary containment areas will occur in accordance with the WTP Inspection Schedule, Operating Unit Group 10, Addendum E in this Permit.

III.10.D CONTAINERS

III.10.D.1 Container Storage Areas and Storage Limits

III.10.D.1.a The Permittees may store dangerous and/or mixed waste meeting the waste acceptance criteria for containerized waste in the WAP, Operating Unit Group 10, Chapter 3, (as approved pursuant to Permit Conditions III.10.C.3 and III.10.C.2), for storage in dangerous and/or mixed waste container storage units identified in Permit Tables III.10.D.A through C.

III.10.D.1.b The Permittees may store containerized dangerous and mixed waste only in container storage areas listed in Permit Tables III.10.D.A (as approved/modified pursuant to Permit Condition III.10.D.10), in accordance with Permit Section III.10.D, and in accordance with Operating Unit Group 10, Chapters 1.0 and 4.0, and Appendices 9.4, 9.5, 9.7, 9.8, 9.9, 9.18, 10.4, 10.5, 10.7, 10.8, 10.9, 10.18, 12.4, 12.5, 12.7, 12.8, 12.9, and 12.15, as approved pursuant to Permit Conditions III.10.D.10.b through d. The Permittees will limit the total volume of waste to quantities specified for the individual container storage areas listed in Permit Table III.10.D.A.

III.10.D.1.c The Permittees must maintain a free volume (i.e., free volume = total capacity of containment system minus volume occupied by equipment and containers within containment systems) within containment systems identified in Permit Tables III.10.D.B and III.10.D.C (as approved/modified pursuant to Permit Condition III.10.D.10), equal to ten percent (10%) of the total volume of dangerous and mixed waste stored within the containment system, or the volume of the largest container stored within the containment system, whichever is greater.

III.10.D.1.d The Permittees will maintain documentation in the operating record for each container storage area listed in Permit Table III.10.D.A (as approved/modified pursuant to Permit Condition III.10.D.10), in accordance with WAC 173-303-380.

III.10.D.1.e For the purpose of determining compliance with container storage area capacity limits and containment system requirements, every waste container will be considered to be full.

III.10.D.1.f RESERVED

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III.10.D.2 Container Storage Areas Design and Construction

III.10.D.2.a The Permittees will construct container storage areas identified in Permit Tables III.10.D.A through III.10.D.C, as specified in all applicable drawings and specifications in Operating Unit Group 10, Appendices 9.4, 9.5, 9.7, 9.8, 9.9, 10.4, 10.5, 10.7, 10.8, 10.9, 12.4, 12.5, 12.7, 12.8, and 12.9, as approved pursuant to Permit Condition III.10.D.10.b.

III.10.D.2.b RESERVED

III.10.D.2.c All container storage areas identified in Permit Tables III.10.D.A through III.10.D.C (as approved/modified pursuant to Permit Condition III.10.D.10), must be constructed to protect containers from contact with accumulated liquids (e.g., leaks, spills, precipitation, fire water, liquids from damaged or broken pipes) [WAC 173-303-630(7)(a)(i) and WAC 173-303-630(7)(c)(ii)].

III.10.D.2.d Modifications to approved design, plans, and specifications for the container storage areas identified in Permit Tables III.10.D.A through III.10.D.C must be made in accordance with Permit Conditions III.10.C.2.e, f, and g, or III.10.C.9.d, e, and h.

III.10.D.3 Container Storage Area Installation

III.10.D.3.a RESERVED

III.10.D.3.b The Permittees will obtain and place in the WTP Unit operating record, within thirty (30) days of completion of each container storage area identified in Permit Tables III.10.D.A, through III.10.D.C (as approved/modified pursuant to Permit Condition III.10.D.10), written statements by a qualified installation inspector or a registered professional engineer, attesting that these areas were installed in compliance with WAC 173-303-630(7)(a), (b), and (c) [WAC 173-303-630(7), WAC 173-303-806(4)(b)(i)].

III.10.D.4 Container Management Practices

III.10.D.4.a RESERVED

III.10.D.4.b The Permittees will manage all waste in container storage areas identified in Permit Tables III.10.D.A through III.10.D.C (as approved/modified pursuant to Permit Condition III.10.D.10), in accordance with procedures described in Operating Unit Group 10, Chapter 4, Appendices 9.18, 10.18, and 12.15, as approved pursuant to Permit Condition III.10.D.10.c, and the following conditions:

III.10.D.4.b.i The operating records and waste tracking procedures will indicate all times at which containerized dangerous and mixed waste were removed from and returned to designated staging, storage, segregation, and treatment areas as approved pursuant to Permit Condition III.10.D.10.c.vi (WAC 173-303-380).

III.10.D.4.b.ii The physical arrangement (i.e., spacing) of dangerous and mixed waste containers will be as specified in WAC 173-303-630(5)(c), except for the ILAW containers and IHLW waste canisters, which must be as described in Operating Unit Group 10, Chapter 4, Sections 4E.1.2.1, 4F.1.2.1, as updated pursuant to Permit Condition III.10.D.10.c.i.

III.10.D.4.b.iii All container storage areas must be operated to protect containers from contact with accumulated liquids resulting from leaks, spills, or precipitation. [WAC 173-303-630(7)(a)(i) and (c)(ii)]

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III.10.D.4.b.iv At all times, the Permittees will place and store ignitable and/or reactive dangerous and/or mixed waste in accordance with the procedures described in Operating Unit Group 10, Appendix 8.18, 9.18, 10.18, 11.18, 12.18, and 13.18 as approved pursuant to Permit Condition III.10.D.10.c.xi.

III.10.D.4.b.v At all times, the Permittees will place and store incompatible dangerous and/or mixed waste in accordance with the procedures described in Operating Unit Group 10, Appendix 8.18, 9.18, 10.18, 11.18, 12.18, and 13.18 as approved pursuant to Permit Condition III.10.D.10.c.xii.

III.10.D.4.b.vi At all times, storage containers holding dangerous and/or mixed waste that contain free liquids and/or exhibit either the characteristic of ignitability or reactivity as described in WAC 173-303-090(5) or (7), must be provided with a containment system in accordance with WAC 173-303-630(7)(a)(i) through (iii). [WAC 173-303-630(7)(c)]

III.10.D.4.b.vii At all times, containers holding dangerous and/or mixed waste in container storage areas must be closed, except when it is necessary to add or remove waste. [WAC 173-303-630(5)(a)]

III.10.D.4.b.viii At all times, containers holding dangerous and/or mixed waste must <u>not</u> be opened, handled, or stored in a manner which may rupture the container or cause it to leak. [WAC 173-303-630(5)(b)]

III.10.D.4.b.ix A storage container holding a dangerous and/or mixed waste that is incompatible, as defined in WAC 173-303-040, with any waste or other materials stored nearby in other containers, piles, open tanks, or surface impoundments must be separated from the other waste or materials or protected from them by means of a dike, berm, or wall. [WAC 173-303-630(9)(c)]

III.10.D.4.b.x If a container holding dangerous and/or mixed waste is not in good condition (e.g., exhibits severe rusting, apparent structural defects, or any other condition that could lead to container rupture or leakage) or is leaking, the Permittees will manage the container in accordance with procedures described in Operating Unit Group 10, Appendices 8.15, 9.18, 10.18, 11.15, and 12.15, as approved pursuant to Permit Condition III.10.D.10.c.viii. [WAC 173-303-630(2)]

III.10.D.4.b.xi RESERVED

III.10.D.4.b.xii The Permittees will ensure that all containers used for dangerous and/or mixed waste management, are made of or lined with materials which will not react with and are otherwise compatible with the waste to be stored [WAC 173-303-630(4)].

III.10.D.4.b.xiii Except for lab packs assembled in compliance with WAC 173-303-161 requirements, the Permittees will not place incompatible wastes, or incompatible wastes and materials, in the same container, unless WAC 173-303-395(1)(b) is complied with [WAC 173-303-630(9)(a)].

III.10.D.4.b.xiv The Permittees will not place dangerous and/or mixed waste in an unwashed container that previously held an incompatible waste or material [WAC 173-303-630(9)(b)].

III.10.D.5 Identification of Containers and Container Storage Areas

III.10.D.5.a Pursuant to WAC 173-303-630(3), the Permittees will ensure that all dangerous and/or mixed waste containers (except as otherwise specified in Operating Unit Group 10, Chapter 4, Sections 4D.1.3, 4E.1.3, 4F.1.3, 4H.1.3, 4I.1.3, as updated pursuant to Permit Condition III.10.D.10.c.i, for containers of ILAW and IHLW) are labeled in a manner that

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adequately identifies the major risk(s) associated with the contents. For purposes of container labeling, major risk(s) could include but are not limited to the following:

III.10.D.5.a.i PERSISTENT (if a WP01 or WP02 waste code);

III.10.D.5.a.ii TOXIC (if a WT01, WT02, or D waste code other than D001, D002, or D003);

III.10.D.5.a.iii IGNITABILITY (if a D001 and other waste codes);

III.10.D.5.a.iv CORROSIVE (if a D002 and other waste codes);

III.10.D.5.a.v REACTIVE (if a D003 and other waste codes).

III.10.D.5.b For all dangerous and mixed waste containers (except as otherwise specified in Operating Unit Group 10, Chapter 4, Sections 4D.1.3, 4E.1.3, 4F.1.3, 4H.1.3, 4I.1.3, as updated pursuant to Permit Condition III.10.D.10.c.i, for containers of ILAW and canisters of IHLW), the Permittees will ensure that:

III.10.D.5.b.i Labels are not obscured or otherwise unreadable;

III.10.D.5.b.ii Waste containers are oriented so as to allow inspection of the labels identified in Permit Conditions III.10.D.5.a and III.10.D.5.b, the container tracking number, and, to the extent possible, any labels which the generator placed upon the container; and

III.10.D.5.b.iii Empty dangerous and mixed waste containers, as defined by WAC 173-303-160(2), must have their dangerous and/or mixed waste labels destroyed or otherwise removed immediately upon being rendered empty.

III.10.D.5.c The Permittees will post entrances and access points to all ILAW containers and IHLW canister storage areas, and any other areas where containers of ILAW and IHLW are handled, with signs that, in addition to meeting the requirements of WAC 173-303-310(2)(a), clearly identify the major risk(s) associated with the containers of ILAW and IHLW.

III.10.D.6 Containment Systems

Containerized dangerous and mixed waste, and other materials that are incompatible, will not be staged, segregated, or stored within the same containment system as identified in Permit Table III.10.D.C, as approved/modified pursuant to Permit Condition III.10.D.10 (e.g., metal pan, concrete berm, portable containment system). [WAC 173-303-630(9)(c)]

III.10.D.6.a The integrity of containment systems identified in Permit Table III.10.D.C (as approved/modified pursuant to Permit Condition III.10.D.10) must be maintained so that cracks, gaps, loss of integrity, deterioration, corrosion, or erosion of containment pads, joints in containment pads, berms, curbs, trenches, sumps, and coatings are repaired in accordance with Operating Unit Group 10, Chapter 6, as approved/modified pursuant to Permit Conditions III.10.D.10.c.vii, III.10.C.5.b, and III.10.C.5.c. [WAC 173-303-320, WAC 173-303-630(7)(a)(i)]

III.10.D.6.b An impermeable coating, as specified in Operating Unit Group 10, Appendices 9.4, 9.5, 9.7, 9.8, 9.9, 10.4, 10.5, 10.7, 10.8, 10.9, 12.4, 12.5, 12.7, 12.8, and 12.9 will be maintained for all concrete containment systems and will meet the following performance standards [WAC 173-303-630(7)(a)]:

III.10.D.6.b.i The coating must seal the containment system surface such that no cracks, seams, or other pathways through which liquid could migrate are present;

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III.10.D.6.b.ii The coating must be of adequate thickness and strength to withstand the normal operation of equipment and personnel within the given area such that degradation or physical damage to the coating or lining can be identified and remedied before waste could migrate from the containment system; and

III.10.D.6.b.iii The coating must be compatible with the waste managed in the containment system.

III.10.D.6.c The Permittees must inspect all containment systems specified in Permit Table III.10.D.C in accordance with the inspection schedules and requirements in Operating Unit Group 10, Chapter 6, as approved/modified pursuant to Permit Conditions III.10.D.10.c.vii and III.10.C.5.c, and take the following actions if liquid is detected in these containment systems:

III.10.D.6.c.i Remove the liquid from the containment system in accordance with procedures described in Operating Unit Group 10, Chapter 6, (as modified pursuant to Permit Conditions III.10.C.5.b and III.10.C.5.c), Permit Condition III.10.C.6.a, and Operating Unit Group 10, Chapter 7 (as modified pursuant to Permit Condition III.10.C.6.b and III.10.C.6.c). The liquid removed from containment systems will be managed as dangerous and/or mixed waste, except for liquids from the WTP Waste Storage Area which will be managed as dangerous waste, unless the Permittees demonstrate through designation, (in accordance with WAC 173-303-070, incorporated by reference), that the liquid is no longer dangerous.

III.10.D.6.c.ii Determine the source of the liquid.

III.10.D.6.c.iii If the source of the liquid is determined to be a leak in a container, the Permittees must follow the procedures specified in Permit Condition III.10.D.4.b.x.

III.10.D.6.c.iv The Permittees must take action to ensure the incident that caused liquid to enter the containment system will not reoccur.

III.10.D.6.c.v The Permittees will document in the WTP Unit operating record actions/procedures taken to comply with i through iv above in accordance with WAC 173-303-630(6).

III.10.D.6.c.vi The Permittees will notify and report releases to the environment to Ecology in accordance with Permit Condition III.10.C.6.a.

III.10.D.7 Inspections

III.10.D.7.a The Permittees will inspect the container storage areas in accordance with the Inspection Schedules in Operating Unit Group 10, Chapter 6 of this Permit, as modified pursuant to Permit Condition III.10.C.5.c.

III.10.D.7.b The inspection data for the container storage areas will be recorded, and the records will be placed in the WTP Unit operating record in accordance with Permit Condition III.10.C.4.

III.10.D.8 Recordkeeping (WAC 173-303-380)

For the container storage areas, the Permittees will record and maintain in the WTP Unit operating record, all monitoring, recording, maintenance, calibration, test data, and inspection data compiled under the conditions of this Permit, in accordance with Permit Condition III.10.C.4 and III.10.C.5.

III.10.D.9 Closure

The Permittees will close the container storage areas identified in Permit Tables III.10.D.A through III.10.D.C in accordance with Operating Unit Group 10, Chapter 11 of this Permit, as approved pursuant to Permit Condition III.10.C.8.

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III.10.D.10 Compliance Schedules

III.10.D.10.a All information identified for submittal to Ecology in III.10.D.10.b through III.10.D.10.d of this compliance schedule must be signed in accordance with requirements in WAC 173-303-810(12).

III.10.D.10.b The Permittees will submit to Ecology, consistent with the schedule described in Operating Unit Group 10, Appendix 1.0, for review and approval, prior to construction of container storage area and associated containment systems as identified in Permit Tables III.10.D.A and III.10.D.B respectively, engineering information as specified below, for incorporation into Operating Unit Group 10, Appendices 9.4, 9.5, 9.7, 9.8, 9.9, 10.4, 10.5, 10.7, 10.8, 10.9, 12.4, 12.5, 12.7, 12.8, and 12.9 of this Permit. In order to incorporate engineering information specified below into Operating Unit Group 10, Appendices 9.4, 9.5, 9.7, 9.8, 9.9, 10.4, 10.5, 10.7, 10.8, 10.9, 12.4, 12.5, 12.7, 12.8, and 12.9, Permit Condition III.10.C.2.g process will be followed. At a minimum, container storage area and containment system drawings and specifications will show the following pursuant to WAC 173-303-806(4)(b):

III.10.D.10.b.i Design drawings (General Arrangement Drawings - in plan) and specifications including references to specific building codes (e.g., Uniform Building Code, American Society of Civil Engineers) for each container storage areas' foundation and associated containment system. These items should show basic design parameters and dimensions, and location of the container storage areas and associated containment systems; how containment system design promotes positive drainage control (such as a locked drainage valve) to prevent release of contaminated liquids and so that uncontaminated liquids can be drained promptly for convenience of operation; capacity of the containment system relative to the volume of the largest container to be stored; how the base underlying the containers is sloped (i.e., floor slopes to sumps) or the containment system is otherwise designed and operated to drain and remove liquids resulting from leaks, spills, or other liquids, or how containers are kept from contact with standing liquids in the containment system (i.e., elevated or are otherwise protected); for container storage areas without associated containment systems, a description of how the storage area is designed or operated to drain and remove liquids or how containers are kept from contact with standing liquids;

III.10.D.10.b.ii Containment systems materials selection documentation (including, but not limited to, materials of construction, coatings and liner materials for concrete portions of containment systems);

III.10.D.10.b.iii Sketches, drawings, or data demonstrating compliance with WAC 173-303-630(8) (location of buffer zone and containers holding ignitable or reactive waste) and WAC 173-303-630(9)(c) (location of incompatible waste), where applicable;

III.10.D.10.b.iv Submit Permit Table III.10.D.B completed to provide for all containment systems, the information as specified in each column heading, consistent with information to be provided in III.10.D.10.b.i through iii above.

III.10.D.10.c Prior to initial receipt of dangerous and/or mixed waste in the WTP Unit, the Permittees will update and submit to Ecology, consistent with the schedule described in Operating Unit Group 10, Appendix 1.0, for review and approval, the following, as specified below, for incorporation into Operating Unit Group 10, Chapter 4, and Appendices 9.18, 10.18, and 12.15, except Permit Condition III.10.D.10.c.vii, which will be incorporated into Operating Unit Group 10, Chapter 6. In order to incorporate the following information (specified below) into Operating Unit Group 10, Appendix 9.18, 10.18, and 12.18, Permit

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Condition III.10.C.2.g will be followed. All information provided under this Permit Condition must be consistent with information provided pursuant to Permit Conditions III.10.D.10.b, III.10.D.10.c, and III.10.D.10.d as approved by Ecology, and will include at a minimum, the following information as required pursuant to WAC 173-303-630 and WAC 173-303-340:

III.10.D.10.c.i Operating Unit Group 10, Chapter 4, Narrative Descriptions, updated;

III.10.D.10.c.ii Descriptions of procedures for addition and removal of waste from containers;

III.10.D.10.c.iii Descriptions of procedures for opening and closing of containers, including any inspections performed prior to opening;

III.10.D.10.c.iv Descriptions of procedures for handling and transport of containers within the WTP Unit;

III.10.D.10.c.v Description of the tracking system used to track containers throughout the WTP Unit pursuant to WAC 173-303-380. The tracking system, at a minimum, will do the following:

A. Track the location of containers within the WTP Unit;
B. Track which containers have been shipped off-facility and/or off-site, and to where they have been shipped;
C. For containers intended for transport off-site, include information in accordance with the requirements specified in WAC 173-303-190(3)(b);
D. Record the date container is placed in the container storage area;
E. Record the nature of the waste in any given container, including dangerous waste designation codes, any associated LDR treatment requirements, and the major risk(s) associated with the waste (as described in Permit Conditions III.10.D.5.a and III.10.D.5.c).

III.10.D.10.c.vi Descriptions of procedures for container spacing, stacking, and labeling pursuant to WAC 173-303-630(3), WAC 173-303-630(5)(c), WAC 173-303-340(3), WAC 173-303-630(6);

III.10.D.10.c.vii Descriptions of procedures for investigating container storage areas and investigating and repairing containment systems [WAC 173-303-320, WAC 173-303-630(6)];

III.10.D.10.c.viii Descriptions of procedures for responding to damaged (e.g., severe rusting, apparent structural defects) or leaking containers [WAC 173-303-630(2)];

III.10.D.10.c.ix Descriptions of operational procedures demonstrating how accumulated liquids can be analyzed and removed from containment systems to prevent overflow [WAC 173-303-806(4)(b)(i)(E)];

III.10.D.10.c.x For portable containment systems, vendor information, design drawings, or sketches showing the following information. These items will include as a minimum basic design parameters, dimensions, and materials of construction; how the design promotes positive drainage control (such as a locked drainage valve) to prevent release of contaminated liquids and so that uncontaminated liquids can be drained promptly for convenience of operation; how the base underlying the containers is sloped (i.e., floor slopes to sumps) or the containment system is otherwise designed and operated to drain and remove liquids resulting from leaks, spills, or other liquids, <u>or</u> how containers are kept from contact with standing liquids in the containment system (i.e., elevated or are otherwise protected); and capacity of the containment system relative to the volume of the largest container to be stored;

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III.10.D.10.c.xi Where ignitable and reactive waste are stored or otherwise managed in containers, a description of the procedures used to ensure compliance with WAC 173-303-630(8)(a) and (b);

III.10.D.10.c.xii Where incompatible waste are stored or otherwise managed in containers, a description of the procedures used to ensure compliance with WAC 173-303-630(9)(a) and (b), and 173-303-395(1)(b) and (c);

III.10.D.10.c.xiii Submit Permit Table III.10.D.C completed to provide for all portable containment systems, the information as specified in each column heading, consistent with information to be provided in III.10.D.10.c.i through xii above;

III.10.D.10.c.xiv Test procedures and results or other documentation or information to show that the waste do not contain free liquids, as applicable.

III.10.D.10.d Prior to initial receipt of dangerous and/or mixed waste in the WTP Unit, the Permittees will submit to Ecology, consistent with the schedule described in Operating Unit Group 10, Appendix 1.0, for review and approval, completed Permit Tables III.10.D.A, III.10.D.B, and III.10.D.C, for incorporation into Operating Unit Group 10, Chapter 4, and Appendices 8.18, 9.18, and 10.18 of this Permit. In order to incorporate the information into Operating Unit Group 10, Chapter 4, and Appendices 8.18, 9.18, and 10.18 of this Permit, Permit Condition III.10.C.2.g process will be followed.

III.10.D.10.e The Permittees will submit to Ecology, consistent with the schedule described in Operating Unit Group 10, Appendix 1.0, for review and submittal to the Administrative Record, a gap analysis that identifies:

III.10.D.10.e.i Changes to projected operating conditions that result from the redesign of PTF and HLW (Interim Compliance Schedule Item WTP-47).

III.10.D.10.e.ii Changes to projected operating conditions that result from Direct-Feed Low Activity Waste (DFLAW) operations (Interim Compliance Schedule Item WTP-48).

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Table III.10.D.A – Container Storage/Containment Building Areas Description

Dangerous and Mixed Waste Container Storage Areas	Maximum Capacity Gallons (Solids)(ft^3)[d]	Maximum Operating Volume (Liquid[c])
HLW Vitrification Plant		
IHLW Canister Storage Cave[a] (Room H-0132)	163,599 gal. (21,870 ft^3)	NA
HLW East Corridor El. 0' (Rooms HC-0108/09/10)	183,721 gal. (24,560 ft^3)	NA
HLW Loading Area (Room H-0130)	142,204 gal. (19,010 ft^3)	NA
Other Areas		
WTP Waste Storage Area[b]	253,440 gal. (33,880 ft^3)	31,680 gal. (4,235 ft^3)
Transportation Staging Area	18,095 gal. (2,419 ft^3)	NA
HLW Failed Melter Storage Facility (Building 32)[f]	403,947 gal. (54,000 ft^3)	RESERVED
Lab Waste Management Area (Rooms A-0139, A-0139A/B/C/D)	139,586 gal. (18,660 ft^3)	RESERVED
Containment Buildings/ Container Storage	**Maximum Capacity Gallons (Solids)(ft^3)[d]**	**Maximum Operating Volume (Liquid[c])**
Pretreatment Plant		
P-0123 Pretreatment Hotcell Containment Building	RESERVED	RESERVED
Pretreatment Maintenance Containment Building	RESERVED	RESERVED
PM0124 Hotcell Crane Maintenance Area	RESERVED	RESERVED
P-0121A Spent Resin Dewatering	RESERVED	RESERVED
P-0421A General Filter Room	RESERVED	RESERVED
P-0122A Waste Packaging Area	RESERVED	RESERVED
P-0123A Remote Decontamination Maintenance Cave	RESERVED	RESERVED
P-0124 C3 Workshop	RESERVED	RESERVED
P-0124A C3 Workshop	RESERVED	RESERVED
P-0125 Filter Cask Airlock	RESERVED	RESERVED
P-0125A Filter Cask Area	RESERVED	RESERVED
P-0128A MSM Repair Area	RESERVED	RESERVED

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Table III.10.D.A – Container Storage/Containment Building Areas Description

Dangerous and Mixed Waste Container Storage Areas	Maximum Capacity Gallons (Solids)(ft^3)[d]	Maximum Operating Volume (Liquid[c])
P-0128 Temporary Storage Room	RESERVED	RESERVED
P-0223 Pretreatment Filter Package Maintenance Containment Building		
P-0335 Pretreatment Filter Cave Room	RESERVED	RESERVED
P-0335A Decon Chamber	RESERVED	RESERVED
P-0431A General Filter Room	RESERVED	RESERVED
LAW Vitrification Plant		
L-0112 LAW LSM Gallery Containment Building	RESERVED	RESERVED
LAW Container Finishing Containment Building	RESERVED	RESERVED
L-0109B Swabbing Area Line 2	RESERVED	RESERVED
L-0109C Decontamination Area Line 2	RESERVED	RESERVED
L-0109D Inert Fill Area Line 2	RESERVED	RESERVED
L-0115B Swabbing Area Line 1	RESERVED	RESERVED
L-0115C Decontamination Area Line 1	RESERVED	RESERVED
L-0115D Inert Fill Area Line 1	RESERVED	RESERVED
L-0109E Container Monitoring/Export Area	RESERVED	RESERVED
L-0115E Container Monitoring/Export Area	RESERVED	RESERVED
L-0119B LAW Consumable Import/Export Containment Building	RESERVED	RESERVED
L-0226A LAW C3 Workshop Containment Building	RESERVED	RESERVED
LAW Pour Cave Containment Building	RESERVED	RESERVED
L-B015A Melter 1 Pour Cave	RESERVED	RESERVED
L-B013C Melter 1 Pour Cave	RESERVED	RESERVED
L-B013B Melter 2 Pour Cave	RESERVED	RESERVED
L-B011C Melter 2 Pour Cave	RESERVED	RESERVED
L-B011B Future Melter 3 Pour Cave	RESERVED	RESERVED
L-B009B Future Melter 3 Pour Cave	RESERVED	RESERVED

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Table III.10.D.A – Container Storage/Containment Building Areas Description

Dangerous and Mixed Waste Container Storage Areas	Maximum Capacity Gallons (Solids)(ft^3)[d]	Maximum Operating Volume (Liquid[c])
LAW Buffer Container Containment Building	RESERVED	RESERVED
L-B025C Container Buffer Store	RESERVED	RESERVED
L-B025D Container Rework	RESERVED	RESERVED
HLW Vitrification Plant		
HLW Melter Cave 1 Containment Building	RESERVED	RESERVED
H-0117 Melter Cave 1		
H-0116B Melter Cave 1 C3/C5 Airlock		
H-0310A Melter Cave 1 Equipment Decon Pit		
HLW Melter Cave 2 Containment Building	RESERVED	RESERVED
H-0106 Melter Cave 2		
H-0105B Melter Cave 2 C3/C5 Airlock		
H-0304A Melter Cave 2 Equipment Decon Pit		
H-0136 IHLW Canister Handling Cave Containment Building	RESERVED	RESERVED
H-0133 IHLW Canister Swab and Monitoring Cave Containment Building	RESERVED	RESERVED
HLW C3 Workshop Containment Building	RESERVED	RESERVED
H-0311A C3 Workshop		
H-0311B C3 MSM Maintenance Workshop		
H-0104 HLW Filter Cave Containment Building	RESERVED	RESERVED
H-B032 HLW Pour Tunnel 1 Containment Building	RESERVED	RESERVED
H-B005A HLW Pour Tunnel 2 Containment Building	RESERVED	RESERVED
HLW Waste Handling Area Containment Building	RESERVED	RESERVED
H-0410B E&I Room		
H0411 Waste Handling Room		

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Table III.10.D.A – Container Storage/Containment Building Areas Description

Dangerous and Mixed Waste Container Storage Areas	Maximum Capacity Gallons (Solids)(ft^3)[d]	Maximum Operating Volume (Liquid[c])
HLW Drum Swabbing and Monitoring Area Containment Building	RESERVED	RESERVED
H-0126A Crane Maintenance Room		
H-0126B Swabbing and Monitoring Area		
H-B028 Cask Transfer Tunnel		

[a] Capacity is for immobilized glass waste storage.

[b] Maximum Capacity Gallons (Solids) is based on 4608 drum equivalents spaced two wide and stacked two high and including 30 inch aisle spacing for 33,880 ft^3. Maximum Operating Volume (Liquids) is based on 2304 drum equivalents spaced two wide and including 30 inch aisle spacing for 4,235 ft^3.

[c] All material within the containment systems will be considered waste for the purposes of calculating free volume, where free volume is the amount of space available in containment systems (i.e., free volume = total capacity of containment systems [which includes total capacity of portable containment systems] minus volume occupied by equipment and containers within containment systems).

[d] Gallons converted to cubic feet using a conversion factor of 1 gallon (liquid) x 0.134 = 1 ft^3 (rounded to the nearest whole number).

[e] Location and capacities of containers stored within portable containment systems specified on Permit Table III.10.D.C are limited to the dangerous and mixed waste container storage areas and capacities specified above.

[f] The dimension for height (H) is based on the height of the largest waste container stored in the area (i.e., LAW container is 7.5 ft., HLW canister is 15 ft., melters are assumed to be 16 ft., and a B-25 box is 5 ft. – stacked a maximum of two high is 10ft).

Table III.10.D.B – Container Storage Area Containment Systems

Container Storage Areas	Permanent Containment System Description – Drawing #s	Permanent Containment System Sump/Floor Drain ID #	Permanent Containment System Dimensions[a] (ft) & Materials of Construction	Permanent Containment System Capacity (gal) (relative to 10% of the volume of all containers within the container storage area, or 100% of the volume of the largest container, whichever is greater)
Failed Melter Storage Facility (Building 32)	24590-BOF-P1-32-00001	N/A	45’ x 75” x 16’[b]	403,947 gal. (54,000 ft^3)

[a] Dimensions listed are based on permitted design. Actual dimensions may vary within plus or minus (TBD).

[b] The dimension for height (H) is based on the height of the largest waste container stored in the area (i.e., LAW container is 7.5 ft., HLW canister is 15 ft., melters are assumed to be 16 ft., and a B-25 box is 5 ft. – stacked a maximum of two high is 10 ft).

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Table III.10.D.C – Container Storage Area Portable Containment Systems[a]

Portable Containment System Description – Specifications and Vendor Information	Portable Containment System Container Storage Area(s) Location(s)	Portable Containment System Dimensions[b] (ft) & Materials of Construction	Portable Containment System Capacity (gal) (relative to 10% of the volume of all containers managed within the portable containment system, or 100% of the volume of the largest container, whichever is greater)
RESERVED	RESERVED	RESERVED	RESERVED

[a] Location and capacities of containers stored within portable containment systems specified on this Permit Table are limited to the dangerous and mixed waste container storage areas and capacities specified in Permit Table III.10.D.A.

[b] Dimensions listed are based on permitted design. Actual dimensions may vary within plus or minus (TBD).

III.10.E TANK SYSTEMS

III.10.E.1 Approved Waste and Storage Limits

III.10.E.1.a The Permittees may store in tank systems all dangerous and/or mixed waste listed in the Part A Forms, Operating Unit Group 10, Chapter 1 of this Permit and in accordance with the WAP, Operating Unit Group 10, Chapter 3 as approved pursuant to Permit Condition III.10.C.3 of this Permit. Total tank system dangerous and/or mixed waste storage at the Facility will not exceed the volume(s) specified in the "Part A Form" 3 Permit Application, Chapter 1 of this permit.

III.10.E.1.b The Permittees may store and manage dangerous and/or mixed waste only in approved tank systems listed in Permit Tables III.10.E.A through D, I, K, M, O, and R as approved/modified pursuant to Permit Condition III.10.E.9, in accordance with Permit Section III.10.E of this Permit, and in accordance with Operating Unit Group 10, Chapter 1 and 4, and Operating Unit Group 10, Appendices 8.1 through 8.15, 9.1 through 9.14, 9.18, 10.1 through 10.14, 10.18, 11.1 through 11.15, and 13.1 through 13.18 of this Permit, as approved pursuant to Permit Conditions III.10.E.9.b through e. The Permittees will limit the total volume of waste to quantities specified for the individual units listed in Permit Tables III.10.E.A through D, I, K, M, O, and R.

III.10.E.1.c The Permittees will manage ignitable and reactive, and incompatible waste in accordance with WAC 173-303-395(1). Any tank system specified in Permit Tables III.10.E.A through D and III.10.E, I, K, M, O, and S as approved/modified pursuant to Permit Condition III.10.E.9, in which ignitable, reactive, or incompatible waste are managed will meet the requirements specified in WAC 173-303-640(9) and (10).

III.10.E.1.d The Permittees will ensure all certifications required by specialists (e.g., independent qualified registered professional engineer; independent corrosion expert; independent qualified installation inspector; etc.) use the following statement or equivalent pursuant to Permit Condition III.10.C.10 of this Permit:

"I, (Insert Name) have (choose one or more of the following: overseen, supervised, reviewed, and/or certified) a portion of the design or installation of a new tank system or component located at (address), and owned/operated by (name(s)). My duties were:

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(e.g., installation inspector, testing for tightness, etc.), for the following tank system components (e.g., the tank, venting piping, etc.), as required by the Dangerous Waste Regulations, namely, WAC 173-303-640(3) (applicable paragraphs (i.e., (a) through (g)).

"I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

III.10.E.1.e In all future permit submittals, the Permittees will include tank names with the tank designation (e.g., Process Condensate Vessels located in the Radioactive Liquid Waste Disposal (RLD) System are designated V45028A and V45028B, respectively).

III.10.E.2 Tank System Design and Construction

III.10.E.2.a The Permittees will construct the tank systems identified in Permit Tables III.10.E.A through D, I, K, M, O, and R as approved/modified pursuant to Permit Condition III.10.E.9, as specified in Operating Unit Group 10, Appendices 8.1 through 8.14, 9.1 through 9.14, 10.1 through 10.14, 11.1 through 11.14, and 13.1 through 13.14 of this Permit, as approved pursuant to Permit Conditions III.10.E.9.b, III.10.E.9.c, and III.10.E.9.d.

III.10.E.2.b The Permittees will construct all secondary containment systems identified in Permit Tables III.10.E.A through D, and I through S, as approved/modified pursuant to Permit Condition III.10.E.9, as specified in Operating Unit Group 10, Appendices 8.2, 8.4 through 8.15, 9.2, 9.4 through 9.14, 9.18, 10.2, 10.4 through 10.14, 10.18, 11.2, 11.4 through 11.14, 11.18, and 13.2, 13.4 through 13.14, and 13.18 of this Permit, as approved pursuant to Permit Conditions III.10.E.9.b, III.10.E.9.c, and III.10.E.9.d.

III.10.E.2.c Modifications to approved design, plans, and specifications in Operating Unit Group 10 of this Permit for the WTP Unit Tank Systems will be allowed only in accordance with Permit Conditions III.10.C.2.e and f, or III.10.C.2.g, III.10.C.9.d, e, and h.

III.10.E.2.d The Permittees will maintain construction access to the internal portions of installed tanks with pulse jet mixers until Ecology has provided written approval of the tank system designs for wear allowance pursuant to WAC 173-303-640(3)(a).

III.10.E.2.d.i The Permittees will not install the following tanks in the WTP Unit until Ecology has provided written approval of the tank system designs for wear allowance pursuant to WAC 173-303-640(3)(a):

- Plant Wash Vessel, PWD-VSL-00044.
- Acidic Waste Vessel, RLD-VSL-00007.
- Plant Wash and Drains Vessel, RLD-VSL-00008.
- HLW Feed Receipt Vessel, HLP-VSL-00022.
- HLW Lag Storage Vessels, HLP-VSL-00027A and HLP-VSL-00027B.
- HLW Feed Blend Vessel, HLP-VSL-00028.
- Ultrafiltration Feed Preparation Vessels, UFP-VSL-00001A and UFP-VSL-00001B.
- Ultrafiltration Feed Vessels, UFP-VSL-00002A and UFP-VSL-00002B.

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III.10.E.2.d.ii Except where exempted in writing by Ecology on the basis that wear allowance provisions will not be affected, fabrication and assembly of the following tanks and their internal components will be suspended until Ecology has provided written approval of the tank system designs for wear allowance pursuant to WAC 173-303-640(3)(a).

- HLW Feed Receipt Vessel, HLP-VSL-00022.
- HLW Lag Storage Vessels, HLP-VSL-00027A and HLP-VSL-00027B.
- HLW Feed Blend Vessel, HLP-VSL-00028.
- Ultrafiltration Feed Vessels, UFP-VSL-00002A and UFP-VSL-00002B.

III.10.E.3 Tank System Installation and Certification

III.10.E.3.a The Permittees must ensure that proper handling procedures are adhered to in order to prevent damage to the system during installation. Prior to covering, enclosing, or placing a new tank system or component in use, an independent qualified installation inspector or an independent qualified registered professional engineer, either of whom is trained and experienced in the proper installation of tank systems or components, must inspect the system for the presence of any of the following items:

III.10.E.3.a.i Weld breaks;

III.10.E.3.a.ii Punctures;

III.10.E.3.a.iii Scrapes of protective coatings;

III.10.E.3.a.iv Cracks;

III.10.E.3.a.v Corrosion;

III.10.E.3.a.vi Other structural damage or inadequate construction/installation.

All discrepancies must be remedied before the tank system is covered, enclosed, or placed in use [WAC 173-303-640(3)(c)].

III.10.E.3.b For tank systems or components that are placed underground and that are back-filled, the Permittees must provide a backfill material that is a non-corrosive, porous, homogeneous substance. The backfill must be installed so that it is placed completely around the tank and compacted to ensure that the tank and piping are fully and uniformly supported [WAC 173-303-640(3)(d)].

III.10.E.3.c The Permittees must test for tightness all new tanks and ancillary equipment prior to these components being covered, enclosed, or placed into use. If a tank system is found not to be tight, all repairs necessary to remedy the leak(s) in the system must be performed prior to the tank system being covered, enclosed, or placed in use [WAC 173-303-640(3)(e)].

III.10.E.3.d The Permittees must ensure ancillary equipment is supported and protected against physical damage and excessive stress due to settlement, vibration, expansion, or contraction [WAC 173-303-640(3)(f)].

III.10.E.3.e The Permittees must provide the type and degree of corrosion protection recommended by an independent corrosion expert, based on the information provided in Operating Unit Group 10, Appendices 8.9, 8.11, 9.9, 9.11, 10.9, 10.11, 11.9, 11.11, and 13.11 of this Permit, as approved pursuant to Permit Conditions III.10.E.9.b.i, III.10.E.9.b.iv, III.10.E.9.b.v, III.10.E.9.c.i, III.10.E.9.c.iv, III.10.E.9.c.v, III.10.E.9.d.i, III.10.E.9.d.iv, and III.10.E.9.d.v or other corrosion protection if the Ecology believes other corrosion

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protection is necessary to ensure the integrity of the tank system during use of the tank system. The installation of a corrosion protection system that is field fabricated must be supervised by an independent corrosion expert to ensure proper installation [WAC 173-303-640(3)(g)].

III.10.E.3.f Prior to initial receipt of dangerous and/or mixed waste in the WTP Unit, the Permittees will obtain, and keep on file in the WTP Unit operating record, written statements by those persons required to certify the design of the tank system and supervise the installation of the tank system in accordance with the requirements of WAC 173-303-640(3)(b), (c), (d), (e), (f), and (g), attesting that each tank system and corresponding containment system listed in Permit Tables III.10.E.A through D and III.10.E.I through S, as approved/modified pursuant to Permit Condition III.10.E.9, were properly designed and installed, and that repairs, pursuant to WAC 173-303-640(3)(c) and (e) were performed [WAC 173-303-640(3)(a) WAC 173-303-640(3)(h)].

III.10.E.3.g The independent tank system installation inspection and subsequent written statements will be certified pursuant to Permit Condition III.10.E.1.d, comply with all requirements of WAC 173-303-640(3)(h) and will consider, but not be limited to, the following tank system installation documentation:

III.10.E.3.g.i Field installation report with date of installation;

III.10.E.3.g.ii Approved welding procedures;

III.10.E.3.g.iii Welder qualifications and certification;

III.10.E.3.g.iv Hydro-test reports, as applicable, in accordance with the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section VIII, Division 1, API Standard 620, or Standard 650 as applicable;

III.10.E.3.g.v Tester credentials;

III.10.E.3.g.vi Field inspector credentials;

III.10.E.3.g.vii Field inspector reports;

III.10.E.3.g.viii Field waiver reports; and

III.10.E.3.g.ix Non-compliance reports and corrective action (including field waiver reports) and repair reports.

III.10.E.4 Integrity Assessments

III.10.E.4.a The Permittees will ensure periodic integrity assessments are conducted on the WTP Unit Tank Systems listed in Permit Tables III.10.E.A through D, I, K, M, O, and R as approved/modified pursuant to Permit Condition III.10.E.9, over the term of this Permit as specified in WAC 173-303-640(3)(b), following the description of the integrity assessment program and schedule in Operating Unit Group 10, Chapter 6 of this Permit, as approved pursuant to Permit Conditions III.10.E.9.e.i and III.10.C.5.c. Results of the integrity assessments will be included in the WTP Unit operating record until ten (10) years after post-closure, or corrective action is complete and certified, whichever is later.

III.10.E.4.b The Permittees will address problems detected during the tank integrity assessments specified in Permit Condition III.10.E.4.a following the integrity assessment program in Operating Unit Group 10, Chapter 6 of this Permit, as approved pursuant to Permit Conditions III.10.E.9.e.i and III.10.C.5.c.

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III.10.E.4.c The Permittees must immediately and safely remove from service any Tank System or secondary containment system which through an integrity assessment is found to be "unfit for use" as defined in WAC 173-303-040, following Permit Conditions III.10.E.5.i.i through iv, vi, and vii. The affected tank system or secondary containment system must be either repaired or closed in accordance with Permit Condition III.10.E.5.i.v. [WAC 173-303-640(7)(e) and (f), WAC 173-303-640(8)].

III.10.E.5 Tank Management Practices

III.10.E.5.a No dangerous and/or mixed waste will be managed in the WTP Unit Tank System unless the operating conditions, specified under Permit Condition III.10.E.5 are complied with.

III.10.E.5.b The Permittees will install and test all process and leak detection system monitoring/instrumentation, as specified in Permit Tables III.10.E.E through H, and S as approved/modified pursuant to Permit Condition III.10.E.9, in accordance with Operating Unit Group 10, Appendices 8.1, 8.2, 8.14, 9.1, 9.2, 9.14, 10.1, 10.2, 10.14, 11.1, 11.2, 11.14, and 13.1, 13.2, and 13.14 of this Permit, as approved pursuant to Permit Conditions III.10.E.9.e.ix and III.10.E.9.d.x.

III.10.E.5.c The Permittees will not place dangerous and/or mixed waste, treatment reagents, or other materials in the WTP Unit Tank System if these substances could cause the tank system to rupture, leak, corrode, or otherwise fail [WAC 173-303-640(5)(a)].

III.10.E.5.d The Permittees will operate the WTP Unit Tank System to prevent spills and overflows using the description of controls and practices as required under WAC 173-303-640(5)(b) described in Permit Condition III.10.C.5, and Operating Unit Group 10, Appendices 8.16, 9.18, 10.18, 11.18, and 13.18 of this Permit, as approved pursuant to Permit Condition III.10.E.9.e.iv. [WAC 173-303-640(5)(b), WAC 173-303-806(4)(c)(ix)].

III.10.E.5.e For routinely non-accessible WTP Unit Tank Systems, as specified in Operating Unit Group 10, Chapter 4 of this Permit, as updated pursuant to Permit Condition III.10.E.9.e.vi, the Permittees will mark all routinely non-accessible tank system access points with labels or signs to identify the waste contained in the tanks. The label, or sign, must be legible at a distance of at least fifty (50) feet and must bear a legend that identifies the waste in a manner which adequately warns employees, emergency response personnel, and the public of the major risk(s) associated with the waste being stored or treated in the tank system(s). For the purposes of this Permit Condition, "routinely non-accessible" means personnel are unable to enter these areas while waste is being managed in them [WAC 173-303-640(5)(d)].

III.10.E.5.f For all tank systems not addressed in Permit Condition III.10.E.5.e, the Permittees will mark all these tank systems holding dangerous and/or mixed waste with labels or signs to identify the waste contained in the tank. The labels, or sign, must be legible at a distance of at least fifty (50) feet, and must bear a legend that identifies the waste in a manner which adequately warns employees, emergency response personnel, and the public of the major risk(s) associated with the waste being stored or treated in the tank system(s) [WAC 173-303-640(5)(d)].

III.10.E.5.g The Permittees will ensure that the secondary containment systems for the WTP Unit Tank Systems listed in Permit Tables III.10.E.A through D, I, K, M, O, and R as approved/modified pursuant to Permit Condition III.10.E.9, are free of cracks or gaps to prevent any migration of dangerous and/or mixed waste or accumulated liquid out of the system to the soil, ground water, or surface water at any time that waste is in the tank system. Any indication that a crack or gap may exist in the containment systems will be investigated and repaired in accordance with Operating Unit Group 10, Appendices 8.18,

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9.18, 10.18, 11.18, and 13.18 of this Permit, as approved pursuant to Permit Condition III.10.E.9.e.v [WAC 173-303-320, WAC 173-303-640(4)(b)(i), WAC 173-303-640(4)(e)(i)(C), WAC 173-303-640(6), and WAC 173-303-806(4)(c)(vii)].

III.10.E.5.h An impermeable coating, as specified in Operating Unit Group 10, Appendices 8.4, 8.5, 8.7, 8.9, 8.11, 8.12, 9.4, 9.5, 9.7, 9.9, 9.11, 9.12, 10.4, 10.5, 10.7, 10.9, 10.11, 10.12, 11.4, 11.5, 11.7, 11.9, 11.11, 11.12, and 13.4, 13.5, 13.7, 13.9, 13.11, and 13.12 of this Permit, as approved pursuant to Permit Condition III.10.E.9.b.v, will be maintained for all concrete containment systems and concrete portions of containment systems for each WTP Unit Tank System listed in Permit Tables III.10.E.A through D, I through K, M through O, and R through T as approved/modified pursuant to Permit Condition III.10.E.9. Concrete containment systems that do not have a liner and have construction joints, must meet the requirements of WAC 173-303-640(4)(e)(ii)(C) and -806(4)(c)(vii). The coating will prevent migration of any dangerous and/or mixed waste into the concrete. All coatings will meet the following performance standards:

III.10.E.5.h.i The coating must seal the containment surface such that no cracks, seams, or other avenues through which liquid could migrate are present;

III.10.E.5.h.ii The coating must be of adequate thickness and strength to withstand the normal operation of equipment and personnel within the given area such that degradation or physical damage to the coating or lining can be identified and remedied before dangerous and/or mixed waste could migrate from the system; and

III.10.E.5.h.iii The coating must be compatible with the dangerous and/or mixed waste, treatment reagents, or other materials managed in the containment system [WAC 173-303-640(4)(e)(ii)(D), WAC 173-303-806(4)(c)(vii)].

III.10.E.5.i The Permittees will inspect all secondary containment systems for WTP Unit Tank Systems listed in Permit Tables III.10.E.A through D, I through K, M through O, and R through T as approved/modified pursuant to Permit Condition III.10.E.9, in accordance with the Inspection Plan specified in Operating Unit Group 10, Chapter 6A of this Permit, as approved pursuant to Permit Conditions III.10.E.9.e.v and III.10.C.5, and take the following actions if a leak or spill of dangerous and/or mixed waste is detected in these containment systems [WAC 173-303-320, WAC 173-303-640(5)(c), WAC 173-303-640(6), WAC 173-303-640(7), WAC 173-303-806(4)(a)(v)]:

III.10.E.5.i.i Immediately and safely stop the flow of dangerous and/or mixed waste into the tank system or secondary containment system, in accordance with procedures based on all applicable safety analysis documentation;

III.10.E.5.i.ii Determine the source of the dangerous and/or mixed waste;

III.10.E.5.i.iii Remove the waste from the secondary containment area pursuant to WAC 173-303-640(7)(b). The waste removed from containment areas of WTP Unit Tank Systems will be managed as dangerous and/or mixed waste;

III.10.E.5.i.iv If the cause of the release was a spill that has not damaged the integrity of the tank system, the Permittees may return the tank system to service pursuant to WAC 173-303-640(7)(e)(ii). In such a case, the Permittees will take action to ensure the incident that caused liquid to enter the containment systems of these tank systems will not reoccur [WAC 173-303-320(3)];

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III.10.E.5.i.v If the source of the dangerous waste and/or mixed waste is determined to be a leak from a primary WTP Unit Tank System, or the system is unfit for use as determined through an integrity assessment or other inspection, the Permittees must comply with the requirements of WAC 173-303-640(7) and take the following actions [WAC 173-303-640(5)(c)]:

A. Close the tank system according to procedures in WAC 173-303-640(7)(e)(i), and Operating Unit Group 10, Chapter 11 of this Permit, as approved pursuant to Permit Condition III.10.C.8; or

B. Repair and re-certify (in accordance with WAC 173-303-810(13)(a) as modified pursuant to Permit Condition III.10.E.1.d) the tank system in accordance with Operating Unit Group 10, Appendices 8.18, 9.18, 10.18, 11.18, and 13.18 of this Permit, as approved pursuant to Permit Condition III.10.E.9.e.v before the tank system is placed back into service [WAC 173-303-640(7)(e) and (f), and WAC 173-303-806(4)(c)(vii)];

III.10.E.5.i.vi The Permittees will document in the operating record actions/procedures taken to comply with III.10.E.5.i.i through v above in accordance with WAC 173-303-640(6)(d);

III.10.E.5.i.vii The Permittees will notify and report releases to the environment to Ecology in accordance with WAC 173-303-640(7)(d).

III.10.E.5.j If liquids (e.g., dangerous and/or mixed waste leaks and spills, precipitation, fire water liquids from damaged or broken pipes) cannot be removed from the secondary containment system within twenty-four (24) hours, Ecology will be verbally notified within twenty-four (24) hours of discovery. The notification will provide the information in A, B, and C listed below. The Permittees will provide Ecology with a written demonstration within seven (7) business days, identifying at a minimum [WAC 173-303-640(4)(c)(iv), WAC 173-303-640(7)(b)(ii), WAC 173-303-806(4)(c)(vii)]:

A. Reasons for delayed removal;

B. Measures implemented to ensure continued protection of human health and the environment;

C. Current actions being taken to remove liquids from secondary containment.

III.10.E.5.k The Permittees will operate the WTP Unit Tank System in accordance with Operating Unit Group 10, Chapter 4 as updated pursuant to Permit Condition III.10.E.9.e.vi and Appendices 8.18, 9.18, 10.18, 11.18, and 13.18 of this Permit, as approved pursuant to Permit Condition III.10.E.9.e, and the following:

III.10.E.5.k.i The Permittees will operate the WTP Unit Tank System in order to maintain the systems and process parameters listed in Permit Tables III.10.E.E through H, as approved/modified pursuant to Permit Condition III.10.E.9, within the operating trips and operating ranges specified in Permit Tables III.10.E.E through H, and consistent with assumptions and basis which are reflected in Operating Unit Group 10, Appendix, 6.3. as approved pursuant to Permit Condition III.10.C.11.b [WAC 173-303-815(2)(b)(ii) and WAC 173-303-640(5)(b)]. For the purposes of this permit condition, Operating Unit Group 10, Appendix 6.3 will be superseded by Appendix 6.4 upon its approval pursuant to either Permit Conditions III.10.C.11.c or III.10.C.11.d;

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III.10.E.5.k.ii The Permittees will calibrate/function test the instruments listed on Permit Tables III.10.E.E through H and S in accordance with Operating Unit Group 10, Appendices 8.18, 9.18, 10.18, 11.18, and 13.18 of this Permit, as approved pursuant to Permit Condition III.10.E.9.e.xi.

III.10.E.5.l Tank systems that have the potential for formation and accumulation of hydrogen gases must be operated to maintain hydrogen levels below the lower explosive limit [WAC 173-303-815(2)(b)(ii)].

III.10.E.5.m For each tank system holding dangerous waste which are acutely or chronically toxic by inhalation, operate the system to prevent escape of vapors, fumes or other emissions into the air [WAC 173-303-640(5)(e), WAC 173-303-806(4)(c)(xii)].

III.10.E.6 Inspections [WAC 173-303-640(6)]

III.10.E.6.a The Permittees will inspect the WTP Unit Tank Systems in accordance with the Inspection Plan in Operating Unit Group 10, Chapter 6A of this Permit, as modified pursuant to Permit Condition III.10.C.5.c.

III.10.E.6.b The inspection data for the WTP Unit Tank Systems will be recorded, and the records will be placed in the WTP Unit operating record, in accordance with Permit Condition III.10.C.4.

III.10.E.7 Recordkeeping (WAC 173-303-380)

For the WTP Unit Tank Systems, the Permittees will record and maintain in the WTP Unit operating record, all monitoring, calibration, recording, maintenance, test data, and inspection data compiled under the conditions of this Permit, in accordance with Permit Conditions III.10.C.4 and III.10.C.5.

III.10.E.8 Closure

The Permittees will close the WTP Unit Tank Systems in accordance with Operating Unit Group 10, Chapter 11 of this Permit, as approved pursuant to Permit Condition III.10.C.8.

III.10.E.9 Compliance Schedule

III.10.E.9.a All information identified for submittal to Ecology in b. through e. of this compliance schedule must be signed and certified in accordance with requirements in WAC 173-303-810(12), as modified in accordance with Permit Condition III.10.E.1.d [WAC 173-303-806(4)].

III.10.E.9.b The Permittees will submit to Ecology, pursuant to Permit Condition III.10.C.9.f, prior to construction of each secondary containment and leak detection system for the WTP Unit Tank System (per level, per WTP Unit building and outside the WTP Unit buildings) as identified in Permit Tables III.10.E.A through D, J, L, N, P, and S engineering information as specified below, for incorporation into Operating Unit Group 10, Appendices 8.4, 8.5, 8.7, 8.8, 8.9, 8.11, 8.12, 9.4, 9.5, 9.7, 9.8, 9.9, 9.11, 9.12, 10.4, 10.5, 10.7, 10.8, 10.9, 10.11, 11.4, 11.5, 11.7, 11.8, 11.9, 11.11, and 13.4, 13.5, 13.7, 13.8, 13.9, and 13.11 of this Permit. At a minimum, engineering information specified below will show the following as required pursuant to WAC 173-303-640 (the information specified below will include dimensioned engineering drawings and information on sumps and floor drains):

III.10.E.9.b.i IQRPE Reports (specific to foundation, secondary containment, and leak detection system) will include review of design drawings, calculations, and other information on which the certification report is based and will include as applicable, but not limited to, review of such information described below. Information (drawings,

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specifications, etc.) already included in Operating Unit Group 10, Appendices 8.0 through 11.0 of this Permit, may be included in the report by reference and should include drawing and document numbers. IQRPE Reports will be consistent with the information separately provided in Permit Conditions III.10.E.9.b.ii through ix below. The IQRPE Report(s) (specific to foundation, secondary containment and leak detection system) for the LAW and HLW buildings (-21 foot elevation only) will be submitted with the first IQRPE Report for tanks, identified in Permit Condition III.10.E.9.c.i [WAC 173-303-640(3)(a), WAC 173-303-806(4)(c)(i)];

III.10.E.9.b.ii Design drawings (General Arrangement Drawings in plan) and specifications for the foundation, secondary containment, including, liner installation details, and leak detection methodology [Note: leak detection systems for areas where daily, direct, or remote visual inspection is not feasible, will be continuous in accordance with WAC 173-303-640(4)(e)(iii)(C)]. These items should show the dimensions, volume calculations, and location of the secondary containment system, and should include items such as floor/pipe slopes to sumps, tanks, floor drains [WAC 173-303-640(4)(b) through (f), WAC 173-303-640(3)(a), WAC 173-303-806(4)(c)(i)];

III.10.E.9.b.iii The Permittees will provide the design criteria (references to codes and standards, load definitions, and load combinations, materials of construction, and analysis/design methodology) and typical design details for the support of the secondary containment system. This information will demonstrate the foundation will be capable of providing support to the secondary containment system, resistance to pressure gradients above and below the system, and capable of preventing failure due to settlement, compression, or uplift [WAC 173-303-640(4)(c)(ii), WAC 173-303-806(4)(c)(vii)];

III.10.E.9.b.iv A description of materials and equipment used to provide corrosion protection for external metal components in contact with soil, including factors affecting the potential for corrosion as required under WAC 173-303-640(3)(a)(iii)(B) [WAC 173-303-806(4)(c)(v)];

III.10.E.9.b.v Secondary containment/foundation and leak detection system materials selection documentation (including, but not limited to, concrete coatings and water stops, and liner materials as applicable) [WAC 173-303-806(4)(c)(i)];

III.10.E.9.b.vi Detailed description of how the secondary containment for each tank system will be installed in compliance with WAC 173-303-640(3)(c) [WAC 173-303-806(4)(c)(vi)];

III.10.E.9.b.vii Submit Permit Tables III.10.E.J, N, and S completed to provide for all secondary containment sumps and floor drains, the information as specified in each column heading, consistent with information to be provided in Permit Conditions III.10.E.9.b.i through vi above;

III.10.E.9.b.viii Documentation that secondary containment and leak detection systems will not accumulate hydrogen gas levels above the lower explosive limit and in accordance with Appendix 7.15 for incorporation into the Administrative Record [WAC 173-303-340].

III.10.E.9.b.ix A detailed description of how tank system design provides access for conducting future tank integrity assessments [WAC 173-303-640(3)(b), WAC 173-303-806(4)(c)(vi)];

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III.10.E.9.c The Permittees will submit to Ecology, pursuant to Permit Condition III.10.C.9.f, prior to installation of each tank as identified in Permit Tables III.10.E.A through D, and I, K, M, O, and R engineering information as specified below, for incorporation into Operating Unit Group 10, Appendices 8.1 through 8.9, 8.11 through 8.14, 9.1 through 9.9, 9.11 through 9.14, 10.1 through 10.9, 10.11 through 10.14, 11.1 through 11.9, 11.11 through 11.14, 13.1 through 13.9, and 13.11 through 13.14 of this Permit. Tanks will include primary sumps. At a minimum, engineering information specified below will show the following as required pursuant to WAC 173-303-640 (the information specified below will include dimensioned engineering drawings):

III.10.E.9.c.i IQRPE Reports (specific to tanks) will include review of design drawings, calculations, and other information on which the certification report is based and will include as applicable, but not limited to, review of such information described below. Information (drawings, specifications, etc.) already included in Operating Unit Group 10, Appendices 8.0 through 13.0 of this Permit, may be included in the report by reference and should include drawing and document numbers. The IQRPE Reports will be consistent with the information separately provided in Permit Conditions III.10.E.9.c.ii through xii below and the IQRPE Report specified in Permit Condition III.10.E.9.b.i [WAC 173-303-640(3)(a), WAC 173-303-806(4)(c)(i)];

III.10.E.9.c.ii Design drawings (General Arrangement Drawings in plan, Process Flow Diagrams, Piping and Instrumentation Diagrams [including pressure control systems], Mechanical Drawings) and specifications, and other information, specific to tanks (to show location and physical attributes of each tank) [WAC 173-303-640(3)(a), WAC 173-303-806(4)(c)(i) through (iv)];

III.10.E.9.c.iii The Permittees will provide the design criteria (references to codes and standards, load definitions, and load combinations, materials of construction, and analysis/design methodology) and typical design details for the support of the tank(s). Structural support calculations specific to off-specification, non-standard, and field fabricated tanks will be submitted for incorporation into the Administrative Record [WAC 173-303-640(3)(a), WAC 173-303-806(4)(c)(i)];

III.10.E.9.c.iv A description of materials and equipment used to provide corrosion protection for external metal components in contact with water, including factors affecting the potential for corrosion as required under WAC 173-303-640(3)(a)(iii)(B) [WAC 173-303-806(4)(c)(v)];

III.10.E.9.c.v Tank materials selection documentation (e.g., physical and chemical tolerances) [WAC 173-303-640(3)(a), WAC 173-303-806(4)(c)(i)];

III.10.E.9.c.vi Tank vendor information (including, but not limited to required performance warranties, as available), consistent with information submitted under ii. above, will be submitted for incorporation into the Administrative Record [WAC 173-303-640, and WAC 173-303-806(4)(c)];

III.10.E.9.c.vii System Descriptions related to tanks will be submitted for incorporation into the Administrative Record;

III.10.E.9.c.viii Mass balance for each projected operating condition, including assumptions and formulas used to complete the mass balance, so that they can be independently verified, and will be submitted for incorporation into the Administrative Record;

III.10.E.9.c.ix A detailed description of how the tanks will be installed in compliance with WAC 173-303-640(3)(c), (d), and (e) [WAC 173-303-806(4)(c)(vi)];

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III.10.E.9.c.x Submit Permit Tables III.10.E.I, K, M, O, and R completed to provide for all primary containment sumps and floor drains, the information as specified in each column heading, consistent with information to be provided in Permit Conditions III.10.E.9.c.i through ix;

III.10.E.9.c.xi Documentation that tanks are designed to prevent the accumulation of hydrogen gas levels above the lower explosive limit for incorporation into the Administrative Record [WAC 173-303-340];

III.10.E.9.c.xii Documentation that tanks are designed to prevent escape of vapors and emissions of acutely or chronically toxic (upon inhalation) Extremely Hazardous Waste limit and in accordance with Appendix 7.15 for incorporation into the Administrative Record [WAC 173-303-640(5)(e), WAC 173-303-806(4)(c)(xii)];

III.10.E.9.d The Permittees will submit to Ecology, pursuant to Permit Condition III.10.C.9.f, prior to installation of ancillary equipment for each tank system, as identified in Permit Tables III.10.E.A through D, I through K, M through O, and R through T not addressed in Permit Condition III.10.E.9.c, engineering information as specified below, for incorporation into Operating Unit Group 10, Appendices 8.1 through 8.9, 8.11 through 8.14, 9.1 through 9.9, 9.11 through 9.14, 10.1 through 10.9, 10.11 through 10.14, 11.1 through 11.9, 11.11 through 11.14, 13.1 through 13.9, and 13.11 through 13.14 of this Permit. At a minimum, engineering information specified below will show the following as required pursuant to WAC 173-303-640 (the information specified below will include dimensioned engineering drawings):

III.10.E.9.d.i IQRPE Reports (specific to ancillary equipment) will include a review of design drawings, calculations, and other information as applicable, on which the certification report is based. The reports will include, but not be limited to, review of such information described below. Information (drawings, specifications, etc.) already included in Operating Unit Group 10, Appendix 8.0 through 13.0 of this Permit, may be included in the report by reference and should include drawing and document numbers. The IQRPE Reports will be consistent with the information provided separately in Permit Conditions III.10.E.9.d.ii through xiii below and the IQRPE Reports specified in Permit Conditions III.10.E.9.b and III.10.E.9.c [WAC 173-303-640(3)(a), WAC 173-303-806(4)(c)(i)];

III.10.E.9.d.ii Design drawings (Process Flow Diagrams, Piping and Instrumentation Diagrams [including pressure control systems], etc.) specifications (including required performance warranties), and other information specific to ancillary equipment (these drawings should include all equipment such as pipe, valves, fittings, pumps, instruments, etc.) [WAC 173-303-640(3)(a), WAC 173-303-806(4)(c)(i), (iii), (iv)];

III.10.E.9.d.iii The Permittees will provide the design criteria (references to codes and standards, load definitions, and load combinations, materials of construction, and analysis/design methodology) and typical design details for the support of the ancillary equipment [WAC 173-303-640(3)(a), WAC 173-303-640(3)(f), WAC 173-303-806(4)(c)(i)];

III.10.E.9.d.iv A description of materials and equipment used to provide corrosion protection for external metal components in contact with soil and water, including factors affecting the potential for corrosion as required under WAC 173-303-640(3)(a)(iii)(B) [WAC 173-303-806(4)(c)(v)];

III.10.E.9.d.v Materials selection documentation for ancillary equipment (e.g., physical and chemical tolerances) [WAC 173-303-640(3)(a), WAC 173-303-806(4)(c)(i)];

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III.10.E.9.d.vi Vendor information, consistent with information submitted under ii above, will be submitted for incorporation into the Administrative Record [WAC 173-303-640, and WAC 173-303-806(4)(c)];

III.10.E.9.d.vii Tank, ancillary equipment, and leak detection system instrument control logic narrative description (e.g., descriptions of fail-safe conditions, etc.);

III.10.E.9.d.viii System Descriptions related to ancillary equipment and system descriptions related to leak detection systems, for incorporation into the Administrative Record;

III.10.E.9.d.ix A detailed description of how the ancillary equipment will be installed and tested [WAC 173-303-640(3)(c) through (e), WAC 173-303-640(4)(b) and (c), and WAC 173-303-806(4)(c)(vi)];

III.10.E.9.d.x For process monitoring, control, and leak detection system instrumentation for the WTP Unit Tank System as identified in Permit Tables III.10.E.E through H, and R through S, a detailed description of how the process monitoring, control, and leak detection system instrumentation will be installed and tested [WAC 173-303-640(3)(c) through (e), WAC 173-303-640(4)(b) and (c), WAC 173-303-806(4)(c)(vi)];

III.10.E.9.d.xi Mass balance for projected normal operating condition used in developing the process and instrumentation diagrams, including assumptions and formulas used to complete the mass balance, so that they can be independently verified, for incorporation into the Administrative Record;

III.10.E.9.d.xii Documentation that ancillary equipment is designed to prevent the accumulation of hydrogen gas levels above the lower explosive limit for incorporation into the Administrative Record [WAC 173-303-340].

III.10.E.9.d.xiii Leak detection system documentation (e.g. vendor information, etc.) consistent with information submitted under Permit Condition III.10.E.9.c.ii and Permit Conditions III.10.E.9.d.ii, vii, viii and x above, will be submitted for incorporation into the Administrative Record.

III.10.E.9.e Prior to initial receipt of dangerous and/or mixed waste in the WTP Unit, the Permittees will submit to Ecology, pursuant to Permit Condition III.10.C.9.f, the following as specified below for incorporation into Operating Unit Group 10, Appendices 8.18, 9.18, 10.18, 11.18, and 13.18 of this Permit, except Permit Condition III.10.E.9.e.v, which will be incorporated into Operating Unit Group 10, Chapter 6 of this Permit. All information provided under this permit condition must be consistent with information provided pursuant to Permit Conditions III.10.E.9.b, c, d, and e, III.10.C.3.e, and III.10.C.11.b, as approved by Ecology.

III.10.E.9.e.i Integrity assessment program and schedule for all WTP Unit tanks will address the conducting of periodic integrity assessments on all WTP Unit tanks over the life of the tank, in accordance with III.10.E.9.b.ix and WAC 173-303-640(3)(b), and descriptions of procedures for addressing problems detected during integrity assessments. The schedule must be based on past integrity assessments, age of the tank system, materials of construction, characteristics of the waste, and any other relevant factors [WAC 173-303-640(3)(b), WAC 173-303-806(4)(c)(vi)];

III.10.E.9.e.ii Detailed plans and descriptions, demonstrating the leak detection system is operated so that it will detect the failure of either the primary or secondary containment structure or the presence of any release of dangerous and/or mixed waste, or accumulated liquid in the secondary containment system within twenty-four (24) hours [WAC 173-303-640(4)(c)(iii)]. Detection of a leak of at least 0.1 gallons per

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hour within twenty-four (24) hours is defined as being able to detect a leak within twenty-four (24) hours. Any exceptions to this criteria must be approved by Ecology [WAC 173-303-640(4)(c)(iii), WAC 173-303-806(4)(c)(vii)];

A. Dangerous waste pipe penetrations that require a penetration seal in accordance with the International Building Code (IBC) and DOE-STD-1066, DOE Standard for Fire Protection Design Criteria, or to meet ventilation sealing requirements identified in Table III.10.H.G and Table III.10.M.B, are not required to meet the 0.1 gallons per hour within twenty-four (24) hours leak detection rate for those sections of piping that are in contact with approved silicone or equivalent low-permeability seal material or boot.

B. Piping on either side of the penetration seal must meet the requirements of III.10.E.9.e.ii.

C. Newly identified pipe penetration seals or revisions will be submitted to Ecology for review and approval pursuant to Conditions III.10.C.2.e and III.10.C.2.f. Addition of penetration seal locations will be approved by Ecology prior to installation of the penetration seals.

III.10.E.9.e.iii Detailed operational plans and descriptions, demonstrating that spilled or leaked waste and accumulated liquids can be removed from the secondary containment system within twenty-four (24) hours [WAC 173-303-806(4)(c)(vii)];

III.10.E.9.e.iv Descriptions of operational procedures demonstrating appropriate controls and practices are in place to prevent spills and overflows from tanks or containment systems in compliance with WAC 173-303-640(5)(b)(i) through (iii) [WAC 173-303-640(5)(b), WAC 173-303-806(4)(c)(ix)];

III.10.E.9.e.v Description of procedures for investigation and repair of tank systems [WAC 173-303-320, WAC 173-303-640(6), WAC 173-303-640(7)(e) and (f), WAC 173-303-806(4)(a)(v), WAC 173-303-806(4)(c)(vii)];

III.10.E.9.e.vi Updated Chapter 4, Narrative Descriptions, Tables and Figures as identified in Permit Tables III.10.E.A through D (as modified pursuant to Permit Condition III.10.E.9.e.xii) and updated to identify routinely non-accessible tank systems;

III.10.E.9.e.vii Description of procedures for management of ignitable and reactive, and incompatible dangerous and/or mixed waste in accordance with WAC 173-303-640(9) and (10) [WAC 173-303-806(4)(c)(x)].

III.10.E.9.e.viii A description of the tracking system used to track dangerous and/or mixed waste throughout the WTP Unit Tank System, pursuant to WAC 173-303-380.

III.10.E.9.e.ix Permit Tables III.10.E.E through H, and R through S, will be completed for WTP Unit Tank System process and leak detection system monitors and instruments (to include but not limited to: instruments and monitors measuring and/or controlling flow, pressure, temperature, density, pH, level, humidity, and emission) to provide the information as specified in each column heading. Process and leak detection system monitors and instruments for critical systems as specified in Operating Unit Group 10, Appendix 2.0 and as updated pursuant to Permit Condition III.10.C.9.b and for operating parameters as required to comply with Permit Condition III.10.C.3.e.iii will be addressed. Process monitors and instruments for non-waste management operations (e.g., utilities, raw chemical storage, non-contact cooling waters, etc.) are excluded from this Permit Condition.

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III.10.E.9.e.x Supporting documentation for operating trips and expected operating range as specified in Permit Tables III.10.E.E through H, and R through S, as approved pursuant to Permit Condition III.10.E.9.e.ix.

III.10.E.9.e.xi Documentation of process and leak detection instruments and monitors (as listed in Permit Tables III.10.E.E through H, and R through S) for the WTP Unit Tank Systems are to include but not be limited to the following:

A. Procurement specifications.
B. Location used.
C. Range, precision, and accuracy.
D. Detailed descriptions of calibration/functionality test procedures (e.g., method number [ASTM]) or provide a copy of manufacturer's recommended calibration procedures.
E. Calibration/functionality test, inspection, and routine maintenance schedules and checklists, including justification for calibration, inspection and maintenance frequencies, criteria for identifying instruments found to be significantly out of calibration, and corrective action to be taken for instruments found to be significantly out of calibration (e.g., increasing frequency of calibration, instrument replacement, etc.).
F. Equipment instrument control logic narrative description (e.g., descriptions of failsafe conditions, etc.), as identified in Permit Tables III.10.E.E through H, and R through S, not addressed in Permit Condition III.10.E.9.d.

III.10.E.9.e.xii Permit Tables III.10.E.A through D, and R amended as follows:

A. Under column 1, update and complete list of dangerous and/or mixed waste tank systems, including plant items that comprise each system (listed by item number).
B. Under column 2, update and complete system designations.
C. Under column 3, replace the 'reserved' with the Operating Unit Group 10, Appendices 8.0, 9.0, 10.0, and 11.0, subsections specific to tank systems as listed in column 1.
D. Under column 4, update and complete list of narrative description tables and figures.
E. Under column 5, update and complete maximum capacity, for each tank.

III.10.E.9.e.xiii Permit Tables III.10.E.I, K, M, O, and S amended as follows:

A. Under column 1, replace the "reserved" with the updated and complete list of sump numbers and room location.
B. Under column 2, replace the "reserved" with the updated and complete maximum sump capacities in gallons.
C. Under column 3, replace the "reserved" with the updated and complete sump dimensions and materials of construction.
D. Under column 4, replace the "reserved" with the updated and complete list of engineering descriptions (drawing numbers, specifications, etc.).

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Table III.10.E.A – Pretreatment Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	System Designation	Engineering Description (Drawing Nos., Specifications Nos., etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
Waste Feed Receipt Process System FRP-VSL-00002A (Waste Feed Receipt Vessel) FRP-VSL-00002B (Waste Feed Receipt Vessel) FRP-VSL-00002C (Waste Feed Receipt Vessel) FRP-VSL-00002D (Waste Feed Receipt Vessel)	FRP	**24590-PTF** -M2-FRP-P0001 -M2-FRP-P0002 -M2-FRP-P0003 -M2-FRP-P0004 -M5-V17T-00003 -M6-FRP-00001001 -M6-FRP-00001002 -M6-FRP-00002001 -M6-FRP-00002002 -M6-FRP-00003001 -M6-FRP-00003002 -M6-FRP-00003003 -M6-FRP-00003004 -M6-FRP-00003005 -M6-FRP-00005001 -M6-FRP-00005002 -M6-FRP-00005003 -M6-FRP-00005004 -M6-FRP-00005005 -M6-FRP-00005006 -M6-FRP-00005007 -M6-FRP-00005008 -M6-FRP-00006001 -M6-FRP-00006002	Section 4D.2.1; Tables 4D-1 and 4D-3; and Figures 4A-1, 4A-2, and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.	FRP-VSL-00002A = 472,900 FRP-VSL-00002B = 472,900 FRP-VSL-00002C = 472,900 FRP-VSL-00002D = 472,900

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Table III.10.E.A – Pretreatment Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	System Designation	Engineering Description (Drawing Nos., Specifications Nos., etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
		-M6-FRP-00006003 -M6-FRP-00006004 -M6-FRP-00006005 -M6-FRP-00006006 -M6-FRP-00006007 -M6-FRP-00006008 -M6-FRP-00007001 -M6-FRP-00007002 -M6-FRP-00007003 -M6-FRP-00007004 -M6-FRP-00007005 -M6-FRP-00007006 -M6-FRP-00007007 -M6-FRP-00007008 -M6-FRP-00008001 -M6-FRP-00008002 -M6-FRP-00008003 -M6-FRP-00008004 -M6-FRP-00008005 -M6-FRP-00008006 -M6-FRP-00008007 -M6-FRP-00009001 -M6-FRP-00010001 -M6-FRP-00020001 -M6-FRP-00020002		

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Table III.10.E.A – Pretreatment Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	System Designation	Engineering Description (Drawing Nos., Specifications Nos., etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
		-M6-FRP-00020003 -M6-FRP-00020004 -M6-FRP-00020005 -M6-FRP-00020006 -M6-FRP-00020007 -MVD-FRP-00005 -MVD-FRP-00006 -MVD-FRP-00007 -MVD-FRP-00008 -N1D-FRP-00001 -P1-P01T-00001 -P1-P01T-00002 **24590-WTP** -3PS-G000-T0002 -3PS-MV00-T0001 -3PS-MV00-T0002 -3PS-MV00-T0003		
Waste Feed Evaporation Process System FEP-VSL-00005 (Waste Feed Evaporator Condensate Vessel) FEP-VSL-00017A (Waste Feed Evaporator Feed Vessel)	FEP	**24590-PTF** -3PS-MEVV-T0001 -M5-V17T-00004001 -M6-FEP-00001001 -M6-FEP-00001002 -M6-FEP-00001003 -M6-FEP-00001004	Section 4D.2.2; Tables 4D-1 and 4D-3; and Figures 4A-1, 4A-2, and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.	FEP-VSL-00005 = 5,022 FEP-VSL-00017A = 85,496 FEP-VSL-00017B = 85,496

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Table III.10.E.A – Pretreatment Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	System Designation	Engineering Description (Drawing Nos., Specifications Nos., etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
FEP-VSL-00017B (Waste Feed Evaporator Feed Vessel)		-M6-FEP-00003001 -M6-FEP-00003002 -M6-FEP-00006001 -M6-FEP-00006002 -M6-FEP-00006003 -M6-FEP-00006004 -M6-FEP-00006005 -M6-FEP-00007001 -M6-FEP-00007002 -M6-FEP-00007003 -M6-FEP-00007004 -M6-FEP-00007005 -M6-FEP-00008001 -M6-FEP-00008002 -MVD-FEP-P0001 -MVD-FEP-P0002 -MVD-FEP-00003 -MV-FEP-P0001 -MV-FEP-P0002 -N1D-FEP-00002 -N1D-FEP-P0003 -P1-P01T-00001 -P1-P01T-P0002 -P1-P01T-00003		

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Table III.10.E.A – Pretreatment Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	System Designation	Engineering Description (Drawing Nos., Specifications Nos., etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
		24590-WTP -3PS-G000-T0002 -3PS-MV00-T0001 -3PS-MV00-T0002 -3PS-MV00-T0003		
Ultrafiltration Process System UFP-VSL-00001A (Ultrafiltration Feed Preparation Vessel) UFP-VSL-00001B (Ultrafiltration Feed Preparation Vessel) UFP-VSL-00002A (Ultrafiltration Feed Vessel) UFP-VSL-00002B (Ultrafiltration Feed Vessel) UFP-VSL-00062A (Ultrafilter Permeate Collection Vessel) UFP-VSL-00062B (Ultrafilter Permeate Collection Vessel) UFP-VSL-00062C (Ultrafilter Permeate Collection Vessel)	UFP	**24590-PTF** -M5-V17T-00009 -M5-V17T-00011 -M6-UFP-00001001 -M6-UFP-00001002 -M6-UFP-00001003 -M6-UFP-00001004 -M6-UFP-00001005 -M6-UFP-00001006 -M6-UFP-00001007 -M6-UFP-00002001 -M6-UFP-00002002 -M6-UFP-00002003 -M6-UFP-00002004 -M6-UFP-00002005 -M6-UFP-00002006 -M6-UFP-00002007 -M6-UFP-00002008 -M6-UFP-00003001 -M6-UFP-00003002	Section 4D.2.3; Tables 4D-1 and 4D-3; and Figures 4A-1, 4A-2 and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.	UFP-VSL-00001A = 75,594 UFP-VSL-00001B = 75,594 UFP-VSL-00002A = 39,629 UFP-VSL-00002B = 40,378 UFP-VSL-00062A = 34,700 UFP-VSL-00062B = 34,700 UFP-VSL-00062C = 34,700 UFP-FILT-00001A = 474 UFP-FILT-00001B = 474 UPF-FILT-00002A = 474

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Table III.10.E.A – Pretreatment Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	System Designation	Engineering Description (Drawing Nos., Specifications Nos., etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
UFP-FILT-00001A (Ultrafilter) UFP-FILT-00001B (Ultrafilter) UFP-FILT-00002A (Ultrafilter) UFP-FILT-00002B (Ultrafilter) UFP-FILT-00003A (Ultrafilter) UFP-FILT-00003B (Ultrafilter) UFP-FILT-00004A (Ultrafilter) UFP-FILT-00004B (Ultrafilter) UFP-FILT-00005A (Ultrafilter) UFP-FILT-00005B (Ultrafilter)		-M6-UFP-00003003 -M6-UFP-00003004 -M6-UFP-00003005 -M6-UFP-00003006 -M6-UFP-00003007 -M6-UFP-00003008 -M6-UFP-00004001 -M6-UFP-00004002 -M6-UFP-00004003 -M6-UFP-00005001 -M6-UFP-00005002 -M6-UFP-00005003 -M6-UFP-00005004 -M6-UFP-00005005 -M6-UFP-00005006 -M6-UFP-00005007 -M6-UFP-00006001 -M6-UFP-00006002 -M6-UFP-00006003 -M6-UFP-00006004 -M6-UFP-00006005 -M6-UFP-00006006 -M6-UFP-00006007 -M6-UFP-00007001 -M6-UFP-00007002		UPF-FILT-00002B = 474 UPF-FILT-00003A = 474 UPF-FILT-00003B = 474 UPF-FILT-00004A = 380 UPF-FILT-00004B = 380 UPF-FILT-00005A = 380 UPF-FILT-00005B = 380

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Table III.10.E.A – Pretreatment Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	System Designation	Engineering Description (Drawing Nos., Specifications Nos., etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
		-M6-UFP-00007003 -M6-UFP-00007004 -M6-UFP-00007005 -M6-UFP-00007006 -M6-UFP-00007007 -M6-UFP-00009001 -M6-UFP-00009002 -M6-UFP-00009003 -M6-UFP-00009004 -M6-UFP-00009005 -M6-UFP-00009006 -M6-UFP-00010001 -M6-UFP-00010002 -M6-UFP-00010003 -M6-UFP-00010004 -M6-UFP-00010005 -M6-UFP-00010006 -M6-UFP-00010007 -M6-UFP-00011001 -M6-UFP-00011002 -M6-UFP-00011003 -M6-UFP-00011004 -M6-UFP-00011005 -M6-UFP-00015001 -M6-UFP-00015002		

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Table III.10.E.A – Pretreatment Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	System Designation	Engineering Description (Drawing Nos., Specifications Nos., etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
		-M6-UFP-00016001 -M6-UFP-00017001 -M6-UFP-00021001 -M6-UFP-00021002 -M6-UFP-00022001 -M6-UFP-00022002 -M6-UFP-00027001 -M6-UFP-00027002 -M6-UFP-00027003 -M6-UFP-00027004 -M6-UFP-00027005 -M6-UFP-00027006 -M6-UFP-00027007 -MLD-UFP-P0007 -MVD-UFP-00001 -MVD-UFP-00014 -MVD-UFP-00015 -MVD-UFP-00002 -MVD-UFP-00005 -MVD-UFP-00006 -MVD-UFP-00007 -MV-UFP-00001001 -MV-UFP-00001002 -MV-UFP-00001003 -MV-UFP-00002001		

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Table III.10.E.A – Pretreatment Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	System Designation	Engineering Description (Drawing Nos., Specifications Nos., etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
		-MV-UFP-00002002 -MV-UFP-00002003 -MV-UFP-00003 -MV-UFP-00004 -MV-UFP-P0005 -MV-UFP-P0006 -MV-UFP-P0007 -MV-UFP-00016 -MV-UFP-00017 -MV-UFP-00018 -MV-UFP-00028 -MV-UFP-00029 -MV-UFP-00030 -MV-UFP-00031 -N1D-UFP-P0001 -N1D-UFP-P0002 -N1D-UFP-00003 -N1D-UFP-P0004 -N1D-UFP-P0005 -N1D-UFP-P0008 -N1D-UFP-00009 -P1-P01T-00001		

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Table III.10.E.A – Pretreatment Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	System Designation	Engineering Description (Drawing Nos., Specifications Nos., etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
		24590-WTP -3PS-G000-T0002 -3PS-MV00-T0001 -3PS-MV00-T0002 -3PS-MV00-T0003		
HLW Lag Storage and Feed Blending Process System HLP-VSL-00022 (HLW Feed Receipt Vessel) HLP-VSL-00027A (HLW Lag Storage Vessel) HLP-VSL-00027B (HLW Lag Storage Vessel) HLP-VSL-00028 (HLW Feed Blend Vessel)	HLP	**24590-PTF** -M5-V17T-00007 -M5-V17T-00008 -M6-HLP-00001001 -M6-HLP-00001002 -M6-HLP-00001003 -M6-HLP-00001004 -M6-HLP-00002001 -M6-HLP-00002002 -M6-HLP-00003001 -M6-HLP-00003002 -M6-HLP-00003003 -M6-HLP-00005001 -M6-HLP-00005002 -M6-HLP-00005003 -M6-HLP-00005004 -M6-HLP-00005005 -M6-HLP-00005006 -M6-HLP-00005007 -M6-HLP-00006001	Section 4D.2.4; Tables 4D-1 and 4D-3; and Figures 4A-1, 4A-2, and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.	HLP-VSL-00022 = 268,800 HLP-VSL-00027A = 127,260 HLP-VSL-00027B = 127,260 HLP-VSL-00028 = 142,200

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Table III.10.E.A – Pretreatment Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	System Designation	Engineering Description (Drawing Nos., Specifications Nos., etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
		-M6-HLP-00006002 -M6-HLP-00006003 -M6-HLP-00006004 -M6-HLP-00006005 -M6-HLP-00006006 -M6-HLP-00006007 -M6-HLP-00007001 -M6-HLP-00007002 -M6-HLP-00007003 -M6-HLP-00007004 -M6-HLP-00007005 -M6-HLP-00007006 -M6-HLP-00007007 -M6-HLP-00009001 -M6-HLP-00009002 -M6-HLP-00009003 -M6-HLP-00010001 -M6-HLP-00010002 -M6-HLP-00010003 -M6-HLP-00027001 -M6-HLP-00027002 -M6-HLP-00027003 -M6-HLP-00027004 -M6-HLP-00027005 -M6-HLP-00027006		

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Table III.10.E.A – Pretreatment Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	System Designation	Engineering Description (Drawing Nos., Specifications Nos., etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
		-M6-HLP-00028004 -M6-HLP-00028005 -M6-HLP-00028006 -MVD-HLP-00006 -MVD-HLP-00007 -MVD-HLP-00008 -MVD-HLP-00009 -MV-HLP-00003001 -MV-HLP-00004 -MV-HLP-00005 -MV-HLP-00006 -N1D-HLP-00001 -N1D-HLP-P0003 -N1D-HLP-00007 -N1D-HLP-00010 -P1-P01T-00001 **24590-WTP** -3PS-G000-T0002 -3PS-MV00-T0001 -3PS-MV00-T0003		
Cesium Ion Exchange Process System CXP-VSL-00004 (Cesium Ion Exchange Feed)	CXP	**24590-PTF** -M5-V17T-00012001 -M5-V17T-00012002 -M5-V17T-00013	Section 4D.2.5; Tables 4D-1 and 4D-3; and Figures 4A-1, 4A-2, and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.	CXP-VSL-00004 = 10,633 CXP-VSL-00026A = 38,000

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Table III.10.E.A – Pretreatment Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	System Designation	Engineering Description (Drawing Nos., Specifications Nos., etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
CXP-VSL-00026A (Cesium Ion Exchange Treated LAW Collection Vessel) CXP-VSL-00026B (Cesium Ion Exchange Treated LAW Collection Vessel) CXP-VSL-00026C (Cesium Ion Exchange Treated LAW Collection Vessel) CXP-IXC-00001 (Cesium Ion Exchange Column) CXP-IXC-00002 (Cesium Ion Exchange Column) CXP-IXC-00003 (Cesium Ion Exchange Column) CXP-IXC-00004 (Cesium Ion Exchange Column)		-M5-V17T-00025 -M6-CXP-00001002 -M6-CXP-00001003 -M6-CXP-00001004 -M6-CXP-00001006 -M6-CXP-00001007 -M6-CXP-00002001 -M6-CXP-00002002 -M6-CXP-00003001 -M6-CXP-00003002 -M6-CXP-00003003 -M6-CXP-00005001 -M6-CXP-00005002 -M6-CXP-00005003 -M6-CXP-00005004 -M6-CXP-00007 -M6-CXP-000100001 -M6-CXP-000100002 -M6-CXP-000100003 -M6-CXP-000100004 -M6-CXP-00011001 -M6-CXP-00011002 -M6-CXP-00011003 -M6-CXP-00011004 -M6-CXP-00011005		CXP-VSL-00026B = 38,000 CXP-VSL-00026C = 38,000 CXP-IXC-00001 = 680 CXP-IXC-00002 = 680 CXP-IXC-00003 = 680 CXP-IXC-00004 = 680

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Table III.10.E.A – Pretreatment Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	System Designation	Engineering Description (Drawing Nos., Specifications Nos., etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
		-M6-CXP-00011006 -M6-CXP-00011007 -M6-CXP-00012001 -M6-CXP-00012002 -M6-CXP-00012003 -M6-CXP-00012004 -M6-CXP-00013 -MV-CXP-P0002 -MV-CXP-P0008 -MV-CXP-P0009 -MV-CXP-P0010 -MVD-CXP-P0015 -MVD-CXP-P0021 -MVD-CXP-P0022 -MVD-CXP-P0023 -N1D-CXP-P0003 -N1D-CXP-P0007 -P1-P01T-00001 -P1-P01T-00002 **24590-WTP** -3PS-G000-T0002 -3PS-MV00-T0001 -3PS-MV00-T0002 -3PS-MV00-T0003		

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Table III.10.E.A – Pretreatment Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	System Designation	Engineering Description (Drawing Nos., Specifications Nos., etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
Cesium Nitric Acid Recovery Process System CNP-VSL-00001 (Cesium Evaporator Eluant Lute Pot) CNP-VSL-00003 (Eluate Contingency Storage Vessel) CNP-VSL-00004 (Cesium Evaporator Recovered Nitric Acid Vessel)	CNP	**24590-PTF** -M5-V17T-00014 -M6-CNP-00001001 -M6-CNP-00001002 -M6-CNP-00001003 -M6-CNP-00002001 -M6-CNP-00002002 -M6-CNP-00002003 -M6-CNP-00003001 -M6-CNP-00003002 -M6-CNP-00003003 -M6-CNP-00003004 -M6-CNP-00004 -M6-CNP-00005 -MV-CNP-P0001 -MV-CNP-P0002 -MV-CNP-P0005 -MVD-CNP-P0003 -MVD-CNP-P0007 -MVD-CNP-P0010 -N1D-CNP-P0006 -N1D-CNP-P0009 -N1D-CNP-P0011 -P1-P01T-00001	Section 4D.2.6; Tables 4D-1 and 4D-3; and Figures 4A-1, 4A-2, and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.	CNP-VSL-00001 = 109 CNP-VSL-00003 = 21,713 CNP-VSL-00004 = 11,115

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Table III.10.E.A – Pretreatment Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	System Designation	Engineering Description (Drawing Nos., Specifications Nos., etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
Treated LAW Concentrate Storage Process System TCP-VSL-00001 (Treated LAW Concentrate Storage Vessel)	TCP	**24590-PTF** -M5-V17T-00006 -M6-TCP-00001001 -M6-TCP-00001002 -M6-TCP-00001003 -M6-TCP-00002001 -M6-TCP-00002002 -M6-TCP-00002003 -M6-TCP-00002004 -M6-TCP-00002005 -MV-TCP-P0002 -MVD-TCP-P0002 -N1D-TCP-P0001 -P1-P01T-00001 **24590-WTP** -3PS-G000-T0002 -3PS-MV00-T0001 -3PS-MV00-T0002 -3PS-MV00-T0003	Section 4D.2.12; Tables 4D-1 and 4D-3; and Figures 4A-1, 4A-2, and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.	TCP-VSL-00001 = 146,740
Treated LAW Evaporation Process System TLP-VSL-00002 (Treated LAW Evaporator Condensate Vessel)	TLP	**24590-PTF** -3PS-MEVV-T0001 -M5-V17T-00005 -M6-TLP-00001 -M6-TLP-00002001	Section 4D.2.11; Tables 4D-1 and 4D-3; and Figures 4A-1, 4A-2, and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.	TLP-VSL-00002 = 2,227 TLP-VSL-00009A = 130,010 TLP-VSL-00009B = 130,010

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Table III.10.E.A – Pretreatment Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	System Designation	Engineering Description (Drawing Nos., Specifications Nos., etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
TLP-VSL-00009A (LAW SBS Condensate Receipt Vessel) TLP-VSL-00009B (LAW SBS Condensate Receipt Vessel)		-M6-TLP-00002002 -M6-TLP-00002003 -M6-TLP-00002004 -M6-TLP-00003001 -M6-TLP-00003002 -M6-TLP-00003003 -M6-TLP-00003004 -M6-TLP-00005001 -M6-TLP-00005002 -M6-TLP-00005003 -M6-TLP-00005004 -M6-TLP-00005005 -M6-TLP-00006001 -M6-TLP-00006002 -M6-TLP-00006003 -M6-TLP-00006004 -M6-TLP-00006005 -MVD-TLP-P0001 -MVD-TLP-P0002 -MVD-TLP-00004 -MV-TLP-P0001 -MV-TLP-P0002 -N1D-TLP-P0001 -N1D-TLP-P0006 -P1-P01T-00001		

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Table III.10.E.A – Pretreatment Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	System Designation	Engineering Description (Drawing Nos., Specifications Nos., etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
		-P1-P01T-00002 **24590-WTP** -3PS-G000-T0002 -3PS-MV00-T0001 -3PS-MV00-T0002 -3PS-MV00-T0003		
Spent Resin and Dewatering Process System RDP-VSL-00002A (Spent Resin Slurry Vessel) RDP-VSL-00002B (Spent Resin Slurry Vessel) RDP-VSL-00002C (Spent Resin Slurry Vessel) RDP-VSL-00004 (Spent Resin Dewatering Moisture Separation Vessel)	RDP	**24590-PTF** -3PS-MWD0-TP003 -M5-V17T-00020 -M6-RDP-00001001 -M6-RDP-00001002 -M6-RDP-00001003 -M6-RDP-00001004 -M6-RDP-00001005 -M6-RDP-00002 -M6-RDP-00006 -MVD-RDP-P0005 -MVD-RDP-P0006 -MVD-RDP-P0007 -MVD-RDP-P0008 -MV-RDP-P0001 -MV-RDP-P0002 -MV-RDP-P0003 -P1-P01T-00001	Section 4D.2.13; Tables 4D-1 and 4D-3; and Figures 4A-1, 4A-2, and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.	RDP-VSL-00002A = 15,230 RDP-VSL-00002B = 15,230 RDP-VSL-00002C = 15,230 RDP-VSL-00004 = 101

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Table III.10.E.A – Pretreatment Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	System Designation	Engineering Description (Drawing Nos., Specifications Nos., etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
		24590-WTP -3PS-G000-T0002 -3PS-MV00-T0001 -3PS-MV00-T0002 -3PS-MV00-T0003		
Pretreatment Plant Radioactive Liquid Waste Disposal System RLD-TK-00006A (Process Condensate Tank) RLD-TK-00006B (Process Condensate Tank) RLD-VSL-00017A (Alkaline Effluent Vessel) RLD-VSL-00017B (Alkaline Effluent Vessel)	RLD	**24590-PTF** -M5-V17T-00022003 -M5-V17T-00022004 -M6-RLD-00001001 -M6-RLD-00001002 -M6-RLD-00001003 -M6-RLD-00001004 -M6-RLD-00002001 -M6-RLD-00002002 -M6-RLD-00002003 -M6-RLD-00003001 -M6-RLD-00003002 -M6-RLD-00003003 -M6-RLD-00004 -M6-RLD-00005 -M6-RLD-00006 -M6-RLD-00007001 -MVD-RLD-P0005 -MVD-RLD-P0006 -MV-RLD-P0001	Section 4D.2.16; Tables 4D-1 and 4D-3; and Figures 4A-1, 4A-2, and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.	RLD-TK-00006A = 343,734 RLD-TK-00006B = 343,734 RLD-VSL-00017A = 34,340 RLD-VSL-00017B = 34,340

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Table III.10.E.A – Pretreatment Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	System Designation	Engineering Description (Drawing Nos., Specifications Nos., etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
		-MV-RLD-P0002 -N1D-RLD-P0002 -P1-P01T-00001 **24590-WTP** -3PS-G000-T0002 -3PS-MV00-T0001 -3PS-MV00-T0002 -3PS-MV00-T0003		
Pretreatment Plant Wash and Disposal System PWD-VSL-00015 (Acidic/Alkaline Effluent Vessel) PWD-VSL-00016 (Acidic/Alkaline Effluent Vessel) PWD-VSL-00033 (Ultimate Overflow Vessel) PWD-VSL-00043 (HLW Effluent Transfer Vessel) PWD-VSL-00044 (Plant Wash Vessel)	PWD	**24590-PTF** -M5-V17T-00022001 -M5-V17T-00022002 -M6-PWD-00001 -M6-PWD-00002001 -M6-PWD-00002002 -M6-PWD-00003001 -M6-PWD-00003002 -M6-PWD-00003003 -M6-PWD-00003004 -M6-PWD-00005 -M6-PWD-00006 -M6-PWD-00007 -M6-PWD-00008 -M6-PWD-00009 -M6-PWD-00010	Section 4D.2.15; Tables 4D-1 and 4D-3; and Figures 4A-1, 4A-2 and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.	PWD-VSL-00015 = 119,150 PWD-VSL-00016 = 119,150 PWD-VSL-00033 = 41,650 PWD-VSL-00043 = 41,650 PWD-VSL-00044 = 103,024 PWD-VSL-00046 = 4,982

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Table III.10.E.A – Pretreatment Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	System Designation	Engineering Description (Drawing Nos., Specifications Nos., etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
PWD-VSL-00046 (C3 Floor Drain Collection Vessel)		-M6-PWD-00011 -M6-PWD-00012 -M6-PWD-00014 -M6-PWD-P0018 -M6-PWD-P0019 -M6-PWD-00020001 -M6-PWD-00020002 -M6-PWD-00020003 -M6-PWD-00020004 -M6-PWD-00020005 -M6-PWD-00020006 -M6-PWD-00021001 -M6-PWD-00021002 -M6-PWD-00021003 -M6-PWD-00021004 -M6-PWD-00021005 -M6-PWD-00021006 -M6-PWD-00023001 -M6-PWD-00023002 -M6-PWD-00023003 -M6-PWD-00023004 -M6-PWD-00023005 -M6-PWD-00024001 -M6-PWD-00024002 -M6-PWD-00024003		

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Table III.10.E.A – Pretreatment Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	System Designation	Engineering Description (Drawing Nos., Specifications Nos., etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
		-M6-PWD-00024004 -M6-PWD-00024005 -M6-PWD-00024006 -M6-PWD-00024007 -M6-PWD-00025001 -M6-PWD-00025002 -M6-PWD-00025003 -M6-PWD-00025004 -M6-PWD-00026 -M6-PWD-00029 -M6-PWD-00033 -M6-PWD-00041 -M6-PWD-00043 -M6-PWD-00044 -M6-PWD-00046 -M6-PWD-00050 -M6-PWD-00051 -M6-PWD-00057 -M6-PWD-00058001 -M6-PWD-00058002 -MVD-PWD-P0001 -MVD-PWD-00002 -MVD-PWD-P0003 -MVD-PWD-P0010 -MVD-PWD-P0011		

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Table III.10.E.A – Pretreatment Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	System Designation	Engineering Description (Drawing Nos., Specifications Nos., etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
		-MVD-PWD-P0012 -MV-PWD-P0001001 -MV-PWD-P0001002 -MV-PWD-P0003001 -MV-PWD-P0003002 -MV-PWD-P0005 -MV-PWD-P0006 -MV-PWD-P0007 -MV-PWD-P0010 -N1D-PWD-P0001 -N1D-PWD-00002 -N1D-PWD-P0003 -N1D-PWD-P0005 -N1D-PWD-P0006 -P1-P01T-00001 -P1-P01T-00006		
Pretreatment Vessel Vent Process System PVP-VSL-00001 (Vessel Vent HEME Drain Collection Vessel)	PVP	**24590-PTF** -M5-V17T-00021001 -M5-V17T-00021002 -M5-V17T-00021004 -M6-PVP-00002 -M6-PVP-00004001 -M6-PVP-00004002 -M6-PVP-00017001 -M6-PVP-00017002	Section 4D.4.2; Tables 4D-1 and 4D-3; and Figures 4A-1, 4A-2 and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.	PVP-VSL-00001 = 1,969

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Table III.10.E.A – Pretreatment Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	System Designation	Engineering Description (Drawing Nos., Specifications Nos., etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
		-M6-PVP-00017003 -M6-PVP-00018001 -M6-PVP-00018002 -MVD-PVP-P0001 -MV-PVP-P0002 -N1D-PVP-P0002 -P1-P01T-00001 **24590-WTP** -3PS-G000-T0002 -3PS-MV00-T0001 -3PS-MV00-T0002 -3PS-MV00-T0003		
Pretreatment In-Cell Handling System PIH-TK-00001 (Decontamination Soak Tank)	PIH	**24590-PTF** -M6-PIH-00001001 -M6-PIH-00001002 -P1-P01T-00001 **24590-WTP** -3PS-HD00-T0001	Section 4.D.2.14; Tables 4D-1 and 4D-3; and Figures 4A-1, 4A-2, and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.	PIH-TK-00001 = 1504

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Table III.10.E.B – LAW Vitrification Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	Unit Designation	Engineering Description (Drawing Nos, Specification Nos, etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
LAW Concentrate Receipt Process System LCP-VSL-00001 (LAW Melter 1 Concentrate Receipt Vessel) LCP-VSL-00002 (LAW Melter 2 Concentrate Receipt Vessel)	LCP	**24590-LAW** -M5-V17T-00001 -M5-V17T-00002 -M6-LCP-00001002 -M6-LCP-00001003 -M6-LCP-00002003 -M6-LCP-00002004 -MV-LCP-P0001 -MV-LCP-P0002 -MVD-LCP-P0004 -MVD-LCP-P0005 -N1D-LCP-P0001 -P1-P01T-00002	Section 4E.2.1; Tables 4E-1 and 4E-3; and Figures 4A-1 and 4A-3 of Operating Unit Group 10, Chapter 4 of this Permit.	LCP-VSL-00001 = 18,130 LCP-VSL-00002 = 18,130
LAW Melter Feed Process System LFP-VSL-00001 (Melter 1 Feed Preparation Vessel) LFP-VSL-00002 (Melter 1 Feed Vessel) LFP-VSL-00003 (Melter 2 Feed Preparation Vessel)	LFP	**24590-LAW** -M5-V17T-00001 -M5-V17T-00002 -M6-LFP-00001001 -M6-LFP-00001002 -M6-LFP-00001003 -M6-LFP-00001004 -M6-LFP-00001005 -M6-LFP-00001006 -M6-LFP-00003001 -M6-LFP-00003002	Section 4E.2.1; Tables 4E-1 and 4E-3; and Figures 4A-1 and 4A-3 of Operating Unit Group 10, Chapter 4 of this Permit.	LFP-VSL-00001 = 9,123 LFP-VSL-00002 = 9,123 LFP-VSL-00003 = 9,123 LFP-VSL-00004 = 9,123

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Table III.10.E.B – LAW Vitrification Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	Unit Designation	Engineering Description (Drawing Nos, Specification Nos, etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
LFP-VSL-00004 (Melter 2 Feed Vessel)		-M6-LFP-00003003 -M6-LFP-00003004 -M6-LFP-00003005 -M6-LFP-00003006 -MV-LFP-P0001 -MV-LFP-P0002 -MV-LFP-P0004 -MV-LFP-P0005 -MVD-LFP-P0007 -MVD-LFP-P0008 -MVD-LFP-P0010 -MVD-LFP-P0011 -P1-P01T-00002 -N1D-LFP-00004 -N1D-LFP-00006		
LAW Secondary Off-gas/Vessel Vent Process System LVP-TK-00001 (LAW Caustic Collection Tank)	LVP	**24590-LAW** -M5-V17T-00011 -P1-P01T-00004 -MT-LVP-00005001 -MTD-LVP-00001 -N1D-LVP-00002	Section 4E.4.2.2; Tables 4E-1 and 4E-3; and Figures 4A-1 and 4A-3 of Operating Unit Group 10, Chapter 4 of this Permit.	LVP-TK-00001 = 14,232
LAW Primary Off-gas Process System	LOP	**24590-LAW** -M5-V17T-P0007 -M5-V17T-P0008	Section 4E.4.2.1; Tables 4E-1 and 4E-3; and Figures 4A-1 and 4A-3 of Operating Unit Group 10, Chapter 4 of this Permit.	LOP-VSL-00001 = 9,056

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Table III.10.E.B – LAW Vitrification Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	Unit Designation	Engineering Description (Drawing Nos, Specification Nos, etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
LOP-VSL-00001 (LAW Melter 1 SBS Condensate Vessel) LOP-VSL-00002 (LAW Melter 2 SBS Condensate Vessel)		-M6-LOP-00001002 -M6-LOP-00002002 -MV-LOP-P0001 -MV-LOP-P0002 -MVD-LOP-00004 -MVD-LOP-00005 -N1D-LOP-P0002 -P1-P01T-00002		LOP-VSL-00002 = 9,056
LAW Vitrification Plant Radioactive Liquid Waste Disposal System RLD-VSL-00003 (Plant Wash Vessel) RLD-VSL-00004 (C3/C5 Drains/Sump Collection Vessel) RLD-VSL-00005 (SBS Condensate Collection Vessel)	RLD	**24590-LAW** -M5-V17T-00014 -M6-RLD-00001001 -M6-RLD-00001002 -M6-RLD-00001003 -M6-RLD-00001004 -M6-RLD-00001005 -M6-RLD-00001006 -M6-RLD-00002001 -M6-RLD-00002002 -M6-RLD-00002003 -M6-RLD-00002004 -M6-RLD-00002005 -M6-RLD-00003001 -M6-RLD-00003002 -M6-RLD-00003003	Section 4E.2.3; Tables 4E-1 and 4E-3; and Figures 4A-1 and 4A-3 of Operating Unit Group 10, Chapter 4 of this Permit.	RLD-VSL-00003 = 25,680 RLD-VSL-00004 = 7,675 RLD-VSL-00005 = 25,670

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Table III.10.E.B – LAW Vitrification Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	Unit Designation	Engineering Description (Drawing Nos, Specification Nos, etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
		-MVD-RLD-00001 -MVD-RLD-00006 -MVD-RLD-00007 -MV-RLD-P0001 -MV-RLD-P0002 -MV-RLD-P0003 -P1-P01T-00001 -P1-P01T-00002 -N1D-RLD-00001 -N1D-RLD-00002 -N1D-RLD-00005		

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Table III.10.E.C – HLW Vitrification Plant Tank Systems Description

Mixed Waste Tank Systems Name	Unit Designation	Engineering Description (Drawing Nos, Specification Nos, etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
HLW Concentrate Receipt Process System The HCP System has ancillary equipment only	HCP	**24590-HLW** -M5-V17T-P0001 -M6-HCP-00001001 -M6-HCP-00002001	Section 4F.2.1; Tables 4F-4; Figures 4A-1 and 4A-4 of Operating Unit Group 10, Chapter 4 of this Permit.	
HLW Melter Feed Process System HFP-VSL-00001 (Melter 1 Feed Preparation Vessel)	HFP	**24590-HLW** -3YD-HFP-00001[a] -M5-V17T-00001 -P1-P01T-00002 -M6-HFP-00001001 -M6-HFP-00001002 -M6-HFP-00001003 -M6-HFP-00001004 -M6-HFP-00007001 **24590-WTP** -3PS-G000-T0002 -3PS-MV00-T0001 -3PS-MV00-T0002 -3PS-MV00-T0003	Section 4F.2.1; Tables 4F-4; Figures 4A-1, 4A-4 and 4A-53 of Operating Unit Group 10, Chapter 4 of this Permit.	HFP-VSL-00001 = 8,311
Melter Feed Process System cont. HFP-VSL-00002 (Melter 1 Feed Vessel)	HFP	**24590-HLW** -3YD-HFP-00001[a] -M5-V17T-P0001 -P1-P01T-00002 -M6-HFP-00002001	Section 4F.2.1; Tables 4F-1 and 4F-3; Figures 4A-1, 4A-4 and 4A-53 of Operating Unit Group 10, Chapter 4 of this Permit.	HFP-VSL-00002 = 8,311

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Table III.10.E.C – HLW Vitrification Plant Tank Systems Description

Mixed Waste Tank Systems Name	Unit Designation	Engineering Description (Drawing Nos, Specification Nos, etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
		-M6-HFP-00002002 -M6-HFP-00002003 -M6-HFP-00008001 **24590-WTP** -3PS-G000-T0002 -3PS-MV00-T0001 -3PS-MV00-T0002 -3PS-MV00-T0003		
Melter Feed Process System cont. HFP-VSL-00005 (Melter 2 Feed Preparation Vessel)	HFP	**24590-HLW** -3YD-HFP-00001[a] -M5-V17T-P0001 -P1-P01T-00002 -M6-HFP-20001001 -M6-HFP-20001002 -M6-HFP-20001003 -M6-HFP-20001004 -M6-HFP-20007001 **24590-WTP** -3PS-G000-T0002 -3PS-MV00-T0001 -3PS-MV00-T0002 -3PS-MV00-T0003	Section 4F.2.1; Tables 4F-1 and 4F-3; Figures 4A-1, 4A-4 and 4A-53 of Operating Unit Group 10, Chapter 4 of this Permit.	HFP-VSL-00005 = 8,311

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Table III.10.E.C – HLW Vitrification Plant Tank Systems Description

Mixed Waste Tank Systems Name	Unit Designation	Engineering Description (Drawing Nos, Specification Nos, etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
Melter Feed Process System cont. HFP-VSL-00006 (Melter 2 Feed Vessel)	HFP	**24590-HLW** -3YD-HFP-00001[a] -M5-V17T-P0001 -P1-P01T-00002 -M6-HFP-20002001 -M6-HFP-20002002 -M6-HFP-20002003 -M6-HFP-20008001 **24590-WTP** -3PS-G000-T0002 -3PS-MV00-T0001 -3PS-MV00-T0002 -3PS-MV00-T0003	Section 4F.2.1; Tables 4F-1 and 4F-3; Figures 4A-1, 4A-4 and 4A-53 of Operating Unit Group 10, Chapter 4 of this Permit.	HFP-VSL-00006 = 8,311
Melter Off-gas Treatment Process System HOP-VSL-00903 (Melter 1 SBS Condensate Receiver Vessel) HOP-VSL-00904 (Melter 2 SBS Condensate Receiver Vessel)	HOP	**24590-HLW** -3YD-HOP-00001[a] -M5-V17T-P0003 -M5-V17T-P20003 -M6-HOP-00004 -M6-HOP-00006001 -M6-HOP-00006002 -M6-HOP-20004 -M6-HOP-20006001 -M6-HOP-20006002	Section 4F.4.2; Tables 4F-1 and 4F-3; Figures 4A-1 and 4A-4, C1-1 and C1-4 of Operating Unit Group 10, Chapter 4 of this Permit.	HOP-VSL-00903 = 9891 HOP-VSL-00904 = 9891

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Table III.10.E.C – HLW Vitrification Plant Tank Systems Description

Mixed Waste Tank Systems Name	Unit Designation	Engineering Description (Drawing Nos, Specification Nos, etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
		-MVD-HOP-P0001 -MVD-HOP-P0012 -MV-HOP-P0001 -MV-HOP-P0003 -N1D-HOP-P0009 -P1-P01T-00001 **24590-WTP** -3PS-G000-T0002 -3PS-MV00-T0001 -3PS-MV00-T0002 -3PS-MV00-T0003		
HLW Canister Decontamination Handling System HDH-VSL-00001 (Canister Rinse Vessel) HDH-VSL-00002 (Canister Decon Vessel 1) HDH-VSL-00003 (Waste Neutralization Vessel) HDH-VSL-00004 (Canister Decon Vessel 2)	HDH	**24590-HLW** -M5-V17T-00006 -M6-HDH-00001001 -M6-HDH-00002001 -M6-HDH-00002002 -M6-HDH-00002003 -M6-HDH-20001001 -M6-HDH-20001002 -M0-HDH-P0012001 -M0-HDH-P0012002 -MV-HDH-00003 -MVD-HDH-00003	Section 4F.2.4; Tables 4F-1 and 4F-3; Figures 4A-1 and 4A-4 of Operating Unit Group 10, Chapter 4 of this Permit.	HDH-VSL-00001 = 3314 HDH-VSL-00002 = 630 HDH-VSL-00003 = 5315 HDH-VSL-00004 = 630

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Table III.10.E.C – HLW Vitrification Plant Tank Systems Description

Mixed Waste Tank Systems Name	Unit Designation	Engineering Description (Drawing Nos, Specification Nos, etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
		-MVD-HDH-00006 -MVD-HDH-P0009 -N1D-HDH-00003 -N1D-HDH-P0005 -N1D-HDH-P0007 -P1-P01T-00001 -P1-P01T-00002 -3YD-HDH-00002[a] **24590-WTP** -3PS-G000-T0002 -3PS-MV00-T0001 -3PS-MV00-T0002 -3PS-MV00-T0003		
HLW Melter Cave Support Handling System HSH-TK-00001 (Decontamination Tank Melter Cave 1) HSH-TK-00002 (Decontamination Tank Melter Cave 2)	HSH	**24590-HLW** -M6-HSH-00004001 -M6-HSH-20004001 -M6-HSH-20004002 -M0-HSH-P0072 -N1D-HSH-P0001 -P1-P01T-00002 **24590-WTP** -3PS-HD00-T0001	Section 4F.2.4; Tables 4F-1 and 4F-4; Figures 4A-1 and 4A-4 of Operating Unit Group 10, Chapter 4 of this Permit.	HSH-TK-00001 = 4,000 HSH-TK-00002 = 4,000

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Table III.10.E.C – HLW Vitrification Plant Tank Systems Description

Mixed Waste Tank Systems Name	Unit Designation	Engineering Description (Drawing Nos, Specification Nos, etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
HLW Vitrification Plant Radioactive Liquid Waste Disposal System RLD-VSL-00002 (Off-gas Drains Collection Vessel) RLD-VSL-00007 (Acidic Waste Vessel) RLD-VSL-00008 (Plant Wash & Drain Vessel)	RLD	**24590-HLW** -3YD-RLD-00001[a] -M5-V17T-P0007001 -M5-V17T-P0007002 -M6-RLD-00001001 -M6-RLD-00001002 -M6-RLD-00001003 -M6-RLD-00002001 -M6-RLD-00002002 -M6-RLD-00002003 -M6-RLD-00002004 -M6-RLD-00006 -M6-RLD-00007 -M6-RLD-00014 -MV-RLD-00002 -MV-RLD-P0003 -MV-RLD-00025001 -MV-RLD-00025002 -MV-RLD-00025003 -MV-RLD-00025004 -MVD-RLD-00005 -MVD-RLD-00007 -MVD-RLD-00008 -N1D-RLD-P0001 -N1D-RLD-P0006	Section 4H.2.1; Tables 4-4 and 4-6; Figures C1-1 and C1-4 of Operating Unit Group 10, Chapter 4 of this Permit.	RLD-VSL-00002 = 334 RLD-VSL-00007 = 18,145 RLD-VSL-00008 = 13,774

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Table III.10.E.C – HLW Vitrification Plant Tank Systems Description

Mixed Waste Tank Systems Name	Unit Designation	Engineering Description (Drawing Nos, Specification Nos, etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
		-N1D-RLD-P0013 -P1-P01T-00001 -P1-P01T-00002 **<u>24590-WTP</u>** -3PS-G000-T0002 -3PS-MV00-T0001 -3PS-MV00-T0002 -3PS-MV00-T0003		

[a] System Descriptions are maintained in the Administrative Record, and are listed here for information only.

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Table III.10.E.D – Analytical Laboratory Tank Systems Description

Mixed Waste Tank Systems Name	Unit Designation	Engineering Description (Drawing Nos, Specification Nos, etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
Radioactive Liquid Waste Disposal System RLD-VSL-00164 (Laboratory Area Sink Drain Collection Vessel) • RLD-LT-6202 • RLD-EDUC-00002A/B/C • RLD-SUMP-00041 • RLD-LT-6211 • RLD-PMP-00182A/B • RLD-SUMP-00045 • RLD-TWDVC-00003 • RLD-LT-6212 • RLD-LDB-00005/6/7/8/11 RLD-VSL-00165 (Hotcell Drain Collection Vessel) • RLD-LT-6104 • RLD-EDUC-00003A/B/C/D/E/F/G/H • RLD-SUMP-00042 • RLD-LT-6115 • RLD-PMP-00183A • RLD-SUMP-00043A • RLD-TWDVC-00002A	RLD	**24590-LAB** -3ZD-RLD-00001[a] -M5-V17T-00029 -M6-RLD-00001001 -M6-RLD-00001002 -M6-RLD-00001003 -M6-RLD-00001004 -M6-RLD-00002001 -M6-RLD-00002003 -M6-RLD-00006001 -M6-RLD-00006002 -M6-RLD-00006003 -M6-RLD-00007001 -M6-RLD-00007002 -M6-RLD-00008001 -M6-RLD-00008002 -MVD-RLD-00164 -MVD-RLD-P0165 -N1D-RLD-P0002 -N1D-RLD-P0003 -P1-60-00007 -P1-60-00008 **24590-WTP** -3PS-G000-T0002	Section 4H.2.1; Table 4H-3 of Operating Unit Group 10, Chapter 4H of this Permit.	RLD-VSL-00164 = 3,200 RLD-VSL-00165 = 9,090

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Table III.10.E.D – Analytical Laboratory Tank Systems Description

Mixed Waste Tank Systems Name	Unit Designation	Engineering Description (Drawing Nos, Specification Nos, etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
• RLD-LT-6116 • RLD-PMP-00183B • RLD-SUMP-00043B • RLD-TWDVC-00002B • RLD-LT-6124 • RLD-SUMP-00044 • RLD-TWDVC-00001 • RLD-LT-6123 • RLD-LDB-00002/4/9		-3PS-MV00-T0001 -3PS-MV00-T0002 -3PS-MV00-T0003 24590-CM-POA-MVA0-00010-01-02 24590-QL-POC-MVA0-00008-01-00001		

[a] System Descriptions are maintained in the Administrative Record, and are listed here for information only.

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Table III.10.E.E – Pretreatment Plant Tank System Process and Leak Detection System Instruments and Parameters

Tank System Name and Locator (including P&ID)	Control Parameter	Type of Measuring or Leak Detection Instrument	Location of Measuring Instrument (Tag No.)	Instrument Range	Expected Range	Fail States	Instrument Accuracy	Operating Trips (Description & Numerical Limits)	Instrument Calibration Method No. and Range
PWD-SUMP-00071[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-SUMP-00040[a]	Not Applicable	Bubbler Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-SUMP-00001[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-SUMP-00001A[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-SUMP-00002[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-SUMP-00002A[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-SUMP-00003[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-SUMP-00004[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED

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Table III.10.E.E – Pretreatment Plant Tank System Process and Leak Detection System Instruments and Parameters

Tank System Name and Locator (including P&ID)	Control Parameter	Type of Measuring or Leak Detection Instrument	Location of Measuring Instrument (Tag No.)	Instrument Range	Expected Range	Fail States	Instrument Accuracy	Operating Trips (Description & Numerical Limits)	Instrument Calibration Method No. and Range
PWD-SUMP-00005[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-SUMP-00006[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-SUMP-00007[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-SUMP-00008[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-SUMP-00009[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-SUMP-00010[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-SUMP-00011[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-SUMP-00012[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED

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Table III.10.E.E – Pretreatment Plant Tank System Process and Leak Detection System Instruments and Parameters

Tank System Name and Locator (including P&ID)	Control Parameter	Type of Measuring or Leak Detection Instrument	Location of Measuring Instrument (Tag No.)	Instrument Range	Expected Range	Fail States	Instrument Accuracy	Operating Trips (Description & Numerical Limits)	Instrument Calibration Method No. and Range
PWD-SUMP-00013[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-SUMP-00026[c]	Not Applicable	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-SUMP-00026[b]	Not Applicable	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-SUMP-00028[c]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-SUMP-00028[b]	Not Applicable	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-SUMP-00029[c]	Not Applicable	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-SUMP-00029[b]	Not Applicable	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-SUMP-00031[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED

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Table III.10.E.E – Pretreatment Plant Tank System Process and Leak Detection System Instruments and Parameters

Tank System Name and Locator (including P&ID)	Control Parameter	Type of Measuring or Leak Detection Instrument	Location of Measuring Instrument (Tag No.)	Instrument Range	Expected Range	Fail States	Instrument Accuracy	Operating Trips (Description & Numerical Limits)	Instrument Calibration Method No. and Range
PWD-SUMP-00032[c]	Not Applicable	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-SUMP-00032[b]	Not Applicable	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-SUMP-00033[c]	Not Applicable	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-SUMP-00033[b]	Not Applicable	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-SUMP-00034[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-SUMP-00035[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-SUMP-00036[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-SUMP-00037[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED

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Table III.10.E.E – Pretreatment Plant Tank System Process and Leak Detection System Instruments and Parameters

Tank System Name and Locator (including P&ID)	Control Parameter	Type of Measuring or Leak Detection Instrument	Location of Measuring Instrument (Tag No.)	Instrument Range	Expected Range	Fail States	Instrument Accuracy	Operating Trips (Description & Numerical Limits)	Instrument Calibration Method No. and Range
RLD-SUMP-00003[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PVP-BULGE-00001	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PVP-BULGE-00002	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
TCP-BULGE-00004	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
DIW-BULGE-00001	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
DIW-BULGE-00002	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
CRP-BULGE-00001	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
CXP-BULGE-00004	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED

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Table III.10.E.E – Pretreatment Plant Tank System Process and Leak Detection System Instruments and Parameters

Tank System Name and Locator (including P&ID)	Control Parameter	Type of Measuring or Leak Detection Instrument	Location of Measuring Instrument (Tag No.)	Instrument Range	Expected Range	Fail States	Instrument Accuracy	Operating Trips (Description & Numerical Limits)	Instrument Calibration Method No. and Range
UFP-BULGE-00001	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
UFP-BULGE-00002	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
UFP-BULGE-00005	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
UFP-BULGE-00006	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-LDB-00001	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-LDB-00002	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-LDB-00003	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-LDB-00004	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED

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Table III.10.E.E – Pretreatment Plant Tank System Process and Leak Detection System Instruments and Parameters

Tank System Name and Locator (including P&ID)	Control Parameter	Type of Measuring or Leak Detection Instrument	Location of Measuring Instrument (Tag No.)	Instrument Range	Expected Range	Fail States	Instrument Accuracy	Operating Trips (Description & Numerical Limits)	Instrument Calibration Method No. and Range
PWD-LDB-00005	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-LDB-00006	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-LDB-00007	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-LDB-00008	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-LDB-00009	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-LDB-00010	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-LDB-00011	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-LDB-00012	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED

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Table III.10.E.E – Pretreatment Plant Tank System Process and Leak Detection System Instruments and Parameters

Tank System Name and Locator (including P&ID)	Control Parameter	Type of Measuring or Leak Detection Instrument	Location of Measuring Instrument (Tag No.)	Instrument Range	Expected Range	Fail States	Instrument Accuracy	Operating Trips (Description & Numerical Limits)	Instrument Calibration Method No. and Range
PWD-LDB-00013	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-LDB-00014	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-LDB-00015	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-LDB-00016	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-LDB-00017	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-LDB-00018	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
PWD-LDB-00019	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
RLD-LDB-00012	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED

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Table III.10.E.E – Pretreatment Plant Tank System Process and Leak Detection System Instruments and Parameters

Tank System Name and Locator (including P&ID)	Control Parameter	Type of Measuring or Leak Detection Instrument	Location of Measuring Instrument (Tag No.)	Instrument Range	Expected Range	Fail States	Instrument Accuracy	Operating Trips (Description & Numerical Limits)	Instrument Calibration Method No. and Range
RLD-LDB-00013	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
ASX Sampler 00013 Lower Containment Drain	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED
ASX Sampler 00017 Lower Containment Drain	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED
ASX Sampler 00019 Lower Containment Drain	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED
ASX Sampler 00020 Lower Containment Drain	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

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Table III.10.E.E – Pretreatment Plant Tank System Process and Leak Detection System Instruments and Parameters

Tank System Name and Locator (including P&ID)	Control Parameter	Type of Measuring or Leak Detection Instrument	Location of Measuring Instrument (Tag No.)	Instrument Range	Expected Range	Fail States	Instrument Accuracy	Operating Trips (Description & Numerical Limits)	Instrument Calibration Method No. and Range
ASX Sampler 00025 Lower Containment Drain	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED
RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

[a] Locator (including P&ID designator) is located on Permit Table III.10.E.J – Pretreatment Plant Tank Systems Secondary Containment Systems Including Sumps and Floor Drains.

[b] Locator (including P&ID designator) is located on Permit Table III.10.E.I – Pretreatment Plant Tank Systems Primary Containment Systems.

[c] Leak detection instruments for secondary containment to a primary containment sump.

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Table III.10.E.F – LAW Vitrification Plant Tank System Process and Leak Detection System Instruments and Parameters

Tank System Name and Locator (including P&ID)	Control Parameter	Type of Measuring or Leak Detection Instrument	Location of Measuring Instrument (Tag No.)	Instrument Range	Expected Range	Fail States	Instrument Accuracy	Operating Trips (Description & Numerical Limits)	Instrument Calibration Method No. and Range
RLD-SUMP-00028[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
RLD-SUMP-00029[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
RLD-SUMP-00030[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
RLD-SUMP-00031[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
RLD-SUMP-00032[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
RLD-SUMP-00035[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
RLD-SUMP-00036[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
LVP-FD-00001[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED

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Table III.10.E.F – LAW Vitrification Plant Tank System Process and Leak Detection System Instruments and Parameters

Tank System Name and Locator (including P&ID)	Control Parameter	Type of Measuring or Leak Detection Instrument	Location of Measuring Instrument (Tag No.)	Instrument Range	Expected Range	Fail States	Instrument Accuracy	Operating Trips (Description & Numerical Limits)	Instrument Calibration Method No. and Range
Melter 1 Encasement Assembly Drain	Not Applicable	Conductivity Cable	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED
Melter 2 Encasement Assembly Drain	Not Applicable	Conductivity Cable	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED
ASX Sampler 00012 Lower Containment Drain	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED
ASX Sampler 00013 Lower Containment Drain	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED
		RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED
		RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

[a] Locator (including P&ID designator) is located on Permit Table III.10.E.L – LAW Vitrification Plant Tank Systems Secondary Containment Systems Including Sumps and Floor Drains.

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Table III.10.E.G – HLW Vitrification Plant Tank System Process and Leak Detection System Instruments and Parameters

Tank System Name and Locator (including P&ID)	Control Parameter	Type of Measuring or Leak Detection Instrument	Location of Measuring Instrument (Tag No.)	Instrument Range	Expected Range	Fail States	Instrument Accuracy	Operating Trips (Description & Numerical Limits)	Instrument Calibration Method No. and Range
HCP-SUMP-00001[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
RLD-SUMP-00001[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
HOP-SUMP-00003[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
HOP-SUMP-00008[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
HDH-SUMP-00001[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
HDH-SUMP-00002[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
HDH-SUMP-00003[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
HFP-SUMP-00002[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
HFP-SUMP-00005[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
HSH-SUMP-00003[a]	Not Applicable	Bubbler	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
HSH-SUMP-00007[a]	Not Applicable	Bubbler	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
HSH-SUMP-00008[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED

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Table III.10.E.G – HLW Vitrification Plant Tank System Process and Leak Detection System Instruments and Parameters

Tank System Name and Locator (including P&ID)	Control Parameter	Type of Measuring or Leak Detection Instrument	Location of Measuring Instrument (Tag No.)	Instrument Range	Expected Range	Fail States	Instrument Accuracy	Operating Trips (Description & Numerical Limits)	Instrument Calibration Method No. and Range
HSH-SUMP-00009[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
HPH-SUMP-00001[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
HPH-SUMP-00003[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
HPH-SUMP-00005[a]	Not Applicable	Radar Leak Detector	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
ASX Sampler 00028 Lower Containment Drain	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
ASX Sampler 00029 Lower Containment Drain	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
ASX Sampler 00042 Lower Containment Drain	Not Applicable	Thermal Dispersion Level Switch	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	Not Applicable	RESERVED
RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

[a] Locator (including P&ID designator) is located on Permit Table III.10.E.N – HLW Vitrification Plant Tank Systems Secondary Containment Systems Including Sumps, and Floor Drains.

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Table III.10.E.H – Laboratory Tank System Process and Leak Detection System Instruments and Parameters

Instrument/ Monitor Tag Number	Type and Location	Monitored Parameter	Measurement or Display Range	Expected Operating Range	Failure State	Accuracy	Numerical Set Point	Control Function	Calibration Method and Frequency
Lab Area Sink Drain Collection Vessel (RLD-VSL-00164) in A-B003 (see 24590-LAB-M6-RLD-00002001)									
RLD-LT-6202	Radar level transmitter/ A-0160	Liquid level in RLD-VSL-00164	0 to 104-inches	35.5 to 51-inches	NA	± 0.4-inch	NA	Transmit liquid level in RLD-VSL-00164 to PCJ	Non-calibratable
RLD-LI-6202A	Graphic display level indicator/ Control room	Liquid level in RLD-VSL-00164	0 to 3,200 gallons	1,018 to 1,578 gallons	Alarm as "bad quality", hold last good value	NA	NA	Display liquid level in control room, provides notifications	NA
RLD-LSHH-6202A	Level interlock/soft ware	Overfill prevention	NA	NA	Will cause protective interlocks to trip	NA	High-high liquid level = 2,248 gallons (70-inches)	Close RLD-YV-6210 and RLD-YV-6216 at Level HH set point	NA
C3 Vessel Cell Sump (RLD-SUMP-00041) in A-B003 (see 24590-LAB-M6-RLD-00002001)									
RLD-LT-6211	Radar level transmitter/ A-0160	Liquid level in RLD-SUMP-00041	0 to 75-inches	1.74 to 10-inches	NA	± 0.4-inch	NA	Transmit liquid level in RLD-SUMP-00041 to PCJ	Non-calibratable
RLD-LI-6211	Graphic display level indicator/ Control room	Liquid level in RLD-SUMP-00041	0 to 75-inches	1.74 to 10-inches	NA	NA	NA	Display liquid level in control room, provides notifications	NA
RLD-LKY-6211	Graphic display leak rate indicator/ Control room	Rate of liquid level change (LKY) in RLD-SUMP-00041	NA	NA	NA	NA	High leak rate = 2.4 gallons per day	Display control room high leak rate alarm	NA

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Table III.10.E.H – Laboratory Tank System Process and Leak Detection System Instruments and Parameters

Instrument/ Monitor Tag Number	Type and Location	Monitored Parameter	Measurement or Display Range	Expected Operating Range	Failure State	Accuracy	Numerical Set Point	Control Function	Calibration Method and Frequency
C3 Leak Detection Box (RLD-LDB-00005) in A-B003 (see 24590-LAB-M6-RLD-00007001)									
RLD-LSH-6215	Thermal level switch/ A-0160	Liquid level in RLD-LDB-00005	NA	NA	NA	±0.25-inch	NA	Detect liquid in leak detection box	Non-calibratable
RLD-LAH-6215	Graphic alarm display/ Control room	Presence or absence of liquid	On/off	NA	NA	NA	High liquid level = 0.5-inch	Indicate presence or absence of liquid	NA
C3 Leak Detection Box (RLD-LDB-00006) in A-B003 (see 24590-LAB-M6-RLD-00007001)									
RLD-LSH-6701	Thermal level switch/ A-0160	Liquid level in RLD-LDB-00006	NA	NA	NA	±0.25-inch	NA	Detect liquid in leak detection box	Non-calibratable
RLD-LAH-6701	Graphic alarm display/ Control room	Presence or absence of liquid	On/off	NA	NA	NA	High liquid level = 0.5-inch	Indicate presence or absence of liquid	NA
C3 Leak Detection Box (RLD-LDB-00007) in A-B003 (see 24590-LAB-M6-RLD-00007001)									
RLD-LSH-6702	Thermal level switch/ A-0160	Liquid level in RLD-LDB-00007	NA	NA	NA	±0.25-inch	NA	Detect liquid in leak detection box	Non-calibratable
RLD-LAH-6702	Graphic alarm display/ Control room	Presence or absence of liquid	On/off	NA	NA	NA	High liquid level = 0.5-inch	Indicate presence or absence of liquid	NA
C3 Leak Detection Box (RLD-LDB-00008) in A-B003 (see 24590-LAB-M6-RLD-00007001)									
RLD-LSH-6703	Thermal level switch/ A-0160	Liquid level in RLD-LDB-00008	NA	NA	NA	±0.25-inch	NA	Detect liquid in leak detection box	Non-calibratable

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Table III.10.E.H – Laboratory Tank System Process and Leak Detection System Instruments and Parameters

Instrument/ Monitor Tag Number	Type and Location	Monitored Parameter	Measurement or Display Range	Expected Operating Range	Failure State	Accuracy	Numerical Set Point	Control Function	Calibration Method and Frequency
RLD-LAH-6703	Graphic alarm display/ Control room	Presence or absence of liquid	On/off	NA	NA	NA	High liquid level = 0.5-inch	Indicate presence or absence of liquid	NA
C3 Leak Detection Box (RLD-LDB-00011) in A-B003 (see 24590-LAB-M6-RLD-00007001)									
RLD-LSH-6704	Thermal level switch/ A-0160	Liquid level in RLD-LDB-00011	NA	NA	NA	±0.25-inch	NA	Detect liquid in leak detection box	Non-calibratable
RLD-LAH-6704	Graphic alarm display/ Control room	Presence or absence of liquid	On/off	NA	NA	NA	High liquid level = 0.5-inch	Indicate presence or absence of liquid	NA
C3 Pump Pit Sump (RLD-SUMP-00045) in A-B002 (see 24590-LAB-M6-RLD-00002003)									
RLD-LT-6212	Radar level transmitter/ A-0160	Liquid level in RLD-SUMP-00045	0 to 15-inches	0 to 1.25-inches	NA	± 0.4-inch	NA	Transmit liquid level in RLD-SUMP-00045 to PCJ	Non-calibratable
RLD-LI-6212	Graphic display level indicator/ Control room	Liquid level in RLD-SUMP-00045	0 to 15-inches	0 to 1.25-inches	NA	NA	High liquid level = 1.25-inches	Display liquid level in control room, provides notifications	NA
Hotcell Drain Collection Vessel (RLD-VSL-00165) in A-B004 (see 24590-LAB-M6-RLD-00001001)									
RLD-LT-6104	Radar level transmitter/ A-0167	Liquid level in RLD-VSL-00165	0 to 100-inches	21 to 43-inches	NA	± 0.4-inch	NA	Transmit liquid level in RLD-VSL-00164 to PCJ	Non-calibratable
RLD-LI-6104A	Graphic display level indicator/ Control room	Liquid level in RLD-VSL-00165	0 to 9,090 gallons	1,258 to 3,829 gallons	Alarm as “bad quality”, hold last good value	NA	NA	Display liquid level in control room, provides notifications	NA

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Table III.10.E.H – Laboratory Tank System Process and Leak Detection System Instruments and Parameters

Instrument/ Monitor Tag Number	Type and Location	Monitored Parameter	Measurement or Display Range	Expected Operating Range	Failure State	Accuracy	Numerical Set Point	Control Function	Calibration Method and Frequency
RLD-LSHH-6104A	Level interlock/soft ware	Overfill prevention	NA	NA	Will cause protective interlocks to trip	NA	High-high liquid level = 4,609 gallons (50-inches)	Close RLD-YV-6511, RLD-YV-6802, and RLD-YV-6102 at Level HH set point	NA
C5 Vessel Cell Sump (RLD-SUMP-00042) in A-B004 (see 24590-LAB-M6-RLD-00001001)									
RLD-LT-6115	Radar level transmitter/ A-0167	Liquid level in RLD-SUMP-00042	0 to 66-inches	1.74 to 10-inches	NA	± 0.4-inch	NA	Transmit liquid level in RLD-SUMP-00041 to PCJ	Non-calibratable
RLD-LI-6115	Graphic display level indicator/ Control room	Liquid level in RLD-SUMP-00042	0 to 66-inches	1.74 to 10-inches	NA	NA	NA	Display liquid level in control room, provides notifications	NA
RLD-LKY-6115	Graphic display leak rate indicator/ Control room	Rate of liquid level change (LKY) in RLD-SUMP-00042	NA	NA	NA	NA	High leak rate = 2.4 gallons per day	Display control room high leak rate alarm	NA
C5 Pump Pit Sump (RLD-SUMP-00043A) A-B007 (see 24590-LAB-M6-RLD-00001002)									
RLD-LT-6116	Radar level transmitter/ A-0167	Liquid level in RLD-SUMP-00043A	0 to 75-inches	0 to 1.25-inches	NA	± 0.4-inch	NA	Transmit liquid level in RLD-SUMP-00043A to PCJ	Non-calibratable
RLD-LI-6116	Graphic display level indicator/ Control room	Liquid level in RLD-SUMP-00043A	0 to 75-inches	0 to 1.25-inches	NA	NA	High liquid level = 1.25-inches	Display liquid level in control room, provides notifications	NA

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Table III.10.E.H – Laboratory Tank System Process and Leak Detection System Instruments and Parameters

Instrument/ Monitor Tag Number	Type and Location	Monitored Parameter	Measurement or Display Range	Expected Operating Range	Failure State	Accuracy	Numerical Set Point	Control Function	Calibration Method and Frequency
C5 Pump Pit Sump (RLD-SUMP-00043B) in A-B005 (see 24590-LAB-M6-RLD-00001003)									
RLD-LT-6124	Radar level transmitter/ A-0167	Liquid level in RLD-SUMP-00043B	0 to 15-inches	0 to 1.25-inches	NA	± 0.4-inch	NA	Transmit liquid level in RLD-SUMP-00043B to PCJ	Non-calibratable
RLD-LI-6124	Graphic display level indicator/ Control room	Liquid level in RLD-SUMP-00043B	0 to 15-inches	0 to 1.25-inches	NA	NA	High liquid level = 1.25-inches	Display liquid level in control room, provides notifications	NA
C5 Piping Pit Sump (RLD-SUMP-00044) in A-B006 (see 24590-LAB-M6-RLD-00001004)									
RLD-LT-6123	Radar level transmitter/ A-0167	Liquid level in RLD-SUMP-00044	0 to 24-inches	0 to 1.25-inches	NA	± 0.4-inch	NA	Transmit liquid level in RLD-SUMP-00044 to PCJ	Non-calibratable
RLD-LI-6123	Graphic display level indicator/ Control room	Liquid level in RLD-SUMP-00044	0 to 24-inches	0 to 1.25-inches	NA	NA	High liquid level = 1.25-inches	Display liquid level in control room, provides notifications	NA
C5 Leak Detection Box (RLD-LDB-00002) in A-B004 (see 24590-LAB-M6-RLD-00008001)									
RLD-LSH-6120	Thermal level switch/ A-0167	Liquid level in RLD-LDB-00002	NA	NA	NA	±0.25-inch	NA	Detect liquid in leak detection box	Non-calibratable
RLD-LAH-6120	Graphic alarm display/ Control room	Presence or absence of liquid	On/off	NA	NA	NA	High liquid level = 0.5-inch	Indicate presence or absence of liquid	NA
C5 Leak Detection Box (RLD-LDB-00004) in A-B004 (see 24590-LAB-M6-RLD-00008001)									
RLD-LSH-6118	Thermal level switch/ A-0167	Liquid level in RLD-LDB-00004	NA	<RESERVED>	<RESERVED>	±0.25-inch	NA	Detect liquid in leak detection box	Non-calibratable

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Table III.10.E.H – Laboratory Tank System Process and Leak Detection System Instruments and Parameters

Instrument/ Monitor Tag Number	Type and Location	Monitored Parameter	Measurement or Display Range	Expected Operating Range	Failure State	Accuracy	Numerical Set Point	Control Function	Calibration Method and Frequency
RLD-LAH-6118	Graphic alarm display/ Control room	Presence or absence of liquid	On/off	NA	NA	NA	High liquid level = 0.5-inch	Indicate presence or absence of liquid	NA
C5 Leak Detection Box (RLD-LDB-00009) in A-B004 (see 24590-LAB-M6-RLD-00008001)									
RLD-LSH-6801	Thermal level switch/ A-0167	Liquid level in RLD-LDB-00009	NA	NA	NA	±0.25-inch	NA	Detect liquid in leak detection box	Non-calibratable
RLD-LAH-6801	Graphic alarm display/ Control room	Presence or absence of liquid	On/off	NA	NA	NA	High liquid level = 0.5-inch	Indicate presence or absence of liquid	NA

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Table III.10.E.I – Pretreatment Plant Tank Systems Primary[a] Containment Sump Systems

Sump I.D. # & Room Location	Maximum Sump Capacity (gallons)	Sump Dimensions[b] (feet) & Materials of Construction	Engineering Description (Drawing Nos., Specifications Nos., etc.)
PWD-SUMP-00026 P-0123 (Hotcell El. 0)	RESERVED	RESERVED	RESERVED
PWD-SUMP-00028 P-0123 (Hotcell El. 0)	RESERVED	RESERVED	RESERVED
PWD-SUMP-00029 P-0123 (Hotcell El. 0)	RESERVED	RESERVED	RESERVED
PWD-SUMP-00032 P-0123A (Maintenance Cave, El. 0)	RESERVED	RESERVED	RESERVED
PWD-SUMP-00033 P-0123A (Maintenance Cave, El. 0)	RESERVED	RESERVED	RESERVED

[a] Primary sumps are defined in Permit Section III.10.C, and must comply with dangerous waste tank system requirements for tanks as described in WAC-173-303-640.

[b] Dimensions listed are based on permitted design. Actual dimensions may vary within plus or minus (TBD).

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Table III.10.E.J – Pretreatment Plant Tank Systems Secondary Containment Systems, Including Sumps, Leak Detection Boxes, Bulges, Autosamplers, and Floor Drains

Sump, Bulge or Drain Line I.D. # & Room Location	Maximum Sump (gallons) Capacity	Sump Type/Nominal Operating Volume (gallons)	Sump, Bulge or Drain Line Dimensions[a] (inches) & Materials of Construction	Engineering Description (Drawing Nos., Specifications Nos., etc.)
PWD-SUMP-00071 P-B005 (Pit-19, El. –19')	60	Dry Sump	30"Dia x 18"Deep Epoxy	**24590-PTF** -M6-PWD-00041 -P1-P01T-00006
PWD-SUMP-00040 P-B002 (Pit-45, El. –45')	233.7	Dry Sump	60" x 30" x 30" Stainless Steel	**24590-PTF** -M6-PWD-00012 -P1-P01T-00006
PWD-SUMP-00001 P-0108B (El. 0')	75	Dry Sump	30" Dia. By ~27" deep Stainless Steel	**24590-PTF** -M6-PWD-00008 -P1-P01T-00001
PWD-SUMP-00001A P-0108C (El. 0')	75	Dry Sump	30" Dia. By ~27" deep Stainless Steel	**24590-PTF** -M6-PWD-00010 -P1-P01T-00001
PWD-SUMP-00002 P-0108A (El. 0')	75	Dry Sump	30" Dia. By ~27" deep Stainless Steel	**24590-PTF** -M6-PWD-00008 -P1-P01T-00001
PWD-SUMP-00002A P-0108 (El. 0')	75	Dry Sump	30" Dia. By ~27" deep Stainless Steel	**24590-PTF** -M6-PWD-00010 -P1-P01T-00001
PWD-SUMP-00003 P-0106 (El. 0')	75	Dry Sump	30" Dia. By ~27" deep Stainless Steel	**24590-PTF** -M6-PWD-00008 -P1-P01T-00001

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Table III.10.E.J – Pretreatment Plant Tank Systems Secondary Containment Systems, Including Sumps, Leak Detection Boxes, Bulges, Autosamplers, and Floor Drains

Sump, Bulge or Drain Line I.D. # & Room Location	Maximum Sump (gallons) Capacity	Sump Type/Nominal Operating Volume (gallons)	Sump, Bulge or Drain Line Dimensions[a] (inches) & Materials of Construction	Engineering Description (Drawing Nos., Specifications Nos., etc.)
PWD-SUMP-00004 P-0104 (El. 0')	75	Dry Sump	30" Dia. By ~27" deep Stainless Steel	**24590-PTF** -M6-PWD-00008 -P1-P01T-00001
PWD-SUMP-00005 P-0102A (El. 0')	75	Dry Sump	30" Dia. By ~27" deep Stainless Steel	**24590-PTF** -M6-PWD-00008 -P1-P01T-00001
PWD-SUMP-00006 P-0102 (El. 0')	75	Dry Sump	30" Dia. By ~27" deep Stainless Steel	**24590-PTF** -M6-PWD-00008 -P1-P01T-00001
PWD-SUMP-00007 P-0109 (El. 0')	75	Dry Sump	30" Dia. By ~27" deep Stainless Steel	**24590-PTF** -M6-PWD-00009 -P1-P01T-00001
PWD-SUMP-00008 P-0111 (El. 0')	75	Dry Sump	30" Dia. By ~27" deep Stainless Steel	**24590-PTF** -M6-PWD-00009 -P1-P01T-00001
PWD-SUMP-00009 P-0112 (El. 0')	75	Dry Sump	30" Dia. By ~27" deep Stainless Steel	**24590-PTF** -M6-PWD-00009 -P1-P01T-00001
PWD-SUMP-00010 P-0113 (El. 0')	75	Dry Sump	30" Dia. By ~27" deep Stainless Steel	**24590-PTF** -M6-PWD-00009 -P1-P01T-00001

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Table III.10.E.J – Pretreatment Plant Tank Systems Secondary Containment Systems, Including Sumps, Leak Detection Boxes, Bulges, Autosamplers, and Floor Drains

Sump, Bulge or Drain Line I.D. # & Room Location	Maximum Sump (gallons) Capacity	Sump Type/Nominal Operating Volume (gallons)	Sump, Bulge or Drain Line Dimensions[a] (inches) & Materials of Construction	Engineering Description (Drawing Nos., Specifications Nos., etc.)
PWD-SUMP-00011 P-0114 (El. 0')	75	Dry Sump	30" Dia. By ~27" deep Stainless Steel	**24590-PTF** -M6-PWD-00009 -P1-P01T-00001
PWD-SUMP-00012 P-0117 (El. 0')	75	Dry Sump	30" Dia. By ~27" deep Stainless Steel	**24590-PTF** -M6-PWD-00009 -P1-P01T-00001
PWD-SUMP-00013 P-0117A (El. 0')	75	Dry Sump	30" Dia. By ~27" deep Stainless Steel	**24590-PTF** -M6-PWD-00014 -P1-P01T-00001
RESERVED	RESERVED	RESERVED	RESERVED	RESERVED
RESERVED	RESERVED	RESERVED	RESERVED	RESERVED
RESERVED	RESERVED	RESERVED	RESERVED	RESERVED
PWD-SUMP-00031 P-0119 (El. 0')	75	Dry Sump	30" Dia. By ~27" deep Stainless Steel	**24590-PTF** -M6-PWD-00010 -P1-P01T-00001
RESERVED	RESERVED	RESERVED	RESERVED	RESERVED
RESERVED	RESERVED	RESERVED	RESERVED	RESERVED
PWD-SUMP-00034 P-0121A (Spent Resin Dewatering, El. 0')	75	Dry Sump	30" Dia. x 27" Deep Stainless Steel	**24590-PTF** -M6-PWD-00012
PWD-SUMP-00035 P-0122A (Waste Packaging Area, El. 0')	75	Dry Sump	30" Dia. x 27" Deep Stainless Steel	**24590-PTF** -M6-PWD-00012

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Table III.10.E.J – Pretreatment Plant Tank Systems Secondary Containment Systems, Including Sumps, Leak Detection Boxes, Bulges, Autosamplers, and Floor Drains

Sump, Bulge or Drain Line I.D. # & Room Location	Maximum Sump (gallons) Capacity	Sump Type/Nominal Operating Volume (gallons)	Sump, Bulge or Drain Line Dimensions[a] (inches) & Materials of Construction	Engineering Description (Drawing Nos., Specifications Nos., etc.)
PWD-SUMP-00036 P-0118 (El. 0')	75	Dry Sump	30" Dia. By ~27" deep Stainless Steel	**24590-PTF** -M6-PWD-P0012 -P1-P01T-00001
PWD-SUMP-00037 P-0124A	7.5		30" Dia. x 27" Deep Stainless Steel	**24590-PTF** -M6-PWD-00012
RLD-SUMP-00003 P-0150 (Radioactive Liquid Waste Disposal Area, El. 0', Outdoor)	583	Dry Sump	78" x 48" x 36" Deep Epoxy coating	**24590-PTF** -M6-RLD-00002003
PVP-ZY-00037-S11B-03, P-0105 (PVP-BULGE-00001, El. 0')			3" Stainless Steel	**24590-PTF** -M6-PVP-00017002
PVP-ZY-00036-S11B-03, P-0101A (PVP-BULGE-00002, El. 0')			3" Stainless Steel	**24590-PTF** -M6-PVP-00018002
TCP-ZF-00032-S11B-03 Drain Line, P-0116 (TCP-BULGE-00004, El. 0')	N/A	N/A	3" Stainless Steel	**24590-PTF** -M6-TCP-00001002
DIW-ZF-01511-S11B-03 Drain Line, P-0320 (DIW-BULGE-00001, El. 56')	N/A	N/A	3" Stainless Steel	**24590-PTF** -M6-DIW-00004001
DIW-ZF-01510-S11B-03, P-0320 Drain Line (DIW-BULGE-00002, El. 56')	N/A	N/A	3" Stainless Steel	**24590-PTF** -M6-DIW-00004001

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Table III.10.E.J – Pretreatment Plant Tank Systems Secondary Containment Systems, Including Sumps, Leak Detection Boxes, Bulges, Autosamplers, and Floor Drains

Sump, Bulge or Drain Line I.D. # & Room Location	Maximum Sump (gallons) Capacity	Sump Type/Nominal Operating Volume (gallons)	Sump, Bulge or Drain Line Dimensions[a] (inches) & Materials of Construction	Engineering Description (Drawing Nos., Specifications Nos., etc.)
PWD-FD-00005 PWD-ZF-03000-S11B-06 P-0123 (Hotcell, El.0')	939	N/A	6" Dia. Stainless Steel	**24590-PTF** -M6-PWD-00011
PWD-FD-00006 PWD-ZF-03001-S11B-06 P-0123 (Hotcell, El.0')	939	N/A	6" Dia. Stainless Steel	**24590-PTF** -M6-PWD-00011
PWD-FD-00435 P-0105		NA	3" Dia. Stainless Steel	**24590-PTF** -M6-PWD-00044
PWD-FD-00349 P-0105		NA	6" Dia. Stainless Steel	**24590-PTF** -M6-PWD-00044
PWD-FD-00436 P-0105		NA	3" Dia. Stainless Steel	**24590-PTF** -M6-PWD-00044
PWD-FD-00438 P-0105A		NA	6" Dia. Stainless Steel	**24590-PTF** -M6-PWD-00044
PWD-FD-00348 P-0105A		NA	6" Dia. Stainless Steel	**24590-PTF** -M6-PWD-00044
PWD-FD-00437 P-0105B		NA	3" Dia. Stainless Steel	**24590-PTF** -M6-PWD-00044
PWD-FD-347 P-0105B		NA	6" Dia. Stainless Steel	**24590-PTF** -M6-PWD-00044
PWD-FD-346 P-0105C		NA	4" Dia. Stainless Steel	**24590-PTF** -M6-PWD-00044

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Table III.10.E.J – Pretreatment Plant Tank Systems Secondary Containment Systems, Including Sumps, Leak Detection Boxes, Bulges, Autosamplers, and Floor Drains

Sump, Bulge or Drain Line I.D. # & Room Location	Maximum Sump (gallons) Capacity	Sump Type/Nominal Operating Volume (gallons)	Sump, Bulge or Drain Line Dimensions[a] (inches) & Materials of Construction	Engineering Description (Drawing Nos., Specifications Nos., etc.)
PWD-FD-00293 P-0426 Drain, El. 77’	140	N/A	6” Dia 304L	**24590-PTF** -M6-PWD-00044
PWD-FD-00298 P-0425 Drain, El. 77’	140	N/A	6” Dia 304L	**24590-PTF** -M6-PWD-00044
PWD-FD-00309 P-0402 Drain, El. 77’	655	N/A	8” Dia 304L	**24590-PTF** -M6-PWD-00044
PWD-FD-00310 P-0402 Drain, El. 77’	140	N/A	6” Dia 304L	**24590-PTF** -M6-PWD-00044
PWD-FD-00311 P-0402 Drain, El. 77’	140	N/A	6” Dia 304L	**24590-PTF** -M6-PWD-00044
PWD-FD-00312 P-0402 Drain, El. 77’	655	N/A	8” Dia 304L	**24590-PTF** -M6-PWD-00044
PWD-FD-00376 P-0415 Drain, El. 77’	655	N/A	8” Dia 304L	**24590-PTF** -M6-PWD-00043
PWD-FD-00377 P-0415 Drain, El. 77’	140	N/A	6” Dia 304L	**24590-PTF** -M6-PWD-00043
PWD-FD-00378 P-0415 Drain, El. 77’	140	N/A	6” Dia 304L	**24590-PTF** -M6-PWD-00043
PWD-FD-00379 P-0415 Drain, El. 77’	140	N/A	6” Dia 304L	**24590-PTF** -M6-PWD-00043
PWD-FD-00380 P-0415A Drain, El. 77’	140	N/A	6” Dia 304L	**24590-PTF** -M6-PWD-00043

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Table III.10.E.J – Pretreatment Plant Tank Systems Secondary Containment Systems, Including Sumps, Leak Detection Boxes, Bulges, Autosamplers, and Floor Drains

Sump, Bulge or Drain Line I.D. # & Room Location	Maximum Sump (gallons) Capacity	Sump Type/Nominal Operating Volume (gallons)	Sump, Bulge or Drain Line Dimensions[a] (inches) & Materials of Construction	Engineering Description (Drawing Nos., Specifications Nos., etc.)
PWD-FD-00381 P-0415A Drain, El. 77’	140	N/A	6” Dia 304L	**24590-PTF** -M6-PWD-00043
PWD-FD-00382 P-0415A Drain, El. 77’	655	N/A	8” Dia 304L	**24590-PTF** -M6-PWD-00043
PWD-FD-00383 P-0415A Drain, El. 77’	140	N/A	6” Dia 304L	**24590-PTF** -M6-PWD-00043
PWD-FD-00557 P-0430 Drain, El. 77’	140	N/A	6” Dia 304L	**24590-PTF** -M6-PWD-00043
PWD-FD-00559 P-0430 Drain, El. 77’	665	N/A	8” Dia 304L	**24590-PTF** -M6-PWD-00043
PWD-FD-00561 P-0430 Drain, El. 77’	140	N/A	6” Dia 304L	**24590-PTF** -M6-PWD-00043
PWD-FD-00563 P-0411 Drain, El. 77’	665	N/A	8” Dia 304L	**24590-PTF** -M6-PWD-00043
PWD-FD-00564 P-0411 Drain, El. 77’	140	N/A	6” Dia 304L	**24590-PTF** -M6-PWD-00043
PWD-FD-00565 P-0410 Drain, El. 77’	665	N/A	8” Dia 304L	**24590-PTF** -M6-PWD-00043
PWD-FD-00566 P-0410 Drain, El. 77’	665	N/A	8” Dia 304L	**24590-PTF** -M6-PWD-00043
PWD-FD-00571 P-0410 Drain, El. 77’	140	N/A	6” Dia 304L	**24590-PTF** -M6-PWD-00044

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Table III.10.E.J – Pretreatment Plant Tank Systems Secondary Containment Systems, Including Sumps, Leak Detection Boxes, Bulges, Autosamplers, and Floor Drains

Sump, Bulge or Drain Line I.D. # & Room Location	Maximum Sump (gallons) Capacity	Sump Type/Nominal Operating Volume (gallons)	Sump, Bulge or Drain Line Dimensions[a] (inches) & Materials of Construction	Engineering Description (Drawing Nos., Specifications Nos., etc.)
PWD-FD-00572 P-0410 Drain, El. 77’	140	N/A	6” Dia 304L	**24590-PTF** -M6-PWD-00044
PWD-FD-00573 P-0410 Drain, El. 77’	140	N/A	6” Dia 304L	**24590-PTF** -M6-PWD-00044
PWD-FD-00574 P-0410 Drain, El. 77’	140	N/A	6” Dia 304L	**24590-PTF** -M6-PWD-00044
PWD-FD-00575 P-0410 Drain, El. 77’	140	N/A	6” Dia 304L	**24590-PTF** -M6-PWD-00044
PWD-FD-00576 P-0410 Drain, El. 77’	140	N/A	6” Dia 304L	**24590-PTF** -M6-PWD-00044
PWD-FD-00583 P-0422A Drain, El. 77’	655	N/A	8” Dia 304L	**24590-PTF** -M6-PWD-00044
PWD-FD-00584 P-0422A Drain, El. 77’	140	N/A	6” Dia 304L	**24590-PTF** -M6-PWD-00044
PWD-FD-00589 P-0402 Drain, El. 77’	140	N/A	6” Dia 304L	**24590-PTF** -M6-PWD-00044
PWD-FD-00590 P-0423 Drain, El. 77’	655	N/A	8” Dia 304L	**24590-PTF** -M6-PWD-00044
PWD-FD-00591 P-0423 Drain, El. 77’	655	N/A	8” Dia 304L	**24590-PTF** -M6-PWD-00044
PWD-FD-00592 P-0423 Drain, El. 77’	655	N/A	8” Dia 304L	**24590-PTF** -M6-PWD-00044

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Table III.10.E.J – Pretreatment Plant Tank Systems Secondary Containment Systems, Including Sumps, Leak Detection Boxes, Bulges, Autosamplers, and Floor Drains

Sump, Bulge or Drain Line I.D. # & Room Location	Maximum Sump (gallons) Capacity	Sump Type/Nominal Operating Volume (gallons)	Sump, Bulge or Drain Line Dimensions[a] (inches) & Materials of Construction	Engineering Description (Drawing Nos., Specifications Nos., etc.)
PWD-FD-00593 P-0423 Drain, El. 77’	140	N/A	6” Dia 304L	**24590-PTF** -M6-PWD-00044
PWD-FD-00594 P-0423 Drain, El. 77’	655	N/A	8” Dia 304L	**24590-PTF** -M6-PWD-00044
PWD-FD-00595 P-0431A Drain, El. 77’	140	N/A	6” Dia 304L	**24590-PTF** -M6-PWD-00044
PWD-FD-00596 P-0431A Drain, El. 77’	140	N/A	6” Dia 304L	**24590-PTF** -M6-PWD-00044
PWD-FD-00597 P-0431A Drain, El. 77’	140	N/A	6” Dia 304L	**24590-PTF** -M6-PWD-00044
PWD-FD-00598 P-0431A Drain, El. 77’	655	N/A	8” Dia 304L	**24590-PTF** -M6-PWD-00044
PWD-FD-00599 P-0431A Drain, El. 77’	655	N/A	8” Dia 304L	**24590-PTF** -M6-PWD-00044
PWD-FD-00600 P-0431A Drain, El. 77’	655	N/A	8” Dia 304L	**24590-PTF** -M6-PWD-00044
PWD-FD-00604 P-0431A Drain, El. 77’	140	N/A	6” Dia 304L	**24590-PTF** -M6-PWD-00044
PWD-FD-00605 P-0431A Drain, El. 77’	140	N/A	6” Dia 304L	**24590-PTF** -M6-PWD-00044
PWD-FD-00606 P-0431A Drain, El. 77’	140	N/A	6” Dia 304L	**24590-PTF** -M6-PWD-00044

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Table III.10.E.J – Pretreatment Plant Tank Systems Secondary Containment Systems, Including Sumps, Leak Detection Boxes, Bulges, Autosamplers, and Floor Drains

Sump, Bulge or Drain Line I.D. # & Room Location	Maximum Sump (gallons) Capacity	Sump Type/Nominal Operating Volume (gallons)	Sump, Bulge or Drain Line Dimensions[a] (inches) & Materials of Construction	Engineering Description (Drawing Nos., Specifications Nos., etc.)
PWD-FD-00607 P-0431A Drain, El. 77’	140	N/A	6” Dia 304L	**24590-PTF** -M6-PWD-00044
PWD-FD-00629 P-0425 Drain, El. 77’	655	N/A	8” Dia 304L	**24590-PTF** -M6-PWD-00044
PWD-FD-00630 P-0425 Drain, El. 77’	140	N/A	8” Dia 304L	**24590-PTF** -M6-PWD-00044
CRP-ZF-00002-S11B-03, P-0317 Drain Line (CRP-BULGE-00001 drain, El. 56’)	N/A	N/A	3” Stainless Steel	**24590-PTF** -M6-CRP-00003001
CXP-ZF-00012-S11B-03 Drain Line, P-0317 (CXP-BULGE-00004, El. 56’)	N/A	N/A	3” Stainless Steel	**24590-PTF** -M6-CXP-00003003
UFP-ZF-00043-S11B-03 Drain Line, P-0301 (UFP-BULGE-00001, El. 56’)	N/A	N/A	3” Stainless Steel	**24590-PTF** -M6-UFP-00016001
UFP-ZF-00042-S11B-03 Drain Line, P-0301 (UFP-BULGE-00002, El. 56’)	N/A	N/A	3” Stainless Steel	**24590-PTF** -M6-UFP-00017001
UFP-ZY-00002-S11B-03 Drain Line, P-0311 (UFP-BULGE-00005, El. 56’)	N/A	N/A	3” Stainless Steel	**24590-PTF** -M56-UFP-00031001
UFP-ZY-00001-S11B-03 Drain Line, P-0311A (UFP-BULGE-00006, El. 56’)	N/A	N/A	3” Stainless Steel	**24590-PTF** -M6-UFP-00032001

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Table III.10.E.J – Pretreatment Plant Tank Systems Secondary Containment Systems, Including Sumps, Leak Detection Boxes, Bulges, Autosamplers, and Floor Drains

Sump, Bulge or Drain Line I.D. # & Room Location	Maximum Sump (gallons) Capacity	Sump Type/Nominal Operating Volume (gallons)	Sump, Bulge or Drain Line Dimensions[a] (inches) & Materials of Construction	Engineering Description (Drawing Nos., Specifications Nos., etc.)
PWD-LDB-00001 P-B001 (Inter Facility Transfer Line Tunnel, El.-45')	6	N/A	8" Dia. x 24" Length Stainless Steel	**24590-PTF** -M6-PWD-00050
PWD-LDB-00002 P-B001 (Inter Facility Transfer Line Tunnel, El.-45')	6	N/A	8" Dia. x 24" Length Stainless Steel	**24590-PTF** -M6-PWD-00050
PWD-LDB-00003 P-B001 (Inter Facility Transfer Line Tunnel, El.-45')	6	N/A	8" Dia. x 24" Length Stainless Steel	**24590-PTF** -M6-PWD-00050
PWD-LDB-00004 P-B001 (Inter Facility Transfer Line Tunnel, El.-45')	6	N/A	8" Dia. x 24" Length Stainless Steel	**24590-PTF** -M6-PWD-00050
PWD-LDB-00005 P-B001 (Inter Facility Transfer Line Tunnel, El.-45')	6	N/A	8" Dia. x 24" Length Stainless Steel	**24590-PTF** -M6-PWD-00050
PWD-LDB-00006 P-B001 (Inter Facility Transfer Line Tunnel, El.-45')	6	N/A	8" Dia. x 24" Length Stainless Steel	**24590-PTF** -M6-PWD-00050
PWD-LDB-00007 P-B001 (Inter Facility Transfer Line Tunnel, El.-45')	6	N/A	8" Dia. x 24" Length Stainless Steel	**24590-PTF** -M6-PWD-00050
PWD-LDB-00008 P-B001 (Inter Facility Transfer Line Tunnel, El.-45')	6	N/A	8" Dia. x 24" Length Stainless Steel	**24590-PTF** -M6-PWD-00050

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Table III.10.E.J – Pretreatment Plant Tank Systems Secondary Containment Systems, Including Sumps, Leak Detection Boxes, Bulges, Autosamplers, and Floor Drains

Sump, Bulge or Drain Line I.D. # & Room Location	Maximum Sump (gallons) Capacity	Sump Type/Nominal Operating Volume (gallons)	Sump, Bulge or Drain Line Dimensions[a] (inches) & Materials of Construction	Engineering Description (Drawing Nos., Specifications Nos., etc.)
PWD-LDB-00009 P-B001 (Inter Facility Transfer Line Tunnel, El.-45')	6	N/A	8" Dia. x 24" Length Stainless Steel	**24590-PTF** -M6-PWD-00050
PWD-LDB-00010 P-B001 (Inter Facility Transfer Line Tunnel, El.-45')	6	N/A	8" Dia. x 24" Length Stainless Steel	**24590-PTF** -M6-PWD-00050
PWD-LDB-00011 P-B001 (Inter Facility Transfer Line Tunnel, El.-45')	6	N/A	8" Dia. x 24" Length Stainless Steel	**24590-PTF** -M6-PWD-00050
PWD-LDB-00012 P-B001 (Inter Facility Transfer Line Tunnel, El.-45')	6	N/A	8" Dia. x 24" Length Stainless Steel	**24590-PTF** -M6-PWD-00051
PWD-LDB-00013 P-B001 (Inter Facility Transfer Line Tunnel, El.-45')	6	N/A	8" Dia. x 24" Length Stainless Steel	**24590-PTF** -M6-PWD-00051
PWD-LDB-00014 P-B001 (Inter Facility Transfer Line Tunnel, El.-45')	6	N/A	8" Dia. x 24" Length Stainless Steel	**24590-PTF** -M6-PWD-00051
PWD-LDB-00015 P-B001 (Inter Facility Transfer Line Tunnel, El.-45')	6	N/A	8" Dia. x 24" Length Stainless Steel	**24590-PTF** -M6-PWD-00051
PWD-LDB-00016 P-B001 (Inter Facility Transfer Line Tunnel, El.-45')	6	N/A	8" Dia. x 24" Length Stainless Steel	**24590-PTF** -M6-PWD-00051

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Table III.10.E.J – Pretreatment Plant Tank Systems Secondary Containment Systems, Including Sumps, Leak Detection Boxes, Bulges, Autosamplers, and Floor Drains

Sump, Bulge or Drain Line I.D. # & Room Location	Maximum Sump (gallons) Capacity	Sump Type/Nominal Operating Volume (gallons)	Sump, Bulge or Drain Line Dimensions[a] (inches) & Materials of Construction	Engineering Description (Drawing Nos., Specifications Nos., etc.)
PWD-LDB-00017 P-B001 (Inter Facility Transfer Line Tunnel, El.-45')	6	N/A	8" Dia. x 24" Length Stainless Steel	**24590-PTF** -M6-PWD-00051
PWD-LDB-00018 P-B001 (Inter Facility Transfer Line Tunnel, El.-45')	6	N/A	8" Dia. x 24" Length Stainless Steel	**24590-PTF** -M6-PWD-00051
PWD-LDB-00019 P-B001 (Inter Facility Transfer Line Tunnel, El.-45')	6	N/A	8" Dia. x 24" Length Stainless Steel	**24590-PTF** -M6-PWD-00051
RLD-LDB-00012 P-B001 (Inter Facility Transfer Line Tunnel, El.-45')	6	N/A	8" Dia. x 34" Length Stainless Steel	**24590-PTF** -M6-PWD-00058001 and 00058002
RLD-LDB-00013 P-B001 (Inter Facility Transfer Line Tunnel, El.-45')	6	N/A	8" Dia. x 34" Length Stainless Steel	**24590-PTF** -M6-PWD-00058001 and 00058002
ASX Sampler 00017 Lower Containment Trough/Dam (P-0311B, El. 56')	N/A	N/A	3" Dia. Stainless Steel	**24590-PTF** -M6-PWD-00007
ASX Sampler 00019 Lower Containment Trough/Dam (P-0302, El. 56')	N/A	N/A	3" Dia. Stainless Steel	**24590-PTF** -M6-PWD-00007
ASX Sampler 00020 Lower Containment Trough/Dam (P-0301, El. 56')	N/A	N/A	3" Dia. Stainless Steel	**24590-PTF** -M6-PWD-00007

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Table III.10.E.J – Pretreatment Plant Tank Systems Secondary Containment Systems, Including Sumps, Leak Detection Boxes, Bulges, Autosamplers, and Floor Drains

Sump, Bulge or Drain Line I.D. # & Room Location	Maximum Sump (gallons) Capacity	Sump Type/Nominal Operating Volume (gallons)	Sump, Bulge or Drain Line Dimensions[a] (inches) & Materials of Construction	Engineering Description (Drawing Nos., Specifications Nos., etc.)
ASX Sampler 00025 Lower Containment Trough/Dam (P-0307, El. 56')	N/A	N/A	3" Dia. Stainless Steel	**24590-PTF** -M6-PWD-00007

[a] Dimensions listed are based on permitted design. Actual dimensions may vary within plus or minus (TBD).

Note #1: These are special cases due to their location in equipment berms. The capacity for these drain lines is based on a unique bounding case for liquid spillage.

Table III.10.E.K – LAW Vitrification Plant Tank Systems Primary[a] Containment Sump Systems

Sump I.D. # & Room Location	Maximum Sump Capacity (gallons)	Sump Dimensions[b] (feet) & Materials of Construction	Engineering Description (Drawing Nos., Specifications Nos., etc.)
RESERVED	RESERVED	RESERVED	RESERVED

[a] Primary sumps are defined in Permit Section III.10.C, and must comply with dangerous waste tank system requirements for tanks as described in WAC-173-303-640.

[b] Dimensions listed are based on permitted design. Actual dimensions may vary within plus or minus (TBD).

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Table III.10.E.M – HLW Vitrification Plant Tank Systems Primary[a] Containment Sump Systems

Sump I.D.# & Room Location	Maximum Sump Capacity (gallons)	Sump Dimensions[b] (feet) & Materials of Construction	Engineering Description (Drawing Nos., Specifications Nos., etc.)
RESERVED	RESERVED	RESERVED	RESERVED

[a] Primary sumps are defined in Permit Section III.10.C, and must comply with dangerous waste tank system requirements for tanks as described in WAC-173-303-640.

[b] Dimensions listed are based on permitted design. Actual dimensions may vary within plus or minus (TBD).

Table III.10.E.N – HLW Vitrification Plant Tank Systems Secondary Containment Systems, Including Sumps, Autosamplers, and Floor Drains

Sump or Drain Line I.D. # & Room Location	Maximum Sump (gallons) Capacity	Sump Type	Sump or Drain Line Dimensions[a] (inches) & Materials of Construction	Engineering Description (Drawing Nos., Specifications Nos., etc.)
HCP-SUMP-00001 H-B014 (Wet Process Cell, El. –21')	75	Dry Sump	30" Dia. x 18" Deep Stainless Steel	**24590-HLW** -M6-RLD-00015001 -P1-P01T-00001
RLD-SUMP-00001 H-B014 (Wet Process Cell, El. –21')	75	Dry Sump	30" Dia. x 18" Deep Stainless Steel	**24590-HLW** -M6-RLD-00015001 -P1-P01T-00001
HOP-SUMP-00003 H-B021 (SBS Drain Collection Cell 1, El. –21')	75	Dry Sump	30" Dia. x 18" Deep Stainless Steel	**24590-HLW** -M6-RLD-00015001 -P1-P01T-00001
HOP-SUMP-00008 H-B005 (SBS Drain Collection Cell 2, El. –21')	75	Dry Sump	30" Dia. x 18" Deep Stainless Steel	**24590-HLW** -M6-RLD-20004001 -P1-P01T-00001
HDH-SUMP-00001 H-B039B (Canister Rinse Tunnel, El. –16.5')	75	Dry Sump	30" Dia. x 18" Deep Stainless Steel	**24590-HLW** -M6-RLD-00016001 -P1-P01T-00001

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Table III.10.E.N – HLW Vitrification Plant Tank Systems Secondary Containment Systems, Including Sumps, Autosamplers, and Floor Drains

Sump or Drain Line I.D. # & Room Location	Maximum Sump (gallons) Capacity	Sump Type	Sump or Drain Line Dimensions[a] (inches) & Materials of Construction	Engineering Description (Drawing Nos., Specifications Nos., etc.)
HDH-SUMP-00002 H-B039A (Canister Rinse Bogie Maintenance Room, El. –16')	75	Dry Sump	30" Dia. x 18" Deep Stainless Steel	**24590-HLW** -M6-RLD-00016001 -P1-P01T-00001
HDH-SUMP-00003 H-B035 (Canister Decon Cave, El. –16')	75	Dry Sump	30" Dia. x 18" Deep Stainless Steel	**24590-HLW** -M6-RLD-00004002 -P1-P01T-00001
HFP-SUMP-00002 H-0117 (Melter Cave 1, El. 5')	50	Dry Sump	20.5" x 20.5" x 16" Stainless Steel	**24590-HLW** -M6-RLD-00008002 -P1-P01T-00002
HFP-SUMP-00005 H-0106 (Melter Cave 2, El. 5')	50	Dry Sump	20.5" x 20.5" x 16" Stainless Steel	**24590-HLW** -M6-RLD- 20005001 -P1-P01T-00002
HSH-SUMP-00003 H-0117 (Melter Cave 1, El. 3')	50	Dry Sump	20.5" x 20.5" x 16" Stainless Steel	**24590-HLW** -M6-RLD-00008002 -P1-P01T-00002
HSH-SUMP-00007 H-0106 (Melter Cave 2, El. 3')	50	Dry Sump	20.5" x 20.5" x 16" Stainless Steel	**24590-HLW** -M6-RLD-20005001 -P1-P01T-00002
HSH-SUMP-00008 H-310A (Melter 1 Equip. Decon. Pit Area, El. 0')	50	Dry Sump	30" x 24" x 16" Stainless Steel	**24590-HLW** -M6-RLD-00003001 -P1-P01T-00002
HSH-SUMP-00009 H-0304A (Melter 2 Equip. Decon. Pit Area, El. 0')	50	Dry Sump	30" x 24" x 16" Stainless Steel	**24590-HLW** -M6-RLD-20003001 -P1-P01T-00002

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Table III.10.E.N – HLW Vitrification Plant Tank Systems Secondary Containment Systems, Including Sumps, Autosamplers, and Floor Drains

Sump or Drain Line I.D. # & Room Location	Maximum Sump (gallons) Capacity	Sump Type	Sump or Drain Line Dimensions[a] (inches) & Materials of Construction	Engineering Description (Drawing Nos., Specifications Nos., etc.)
HPH-SUMP-00001 H-0136 (Canister Handling Cave, El. -3')	75	Dry Sump	30" Dia. x 18" Deep Stainless Steel	**24590-HLW** -M6-RLD-00016001
HPH-SUMP-00005 H-0136 (Canister Handling Cave, El. -3')	75	Dry Sump	30" Dia. x 18" Deep Stainless Steel	**24590-HLW** -M6-RLD-00004001
HPH-SUMP-00003 H-B032 (Pour Tunnel 1, El. -21')	75	Dry Sump	30" Dia. x 18" Deep Stainless Steel	**24590-HLW** -M6-RLD-00016001
RLD-ZF-03330-S11B-03 H-B021 (SBS Drain Collection Cell 1)	N/A	N/A	Line Size Pipe Dia 3" 316L Stainless Steel	**24590-HLW** -M6-RLD-00015001
RLD-ZF-03447-S11B-03 H-B005 (SBS Drain Collection Cell 2)	N/A	N/A	Line Size Pipe Dia 3" 316L Stainless Steel	**24590-HLW** -M6-RLD-20004001
RLD-FD-0186 H-0308 (Melter 1 - Active Services Cell, El. 37')	N/A	N/A	Line Size Pipe Dia 6" Stainless Steel	**24590-HLW** -M6-RLD-00015001
RLD-FD-0187 H-0302 (Melter 2 - Active Services Cell, El. 37')	N/A	N/A	Line Size Pipe Dia 6" Stainless Steel	**24590-HLW** -M6-RLD-20004001
ASX Sampler 00028 Lower Containment Trough/Dam (H-0305A, El. 37')	N/A	N/A	3" Dia. Stainless Steel	**24590-HLW** -M6-RLD-00002002

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Table III.10.E.N – HLW Vitrification Plant Tank Systems Secondary Containment Systems, Including Sumps, Autosamplers, and Floor Drains

Sump or Drain Line I.D. # & Room Location	Maximum Sump (gallons) Capacity	Sump Type	Sump or Drain Line Dimensions[a] (inches) & Materials of Construction	Engineering Description (Drawing Nos., Specifications Nos., etc.)
ASX Sampler 00029 Lower Containment Trough/Dam (H-0315, El. 37')	N/A	N/A	3" Dia. Stainless Steel	**24590-HLW** -M6-RLD-00002002
ASX Sampler 00042 Lower Containment Trough/Dam (H-0318, El. 37')	N/A	N/A	3" Dia. Stainless Steel	**24590-HLW** -M6-RLD-00002002
RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

[a] Dimensions listed are based on permitted design. Actual dimensions may vary within plus or minus (TBD).

Table III.10.E.O – Laboratory Tank Systems Primary[a] Containment Sump Systems

Sump I.D. # & Room Location	Maximum Sump Capacity (gallons)	Sump Dimensions[b] (feet) & Materials of Construction	Engineering Description (Drawing Nos., Specifications Nos., etc.)
RESERVED	RESERVED	RESERVED	RESERVED

[a] Primary sumps are defined in Permit Section III.10.C, and must comply with dangerous waste tank system requirements for tanks as described in WAC-173-303-640.

[b] Dimensions listed are based on permitted design. Actual dimensions may vary within plus or minus (TBD).

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Table III.10.E.R – EMF Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	Unit Designation	Engineering Description (Drawing Nos, Specification Nos, etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
DEP-VSL-00001 ED-B001 Low-point drain vessel	DEP	**24590-BOF** -M5-V17T-00011 -M6-DEP-00001001 -M6-DEP-00001002 -MVD-DEP-00002 -N1D-DEP-00001 -P1-25-00001 -3PS-MVSC-T0002 24590-CM-POA-MVSC-00005-07-00001 (Sheet 3 of 23, Sheet 4 of 23)	Section 4G.2.1; Table 4G-1	18,000
DEP-VSL-00002 E-0105 Evaporator feed vessel	DEP	**24590-BOF** -M5-V17T-00011 -M6-DEP-00002002 -MVD-DEP-00003 -N1D-DEP-00002 -P1-25-00001 -3PS-MVSC-T0002 24590-CM-POA-MVSC-00005-07-00002 (Sheet 3 of 18, Sheet 4 of 18)	Section 4G.2.2; Table 4G-1	42,300

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Table III.10.E.R – EMF Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	Unit Designation	Engineering Description (Drawing Nos, Specification Nos, etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
DEP-VSL-00003A E-0105 Evaporator feed vessel	DEP	**24590-BOF** -M5-V17T-00013 -M6-DEP-00005001 -MVD-DEP-00004 -N1D-DEP-00003 -P1-25-00001 -3PS-MVSC-T0002 24590-CM-POA-MVSC-00005-07-00003 (Sheet 3 of 18, Sheet 4 of 18)	Section 4G.2.3; Table 4G-1	14,900
DEP-VSL-00003B E-0105 Evaporator feed vessel	DEP	**24590-BOF** -M5-V17T-00013 -M6-DEP-00005002 -MVD-DEP-00004 -N1D-DEP-00003 -P1-25-00001 -3PS-MVSC-T0002 24590-CM-POA-MVSC-00005-07-00004 (Sheet 3 of 18, Sheet 4 of 18)	Section 4G.2.3; Table 4G-1	14,900

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Table III.10.E.R – EMF Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	Unit Designation	Engineering Description (Drawing Nos, Specification Nos, etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
DEP-VSL-00003C E-0105 Evaporator feed vessel	DEP	**24590-BOF** -M5-V17T-00013 -M6-DEP-00005003 -MVD-DEP-00004 -N1D-DEP-00003 -P1-25-00001 -3PS-MVSC-T0002 24590-CM-POA-MVSC-00005-07-00005 (Sheet 3 of 18, Sheet 4 of 18)	Section 4G.2.3; Table 4G-1	14,900
DEP-VSL-00004A E-0106 Overhead sampling vessel	DEP	Reserved	Section 4G.2.4; Table 4G-1	40,800
DEP-VSL-00004B E-0106 Overhead sampling vessel	DEP	Reserved	Section 4G.2.4; Table 4G-1	40,800
DEP-VSL-00005A E-0106 Process condensate lag storage vessel	DEP	Reserved	Section 4G.2.5; Table 4G-1	127,260
DEP-VSL-00005B E-0106 Process condensate lag storage vessel	DEP	Reserved	Section 4G.2.5; Table 4G-1	127,260

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Table III.10.E.R – EMF Plant Tank Systems Description

Dangerous and/or Mixed Waste Tank Systems Name	Unit Designation	Engineering Description (Drawing Nos, Specification Nos, etc.)	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
DEP-FILT-00003 E-0103 Evaporator feed pre-filter	DEP	**24590-BOF** -M5-V17T-00011 -M6-DEP-0002004 -P1-25-00001 -3PS-MLF0-T0002 24590-CM-POA-MLF0-00005-08-00001 24590-CM-POA-MLF0-00005-05-00004 (Sheet 1 of 3)	Section 4G.3.6; Table 4G-1	NA

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Table III.10.E.S – EMF Plant Tank Systems Secondary Containment Systems, including Sumps, Leak Detection Boxes, Drain Lines, and Floor Drains

Sump/Leak Detection Box, or Floor Drain/Line I.D. # and Room #	Maximum Sump/Leak Detection Box Capacity (gallons)	Sump/Leak Detection Box Level Detection Type	Sump, Leak Detection Box or Floor Drain/Line Dimensions (approximate) and Materials of Construction	Piping and Instrumentation Diagram Number
Effluent Management Facility				
Sumps				
DEP-SUMP-00001 ED-B001	~58	Radio Frequency (RF) Capacitance	24 in. Dia. x 30 in. Length 304L SS	**24590-BOF** -M6-DEP-00001002
DEP-SUMP-00002A E-0103	~58	RF Capacitance	24 in. Dia. x 30 in. Length 304L SS	**24590-BOF** -M6-DEP-00009001
DEP-SUMP-00002B E-0103	~58	RF Capacitance	24 in. Dia. x 30 in. Length 304L SS	**24590-BOF** -M6-DEP-00009001
DEP-SUMP-00003A E-0102	~58	RF Capacitance	24 in. Dia. x 30 in. Length 304L SS	**24590-BOF** -M6-DEP-00009004
DEP-SUMP-00003B E-0102	~58	RF Capacitance	24 in. Dia. x 30 in. Length 304L SS	**24590-BOF** -M6-DEP-00009004
DEP-SUMP-00004A E-0105	~58	RF Capacitance	24 in. Dia. x 30 in. Length 304L SS	**24590-BOF** -M6-DEP-00009002
DEP-SUMP-00004B E-0105	~58	RF Capacitance	24 in. Dia. x 30 in. Length 304L SS	**24590-BOF** -M6-DEP-00009002
DEP-SUMP-00005A E-0106	~58	RF Capacitance	24 in. Dia. x 30 in. Length 304L SS	**24590-BOF** -M6-DEP-00009005
DEP-SUMP-00005B E-0106	~58	RF Capacitance	24 in. Dia. x 30 in. Length 304L SS	**24590-BOF** -M6-DEP-00009005

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Table III.10.E.S – EMF Plant Tank Systems Secondary Containment Systems, including Sumps, Leak Detection Boxes, Drain Lines, and Floor Drains

Sump/Leak Detection Box, or Floor Drain/Line I.D. # and Room #	Maximum Sump/Leak Detection Box Capacity (gallons)	Sump/Leak Detection Box Level Detection Type	Sump, Leak Detection Box or Floor Drain/Line Dimensions (approximate) and Materials of Construction		Piping and Instrumentation Diagram Number
Leak Detection Boxes					
DEP-LDB-00001 ED-B001	~7	Conductivity Switch	8 in. Dia. x 41 in. Length 316L SS		**24590-BOF** -M6-DEP-00011001
DEP-LDB-00002 ED-B001	~7	Conductivity Switch	8 in. Dia. x 41 in. Length 316L SS		**24590-BOF** -M6-DEP-00011001
DEP-LDB-00003 ED-B001	~7	Conductivity Switch	8 in. Dia. x 41 in. Length 316L SS		**24590-BOF** -M6-DEP-00011001
DEP-LDB-00004 ED-B001	~7	Conductivity Switch	8 in. Dia. x 41 in. Length 316L SS		**24590-BOF** -M6-DEP-00011001
DEP-LDB-00005 ED-B001	~7	Conductivity Switch	8 in. Dia. x 41 in. Length 316L SS		**24590-BOF** -M6-DEP-00011001
DEP-LDB-00006 ED-B001	~7	Conductivity Switch	8 in. Dia. x 41 in. Length 316L SS		**24590-BOF** -M6-DEP-00011001
Drain Lines					
BOF-DEP-ZS-20282-W11A-011/02-01 ED-CH01	NA	NA	4 in. Dia. 316L SS	Containment pipe	**24590-BOF** -M6-DEP-00001001
			1 ½ in. Dia. AL6XN	Process pipe	
BOF-DEP-ZS-20236-W31A-02-01 ED-CH01	NA	NA	4 in. Dia. Carbon Steel	Containment pipe	**24590-BOF** -M6-DEP-00001001
			2 in. Dia. 316L SS	Process pipe	

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Table III.10.E.S – EMF Plant Tank Systems Secondary Containment Systems, including Sumps, Leak Detection Boxes, Drain Lines, and Floor Drains

Sump/Leak Detection Box, or Floor Drain/Line I.D. # and Room #	Maximum Sump/Leak Detection Box Capacity (gallons)	Sump/Leak Detection Box Level Detection Type	Sump, Leak Detection Box or Floor Drain/Line Dimensions (approximate) and Materials of Construction		Piping and Instrumentation Diagram Number
BOF-DEP-ZS-20245-W11A-04-01ED-CH01	NA	NA	6 in. Dia. 3166 SS	Containment pipe	**24590-BOF** -M6-DEP-00001001
			4 in. Dia. AL6XN	Process pipe	
BOF-DEP-ZS-20231-W31A-03-01 ED-CH01	NA	NA	6 in. Dia. Carbon Steel	Containment pipe	**24590-BOF** -M6-DEP-00001001
			3 in. Dia. 316L SS	Process pipe	
BOF-DEP-ZS-20242-W31A-10-01 ED-CH01	NA	NA	14 in. Dia. Carbon Steel	Containment pipe	**24590-BOF** -M6-DEP-00001001
			10 in. Dia. 316L SS	Process pipe	
BOF-DEP-ZS-20249-W31A-03-01 ED-CH01	NA	NA	6 in. Dia. Carbon Steel	Containment pipe	**24590-BOF** -M6-DEP-00001001
			3 in. Dia. 316L SS	Process pipe	
BOF-DEP-ZS-20225-W31A-02-01 ED-CH01	NA	NA	4 in. Dia. Carbon steel	Containment pipe	**24590-BOF** -M6-DEP-00001002
			2 in. Dia. 316L SS	Process pipe	
BOF-DEP-ZS-20219-W31A-02-01	NA	NA	4 in. Dia. Carbon steel	Containment pipe	**24590-BOF** -M6-DEP-00001002

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Table III.10.E.S – EMF Plant Tank Systems Secondary Containment Systems, including Sumps, Leak Detection Boxes, Drain Lines, and Floor Drains

Sump/Leak Detection Box, or Floor Drain/Line I.D. # and Room #	Maximum Sump/Leak Detection Box Capacity (gallons)	Sump/Leak Detection Box Level Detection Type	Sump, Leak Detection Box or Floor Drain/Line Dimensions (approximate) and Materials of Construction		Piping and Instrumentation Diagram Number
ED-CH01			2 in. Dia. 316L SS	Process pipe	
BOF-DEP-ZS-20222-W31A-02-01 ED-CH01	NA	NA	4 in. Dia. Carbon Steel	Containment pipe	**24590-BOF** -M6-DEP-00001002
			2 in. Dia. 316L SS	Process pipe	
BOF-DEP-ZS-20252-W11A-03-01 ED-CH01	NA	NA	6 in. Dia. 316L SS	Containment pipe	**24590-BOF** -M6-DEP-00010001
			3 in. Dia. AL6XN	Process pipe	
BOF-DEP-ZS-20265-W31A-03-01 ED-CH01	NA	NA	6 in. Dia. Carbon Steel	Containment pipe	**24590-BOF** -M6-DEP-00002006
			3 in. Dia. 316L SS	Process pipe	
BOF-DEP-ZY-00181-W31A-03-01 ED-CH01	NA	NA	6 in. Dia. Carbon Steel	Containment pipe	**24590-BOF** -M6-DEP-00001001
			3 in. Dia. 316L SS	Process pipe	
BOF-DEP-WU-00008-W31A-03-01 ED-CH01	NA	NA	6 in. Dia. Carbon steel	Containment pipe	**24590-BOF** -M6-DEP-00001001
			3 in. Dia. 316L SS	Process pipe	

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Table III.10.E.S – EMF Plant Tank Systems Secondary Containment Systems, including Sumps, Leak Detection Boxes, Drain Lines, and Floor Drains

Sump/Leak Detection Box, or Floor Drain/Line I.D. # and Room #	Maximum Sump/Leak Detection Box Capacity (gallons)	Sump/Leak Detection Box Level Detection Type	Sump, Leak Detection Box or Floor Drain/Line Dimensions (approximate) and Materials of Construction		Piping and Instrumentation Diagram Number
BOF-DVP-GV-00026-W31A-03-01 ED-CH01	NA	NA	6 in. Dia. Carbon steel	Containment pipe	**24590-BOF** -M6-DEP-00001001
			3 in. Dia. 316L SS	Process pipe	

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Table III.10.E.T – EMF Plant Secondary Containment Rooms/Areas

Room/Area	Approximate Room/Area Dimensions (L × W, in feet)	Miscellaneous Treatment Units or Tanks in Room/Area (Largest Plant Item)	Volume of Largest Plant Item in Room/Area (US Gallons)	Minimum Secondary Containment Height (feet)
E-0102 east evaporator process area	62 ft x 94 ft 6 in.	Process condensate lag storage vessel	127,260	4 ft 6 in.
E-0103 west evaporator process area	62 ft x 56 ft 6 in.	Evaporator feed vessel	42,300	3 ft 5 in.
ED-B001 low-point drain vessel area	28 ft x 33 ft	Low-point drain vessel	18,000	4 ft 2 in.
E-0105 evaporator feed vessel area	45 ft 6 in. x 39 ft	Evaporator feed vessel	42,300	5 ft 2 in.
E-0106 process condensate lag storage vessel area	45 ft 6 in. x 84 ft 4 in.	Process condensate lag storage vessel	127,260	6 ft 10 in.

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III.10.F CONTAINMENT BUILDING UNITS

III.10.F.1 Containment Building Units and Storage Limits

III.10.F.1.a Approved Waste and Storage Limits

III.10.F.1.a.i The Permittees may store and treat, in containment building units listed in Permit Table III.10.F.A, as modified by Permit Condition III.10.F.7.d.iv, all dangerous and mixed waste listed in the Part A Forms, Operating Unit Group 10, Chapter 1 of this Permit, except for those wastes outside the waste acceptance criteria specified in the WAP, Operating Unit Group 10, Chapter 3, as approved pursuant to Permit Condition III.10.C.3. Total dangerous and mixed waste storage at the containment building units will not exceed the sum of the capacities in column 7 of Permit Table III.10.F.A, as modified pursuant to Permit Condition III.10.F.7.d.iv.

III.10.F.1.a.ii The Permittees may place and store dangerous and mixed waste only in the containment building units listed in Permit Table III.10.F.A, as modified pursuant to Permit Condition III.10.F.7.d.iv, in accordance with Permit Condition III.10.F, and in accordance with Operating Unit Group 10, Chapters 1.0 and 4.0, and Operating Unit Group 10, Appendices 8.1, 8.2, 8.4 through 8.10, 8.13, 8.15, 9.1, 9.2, 9.4 through 9.10, 9.13, 9.18, 10.1, 10.2, 10.4 through 10.10, 10.13, and 10.18 of this Permit, as approved pursuant to Permit Conditions III.10.F.7.c and III.10.F.7.d. The Permittees will limit the volume of dangerous and mixed waste to quantities specified for the individual areas listed in column 7 of Permit Table III.10.F.A, as modified pursuant to Permit Condition III.10.F.7.d.iv.

III.10.F.1.b The Permittees will manage any ignitable, reactive, or incompatible waste in these units in accordance with WAC 173-303-395(1). Any containment building units specified in Permit Table III.10.F.A in which ignitable, reactive, or incompatible waste are managed will meet the requirements specified in WAC 173-303-640(9) and (10), in accordance with WAC 173-303-680(2).

III.10.F.1.c The Permittees must maintain documentation in the operating record of the description and quantity of dangerous waste in each containment building unit listed in Permit Table III.10.F.A, as modified pursuant to Permit Condition III.10.F.7.d.iv, in accordance with WAC 173-303-380.

III.10.F.1.d The Permittees will ensure all certifications required by specialists (e.g., IQRPE, etc.) use the following statement or equivalent pursuant to Permit Condition III.10.C.10:

"I, (Insert Name) have (choose one or more of the following: overseen, supervised, reviewed, and/or certified) a portion of the design or installation of a new containment building unit or component located at (address), and owned/operated by (name(s)). My duties were: (e.g., design engineer, etc.), for the following containment building unit components (e.g., the venting piping, etc.), as required by the Resource Conservation and Recovery Act (RCRA) regulation(s), namely, 40 CFR 264.1101(c)(2) in accordance with WAC 173-303-695).

"I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

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III.10.F.2 Containment Building Unit Design and Construction

III.10.F.2.a The Permittees will design and construct the containment building units identified in Permit Table III.10.F.A, as modified pursuant to Permit Condition III.10.F.7.d.iv, as specified in Operating Unit Group 10, Appendices 8.1, 8.2, 8.4 through 8.10, 8.13, 8.15, 9.1, 9.2, 9.4 through 9.10, 9.13, 9.18, 10.1, 10.2, 10.4 through 10.10, 10.13, and 10.18 of this Permit, as approved in accordance with Permit Condition III.10.F.7.a and WAC 173-303-695.

III.10.F.2.b The Permittees will design and construct all applicable containment building units' secondary containment systems for each unit listed in Permit Table III.10.F.A, as specified in Operating Unit Group 10, Appendices 8.4 through 8.9, 8.15, 9.4 through 9.9, 9.18, 10.4 through 10.9, and 10.18 of this Permit, as approved in accordance with Permit Condition III.10.F.7.a and WAC 173-303-695.

III.10.F.2.c Modifications to approved design plans and specifications, in Operating Unit Group 10, Appendices 8.1, 8.2, 8.4 through 8.10, 8.13, 8.15, 9.1, 9.2, 9.4 through 9.10, 9.13, 9.18, 10.1, 10.2, 10.4 through 10.10, 10.13, and 10.18 of this Permit, for the containment building units will be allowed only in accordance with Permit Conditions III.10.C.2.e and III.10.C.2.f, or III.10.C.2.g, III.10.C.9.d, and III.10.C.9.e.

III.10.F.3 Containment Building Unit Management Practices

III.10.F.3.a The Permittees will manage all dangerous and mixed waste in containment building units in accordance with procedures described in Operating Unit Group 10, Appendices 8.15, 9.18, 10.18 and Chapter 4 of this Permit, as approved pursuant to Permit Condition III.10.F.7.d.iv.

III.10.F.3.b The Permittees will follow the description of operating procedures described in Operating Unit Group 10, Appendices 8.15, 9.18, 10.18 and Chapter 4, of this permit, as approved pursuant to Permit Condition III.10.F.7.d.iv and Permit Condition III.10.F.3, and as specified below:

III.10.F.3.b.i Maintain the primary barrier to be free of significant cracks, gaps, corrosion, or other deterioration that could cause dangerous and mixed waste to be released from the primary barrier;

III.10.F.3.b.ii Maintain the level of stored/treated dangerous and mixed waste within the containment building unit walls so that the height of the wall is not exceeded;

III.10.F.3.b.iii Take measures to prevent the tracking of dangerous and mixed waste out of the unit by personnel or by equipment used in handling the waste. An area must be designated to decontaminate equipment and any rinsate must be collected and properly managed;

III.10.F.3.b.iv Maintain the containment building unit at all times to prevent the spread of airborne dangerous and/or mixed waste contamination into less contaminated or uncontaminated areas. All air pollution control devices for exhaust from containment building unit must be properly maintained and operational when storing or treating dangerous and mixed waste in the containment building units;

III.10.F.3.b.v Collect and remove liquids and waste to minimize hydraulic head on the containment system at the earliest practicable time.

III.10.F.3.c The Permittees will inspect the containment building units per requirements in the Operating Unit Group 10, Appendix 6A of this permit, as approved pursuant to Permit Condition III.10.C.5, 40 CFR 264.1101(c)(4), in accordance with WAC 173-303-695 and WAC 173-303-320 and record in the Facility's operating record, at least once every seven

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(7) days, data gathered from monitoring equipment and leak detection equipment as well as the containment building unit and area immediately surrounding the containment building unit to detect signs of releases of dangerous and mixed waste.

III.10.F.3.d Throughout the active life of the containment building unit, if the Permittees detects a condition that could lead to or has caused a release of dangerous and/or mixed waste, the Permittees must repair the condition promptly, in accordance with the following procedures:

III.10.F.3.d.i Upon detection of a condition that has led to the release of dangerous and/or mixed waste (e.g., upon detection of leakage from the primary barrier) the Permittees must:

A. Enter a record of the discovery in the facility operating record;

B. Immediately remove the portion of the containment building unit affected by the condition from service;

C. Determine what steps must be taken to repair the containment building unit, remove any leakage from the secondary collection system, and establish a schedule for accomplishing the cleanup and repairs; and

D. Within seven (7) days after the discovery of the condition, notify Ecology of the condition, and within fourteen (14) working days, provide a written notice to Ecology with a description of the steps taken to repair the containment building unit, and the schedule for accomplishing the work.

III.10.F.3.d.ii Ecology will review the information submitted, make a determination regarding whether the containment building unit must be removed from service completely or partially until repairs and cleanup are complete, and notify the Permittees of the determination and underlying rationale in writing.

III.10.F.3.d.iii Upon completing all repairs and cleanup the Permittees must notify Ecology in writing and provide verification, signed by an IQRPE, that repairs have been completed according to the written notice submitted in accordance with Permit Condition III.10.F.3.d.i.D.

III.10.F.4 Inspections [WAC 173-303-640(6)]

III.10.F.4.a The Permittees will inspect the containment building units in accordance with the Inspection Plan in Operating Unit Group 10, Chapter 6 of this Permit, as modified pursuant to Permit Condition III.10.C.5.c.

III.10.F.4.b The inspection data for the containment building units will be recorded, and the records will be placed in the WTP Unit operating record, in accordance with Permit Condition III.10.C.4.

III.10.F.5 Recordkeeping (WAC 173-303-380)

For the containment building units, the Permittees will record and maintain in the WTP Unit operating record, all monitoring, calibration, recording, maintenance, test data, and inspection data compiled under the conditions of this Permit, in accordance with Permit Conditions III.10.C.4 and III.10.C.5.

III.10.F.6 Closure

The Permittees will close the containment building units in accordance with Operating Unit Group 10, Chapter 11 of this Permit, as approved pursuant to Permit Condition III.10.C.8.

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III.10.F.7 Compliance Schedule

III.10.F.7.a All information identified for submittal to Ecology in Permit Conditions III.10.F.7.b through e of this compliance schedule must be signed in accordance with requirements in WAC 173-303-810(12), as modified in accordance with Permit Condition III.10.F.1.d [WAC 173-303-806(4)].

III.10.F.7.b Prior to initial receipt of dangerous and/or mixed waste, the Permittees will submit to Ecology a certification by an IQRPE that the containment building units design meets the requirements of Permit Conditions III.10.F.1 and III.10.F.2 in accordance with Permit Condition III.10.F.7.a. The certification will also be stored in the WTP Unit operating record. For containment buildings units in Permit Table III.10.F.A, as modified pursuant to Permit Condition III.10.F.7.d.iv, identified as allowed to manage free liquids, the certification will include an additional demonstration that the containment building meets the requirements specified in 40 CFR 264.1101(b), in accordance with WAC 173-303-695.

III.10.F.7.c The Permittees submit to Ecology pursuant to Permit Condition III.10.C.9.f, prior to construction of the containment building unit containment system, and as appropriate, leak detection system for each containment building unit (per level, per WTP Unit building) as identified in Permit Condition III.10.F.1, Permit Tables III.10.F.A, engineering information as specified below, for incorporation, as appropriate, into Operating Unit Group 10, Appendices 8.1, 8.2, 8.3, 8.4 through 8.10, 8.13, 8.15, 9.1, 9.2, 9.4 through 9.10, 9.13, 9.18, 10.1, 10.2, 10.4 through 10.10, 10.13, and 10.18 of this Permit. At a minimum, engineering information specified below will show the following as required in accordance with WAC 173-303-695 (the information specified below will include dimensioned engineering drawings showing floors, walls, and ceilings/roof of the containment building units and other information on floor drains and sumps):

III.10.F.7.c.i Design drawings (General Arrangement Drawings in plan) and specifications for the foundation, containment, including liner/coating installation details and leak detection methodology, as appropriate [40 CFR 264.1101(a)(1) and (b), in accordance with WAC 173-303-695].

III.10.F.7.c.ii The Permittees provide the design criteria (references to codes and standards, load definitions and load combinations, materials of construction, and analysis/design methodology) and typical design details for the support of the containment system. This information demonstrate the foundation will be capable of providing support to the secondary containment system, resistance to pressure gradients above and below the system, and capable of preventing failure due to settlement, compression, or uplift [40 CFR 264.1101(a)(2) in accordance with WAC 173-303-695].

III.10.F.7.c.iii The Permittees provide documentation addressing how coatings will withstand the movement of personnel, waste, and equipment during the operating life of the containment building per 40 CFR 264.1101(a)(2), (a)(4), and (b) in accordance with WAC 173-303-695.

III.10.F.7.c.iv Containment/foundation and, as appropriate, for leak detection systems, materials selection documentation (including, but not limited to, concrete coatings and water stops, and liner materials as applicable [e.g. physical and chemical tolerances]) [40 CFR 264.1101(a)(4) and (b) in accordance with WAC 173-303-695].

III.10.F.7.c.v A detailed description of how the containment/foundation and, as appropriate, leak detection systems, will be installed.

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III.10.F.7.c.vi Submit Permit Tables III.10.F.B and III.10.F.C, completed to provide for all secondary containment sumps and floor drains, the information as specified in each column heading, consistent with the information to be provided in i. through viii.

III.10.F.7.c.vii A detailed description of how fugitive emissions will be controlled such that any openings (e.g., doors, windows, vents, cracks, etc.) exhibit no visible emissions [40 CFR 264.1101(c)(1)(iv) in accordance with WAC 173-303-695].

III.10.F.7.c.viii Prior to installation, the Permittees will submit coating vendor information specific to containment buildings for incorporation into the Administrative Record [40 CFR 264.1101(a)(4) and (b) in accordance with WAC 173-303-695].

III.10.F.7.c.ix Prior to installation, leak detection system documentation (e.g. vendor information, etc.) consistent with information submitted under i. above, will be submitted for incorporation into the Administrative Record;

III.10.F.7.c.x Prior to installation, the Permittees will submit leak detection system instrumentation control logic narrative description (e.g., descriptions of fail-safe conditions, etc.);

III.10.F.7.c.xi Prior to installation, system descriptions related to leak detection systems will be submitted for incorporation into the Administrative Record;

III.10.F.7.c.xii For leak detection system instrumentation for containment buildings as identified in Permit Tables III.10.F.D, a detailed description of how the leak detection system instrumentation will be installed and tested [40 CFR 264.1101(b)(3) in accordance with WAC 173-303-695] will be submitted prior to installation.

Information pertaining to leak detection systems in Permit Conditions III.10.F.7.c.ix through xii will be submitted pursuant to Permit Conditions III.10.E.9.d.vii, viii, x, and xiii.

III.10.F.7.d Prior to initial receipt of dangerous and mixed waste, in the WTP Unit, the Permittees will submit the following, as specified below, for incorporation into Operating Unit Group 10. The information specified below into Operating Unit Group 10, and incorporated pursuant to Permit Condition III.10.C.2.g will be followed:

III.10.F.7.d.i IQRPE certification documentation consistent with the information provided in III.10.F.7.b and III.10.F.7.c for incorporation in the Administrative Record. The certification must be maintained in the WTP Unit Operating Record [40 CFR 264.1101(c)(2)];

III.10.F.7.d.ii Updated Chapter 4, Sections 4D.1, 4E.1, 4F.1, 4H.1, 4I.1, and the figures for containment building units identified in Permit Table III.10.F.A (as modified pursuant to Permit Condition III.10.F.7.d.iv, consistent with Operating Unit Group 10, Appendices 8.1, 8.2, 8.4 through 8.10, 8.13, 8.15, 9.1, 9.2, 9.4 through 9.10, 9.13, 9.18, 10.1, 10.2, 10.4 through 10.10, 10.13, and 10.18, as approved pursuant Permit Conditions III.10.F.7.a through d);

III.10.F.7.d.iii Description of operating procedures demonstrating compliance with 40 CFR 264.1101(c) and (d) in accordance with WAC 173-303-695;

III.10.F.7.d.iv Permit Table III.10.F.A, amended as follows:

A. Under column 1, update and complete list of dangerous and mixed waste containment building units including room location and number.

B. Under column 2, update unit dimensions.

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C. Under column 3, replace the "Reserved" with the Operating Unit Group 10, Appendices 8.0, 9.0, and 10.0, subsections specific to containment building units as listed in column 1.

D. Under column 4, update and complete list of narrative description, tables, and figures.

E. Under column 5, replace the "Reserved" to indicate if container storage is used in each containment building units (Yes or No) consistent with Permit Table III.10.D.A updated pursuant to Permit Condition III.10.D.10.d.

F. Under column 6, replace the "Reserved" to indicate if tank storage is used in each containment building units (Yes or No) consistent with Permit Tables III.10.E.A-D, updated pursuant to Permit Condition III.10.E.9.e.vi.

G. Under column 7, replace the "Reserved" with the maximum operating volume for each containment building unit, to include the container storage capacity specified in Permit Table III.10.D.A, tank capacity specified in Permit Tables III.10.E.A-D and update the total capacity for the containment building units.

H. Under column 8, update the status of each containment building unit.

III.10.F.7.d.v Permit Table III.10.F.D will be completed for Containment Building leak detection system instrumentation and parameters to provide the information as specified in each column heading. Leak detection system monitors and instruments for critical systems as specified in Operating Unit Group 10, Appendix 2.0 and as updated pursuant to Permit Condition III.10.C.9.b will be addressed.

III.10.F.7.e All information provided under Permit Condition III.10.F.7.d must be consistent with information provided pursuant to Permit Conditions III.10.F.7.a through d, as approved by Ecology.

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Table III.10.F.A – Containment Building Unit Description

Mixed Waste Containment Building Units[a] & Systems	Dimensions (L x W x H) (in feet)	Unit Description	Narrative Description and Figures	Container Storage Areas[b]	Tank Systems[c]	Containment Building Capacity (cu ft)	Manage Free Liquids
Pretreatment Plant							
P-0123 Pretreatment Hotcell Containment Building	350 x 51 x 52	RESERVED	Section 4D.3.1; Table 4D-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	No
Pretreatment Maintenance Containment Building							
PM0124 Hotcell Crane Maintenance Mezzanine	27 x 51 x 33	RESERVED	Section 4D.3.2; Table 4D-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	No
P-0121A Spent Resin Dewatering	28 × 18 × 28	RESERVED	Section 4D.3.2; Table 4D-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	No
P-0122A Waste Packaging Area	26 × 51 × 28	RESERVED	Section 4D.3.2; Table 4D-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	No
P-0123A Remote Decontamination Maintenance Cell	55 × 51 × 52	RESERVED	Section 4D.3.2; Table 4D-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	No
P-0124 C3 Workshop	(24 × 24 × 16) + (34 x 24 x 15)	RESERVED	Section 4D.3.2; Table 4D-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	No

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Table III.10.F.A – Containment Building Unit Description

Mixed Waste Containment Building Units[a] & Systems	Dimensions (L x W x H) (in feet)	Unit Description	Narrative Description and Figures	Container Storage Areas[b]	Tank Systems[c]	Containment Building Capacity (cu ft)	Manage Free Liquids
P-0124A C3 Workshop	(73 + 15 × 15) + (16 × 15 + 15)	RESERVED	Section 4D.3.2; Table 4D-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	No
P-0125 Cask Lidding Airlock & Equipment Chase	24 × 20 × 28	RESERVED	Section 4D.3.2; Table 4D-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	No
P-0125A Cask Lidding Room	28 × 18 × 25	RESERVED	Section 4D.3.2; Table 4D-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	No
P-0128A MSM Repair Area	24 × 18 × 28	RESERVED	Section 4D.3.2; Table 4D-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	No
P-0128 MSM Testing Room	24 × 17 × 27	RESERVED	Section 4D.3.2; Table 4D-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	No
P-0223 Spent Filter Drum Handling Area Containment Building	54 x 18 x 26	RESERVED	Section 4D.3.3; Table 4D-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	No
P-0335 Filter Cave Containment Building	198 x 51 x 52	RESERVED	Section 4D.3.4; Table 4D-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	RESERVED

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Table III.10.F.A – Containment Building Unit Description

Mixed Waste Containment Building Units[a] & Systems	Dimensions (L x W x H) (in feet)	Unit Description	Narrative Description and Figures	Container Storage Areas[b]	Tank Systems[c]	Containment Building Capacity (cu ft)	Manage Free Liquids
P-0431A General Filter Rm	RESERVED	RESERVED	Section 4D.3.5; Table 4D-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	RESERVED
LAW Vitrification Plant							
L-0112 LAW LSM Gallery Containment Building	150 x 62 x 24	RESERVED	Section 4E.3.1; Table 4E-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	Yes
LAW Container Finishing Containment Building		RESERVED	Section 4E.3.2; Table 4E-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	No
L-0109B Swabbing Area Line 2	21 × 15 × 24	RESERVED	Section 4E.3.2; Table 4E-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	RESERVED
L-0109C Decontamination Area Line 2	18 × 15 × 24	RESERVED	Section 4E.3.2; Table 4E-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	RESERVED
L-0109D Inert Fill Area Line 2	55 × 15 × 24	RESERVED	Section 4E.3.2; Table 4E-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	RESERVED

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Table III.10.F.A – Containment Building Unit Description

Mixed Waste Containment Building Units[a] & Systems	Dimensions (L x W x H) (in feet)	Unit Description	Narrative Description and Figures	Container Storage Areas[b]	Tank Systems[c]	Containment Building Capacity (cu ft)	Manage Free Liquids
L-0115B Swabbing Area Line 1	21 × 15 × 24	RESERVED	Section 4E.3.2; Table 4E-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	RESERVED
L-0115C Decontamination Area Line 1	18 × 15 × 24	RESERVED	Section 4E.3.2; Table 4E-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	RESERVED
L-0115D Inert Fill Area Line 1	55 × 15 × 24	RESERVED	Section 4E.3.2; Table 4E-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	RESERVED
L-0109E Container/Monitoring/ Export Area	19 × 18 × 14	RESERVED	Section 4E.3.2; Table 4E-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	RESERVED
L-0115E Container/Monitoring/ Export Area	19 × 18 × 14	RESERVED	Section 4E.3.2; Table 4E-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	RESERVED
L-0119B LAW Consumable Import/Export Containment Building	30 x 28 x 17	RESERVED	Section 4E.3.3; Table 4E-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	Yes
L-226A LAW C3 Workshop Containment Building	34 x 22 x 19	RESERVED	Section 4E.3.4; Table 4E-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	RESERVED

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Table III.10.F.A – Containment Building Unit Description

Mixed Waste Containment Building Units[a] & Systems	Dimensions (L x W x H) (in feet)	Unit Description	Narrative Description and Figures	Container Storage Areas[b]	Tank Systems[c]	Containment Building Capacity (cu ft)	Manage Free Liquids
LAW Pour Cave Containment Building		RESERVED	Section 4E.3.5; Table 4E-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	RESERVED
L-B015A Melter 1 Pour Cave	16.5 × 20 x 23	RESERVED	Section 4E.3.5; Table 4E-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	RESERVED
L-B013C Melter 1 Pour Cave	16.5 × 20 x 23	RESERVED	Section 4E.3.5; Table 4E-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	RESERVED
L-B013B Melter 2 Pour Cave	16.5 × 20 x 23	RESERVED	Section 4E.3.5; Table 4E-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	RESERVED
L-B011C Melter 2 Pour Cave	16.5 × 20 x 23	RESERVED	Section 4E.3.5; Table 4E-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	RESERVED
L-B011B Future Melter 3 Pour Cave	16.5 × 20 x 23	RESERVED	Section 4E.3.5; Table 4E-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	RESERVED

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Table III.10.F.A – Containment Building Unit Description

Mixed Waste Containment Building Units[a] & Systems	Dimensions (L x W x H) (in feet)	Unit Description	Narrative Description and Figures	Container Storage Areas[b]	Tank Systems[c]	Containment Building Capacity (cu ft)	Manage Free Liquids
L-B009B Future Melter 3 Pour Cave	16.5 × 20 x 23	RESERVED	Section 4E.3.5; Table 4E-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	RESERVED
LAW Buffer Container Containment Building		RESERVED	Section 4E.3.6; Table 4E-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	RESERVED
L-B025C Container Buffer Store	22 x 22 x 23	RESERVED	Section 4E.3.6; Table 4E-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	RESERVED
L-B025D Container Rework	22 x 14 x 23	RESERVED	Section 4E.3.6; Table 4E-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	RESERVED
HLW Vitrification Plant							
HLW Melter Cave 1 Containment Building: H-0117 Melter Cave 1 H-0116B Melter Cave 1 C3/C5 Airlock H-0310A Melter Cave 1 Equipment Decon Pit	 75 x 32 x 54 24 x 25 x 54 20 x 9 x 10	RESERVED	Section 4F.3.1; Table 4D-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	RESERVED

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Table III.10.F.A – Containment Building Unit Description

Mixed Waste Containment Building Units[a] & Systems	Dimensions (L x W x H) (in feet)	Unit Description	Narrative Description and Figures	Container Storage Areas[b]	Tank Systems[c]	Containment Building Capacity (cu ft)	Manage Free Liquids
HLW Melter Cave 2 Containment Building: H-0106 Melter Cave 2 H-0105B Melter Cave 2 C3/C5 Airlock H-0304A Melter Cave 2 Equipment Decon Pit	75 x 32 x 54 24 x 25 x 54 20 x 9 x 10	RESERVED	Section 4F.3.1; Table 4D-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	RESERVED
H-0136 IHLW Canister Handling Cave Containment Building	18 x 140 x 54	RESERVED	Section 4F.3.2; Table 4D-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	No
H-0133 IHLW Canister Swab and Monitoring Cave Containment Building	41 x 11 x 54	RESERVED	Section 4F.3.3; Table 4D-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	No
HLW C3 Workshop Containment Building: H-0311A C3 Workshop H-0311B MSM Maintenance Workshop	19 x 30 x 22 58 x 69 x 22	RESERVED	Section 4F.3.4; Table 4D-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	No
H-0104 HLW Filter Cave Containment Building	105 x 36 x 36	RESERVED	Section 4F.3.5; Table 4D-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	No

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Table III.10.F.A – Containment Building Unit Description

Mixed Waste Containment Building Units[a] & Systems	Dimensions (L x W x H) (in feet)	Unit Description	Narrative Description and Figures	Container Storage Areas[b]	Tank Systems[c]	Containment Building Capacity (cu ft)	Manage Free Liquids
H-B032 HLW Pour Tunnel 1 Containment Building	85 x 11 x 30	RESERVED	Section 4F.3.6; Table 4D-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	No
H-B005A HLW Pour Tunnel 2 Containment Building	85 x 11 x 30	RESERVED	Section 4F.3.6; Table 4D-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	No
HLW Waste Handling Area Containment Building: H-0410B E&I Room H-0411 Waste Handling Room	17 x 20 x 10 25 x 54 x 10	RESERVED	Section 4F.3.8; Table 4D-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	RESERVED
HLW Drum Swabbing and Monitoring Area: H-0126A Crane Maintenance Room H-0126B Swabbing and Monitoring Room H-028 Cask Import/Export Room	15 x 20 x 31 30 x 18 x 31 15 x 45 x 43	RESERVED	Section 4F.3.7; Table 4D-5; and Fig. 4A-59 (Sheets 1-2) of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED	RESERVED	RESERVED	RESERVED

[a] Containment Building Units include associated process systems and equipment.

[b] Requirements pertaining to the containers in the Containment Building Units are specified in Section III.10.D of this Permit.

[c] Requirements pertaining to the tanks in the Containment Building Units are specified in Section III.10.E of this Permit.

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Table III.10.F.B – Containment Building Primary[a] Containment Sump Systems

Sump I.D. # & Room Location	Maximum Capacity (gallons)	Dimensions[b] (feet) & Materials of Construction	Maximum Allowable Liquid Height (inches)	Secondary Containment Volume (gallons)	Unit Description Drawings
PWD-SUMP-00026 P-0123 (El. 0')	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED
PWD-SUMP-00028 P-0123 (El. 0')	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED
PWD-SUMP-00029 P-0123 (El. 0')	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED
PWD-SUMP-00032 P-0123A	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED
PWD-SUMP-00033 P-0123A (El. 0')	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

[a] Primary sumps are defined in Permit Section III.10.C, and must comply with dangerous waste tank system requirements for tanks as described in WAC-173-303-640.

[b] Dimensions listed are based on permitted design. Actual dimensions may vary within plus or minus (TBD).

Table III.10.F.C – Containment Building Secondary Containment Systems Including Sumps and Floor Drains

Sump or Drain Line I.D. # & Room Location	Maximum Sump (gallons) or Drain Line (gallons per minute) Capacity	Sump Type/Nominal Operating Volume (gallons)	Sump or Drain Line Dimensions[a] (inches) & Materials of Construction	Engineering Description (Drawing Nos., Specifications No.'s, etc.)
RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

[a] Dimensions listed are based on permitted design. Actual dimensions may vary within plus or minus (TBD).

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Table III.10.F.D – Containment Building Leak Detection System Instrumentation and Parameters

Containment Building Locator and Name (including P&ID)	Type of Leak Detection Instrument	Location of Leak Detection Instrument (Tag No.)	Leak Detection Instrument Range	Expected Range	Fail States	Leak Detection Instrument Accuracy	Leak Detection Instrument Calibration Method No. and Range
RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

[a] Locator (including P&ID designator) is located on Permit Table III.10.F.C – Containment Building Secondary Containment Systems Including Sumps and Floor Drains.

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III.10.G PRETREATMENT PLANT MISCELLANEOUS UNIT SYSTEMS

Unless otherwise noted in Permit Table III.10.G.A, for purposes of Permit Section III.10.G, where reference is made to WAC 173-303-640, the following substitutions apply: substitute the terms "Pretreatment Plant Miscellaneous Unit System(s)" for "tank system(s)," "miscellaneous unit(s)" for "tank(s)," "equipment" for "ancillary equipment," and "miscellaneous unit(s) or equipment of a Pretreatment Plant Miscellaneous Unit System" for "component(s)" in accordance with WAC 173-303-680. Miscellaneous unit systems, exempt from the WAC-173-303-640 requirements in Permit Section III.10.G are noted as exempt in Permit Table III.10.G.A.

III.10.G.1 Waste and Storage Limits

III.10.G.1.a The Permittees may process, in the Pretreatment Plant Miscellaneous Unit Systems listed in Permit Table III.10.G.A, as approved/modified pursuant to Permit Condition III.10.G.10, all dangerous and mixed waste listed in the Part A Forms, Operating Unit Group 10, Chapter 1 of this Permit, and in accordance with in the WAP, Operating Unit Group 10, Chapter 3 of this Permit, as approved pursuant to Permit Condition III.10.C.3. Total Pretreatment Plant Miscellaneous Unit dangerous and mixed waste storage at the Facility will not exceed the limits specified in Permit Table III.10.G.A.

III.10.G.1.b The Permittees may process dangerous and mixed waste only in approved Pretreatment Plant Miscellaneous Unit Systems listed in Permit Table III.10.G.A in accordance with Permit Section III.10.G and in accordance with Operating Unit Group 10, Chapters 1.0 and 4.0 of this Permit, and Operating Unit Group 10, Appendices 8.1 through 8.15 of this Permit, as approved pursuant to Permit Conditions III.10.G.10.b through e. The Permittees will limit the total volume of wastes to quantities specified for the individual miscellaneous units listed in Permit Table III.10.G.A.

III.10.G.1.c The Permittees will manage ignitable and reactive, and incompatible waste in accordance with WAC 173-303-395(1). Any Pretreatment Plant Miscellaneous Unit System specified in Permit Tables III.10.G.A and III.10.G.B in which ignitable, reactive or incompatible waste are managed will meet the requirements specified in WAC 173-303-640(9) and (10), in accordance to WAC 173-303-680.

III.10.G.1.d The Permittees will ensure all certifications required by specialists (e.g., independent qualified registered professional engineer; independent corrosion expert; independent qualified installation inspector; etc.) use the following statement or equivalent pursuant to Permit Condition III.10.C.10:

"I, (Insert Name) have (choose one or more of the following: overseen, supervised, reviewed, and/or certified) a portion of the design or installation of a new miscellaneous unit system or component located at (address), and owned/operated by (name(s)). My duties were: (e.g., installation inspector, testing for tightness, etc.), for the following miscellaneous unit system components (e.g., the venting piping, etc.), as required by the Dangerous Waste Regulations, namely, WAC 173-303-640(3) (applicable paragraphs (i.e., (a) through (g)) in accordance with WAC 173-303-680).

"I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

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III.10.G.1.e In all future narrative permit submittals, the Permittees will include miscellaneous unit system names with the unit designation (e.g., Waste Feed Evaporator Separator Vessels are designated V11002A and V11002B, respectively).

III.10.G.2 Miscellaneous Unit Systems Design and Construction [WAC 173-303-640, in accordance with WAC 173-303-680(2) and WAC 173-303-340].

III.10.G.2.a The Permittees will construct the Pretreatment Plant Miscellaneous Unit Systems identified in Permit Table III.10.G.A, as specified in Operating Unit Group 10, Appendices 8.1 through 8.14 of this Permit, as approved pursuant to Permit Conditions III.10.G.10.b, III.10.G.10.c, and III.10.G.10.d.

III.10.G.2.b The Permittees will construct secondary containment systems for the Pretreatment Plant Miscellaneous Unit Systems identified in Permit Tables III.10.G.A and III.10.G.B, as specified in Operating Unit Group 10, Appendices 8.2, 8.4 through 8.14 of this Permit, as approved pursuant to Permit Conditions III.10.G.10.b, III.10.G.10.c, and III.10.G.10.d.

III.10.G.2.c Modifications to approved design, plans, and specifications in Operating Unit Group 10 of this Permit for the Pretreatment Plant Miscellaneous Unit Systems will be allowed only in accordance with Permit Conditions III.10.C.2.e and f, or III.10.C.2.g, III.10.C.9.d, e, and h.

III.10.G.3 Miscellaneous Unit System Installation and Certification [WAC 173-303-640, in accordance with WAC 173-303-680(2) and (3), and WAC 173-303-340].

III.10.G.3.a The Permittees must ensure that proper handling procedures are adhered to in order to prevent damage to Pretreatment Plant Miscellaneous Unit Systems during installation. Prior to covering, enclosing, or placing a new Pretreatment Plant Miscellaneous Unit System(s) or component(s) in use, an independent qualified installation inspector or an independent qualified registered professional engineer, either of whom is trained and experienced in the proper installation of similar systems or components, must inspect the system for the presence of any of the following items:

III.10.G.3.a.i Weld breaks;

III.10.G.3.a.ii Punctures;

III.10.G.3.a.iii Scrapes of protective coatings;

III.10.G.3.a.iv Cracks;

III.10.G.3.a.v Corrosion;

III.10.G.3.a.vi Other structural damage or inadequate construction/installation;

III.10.G.3.a.vii All discrepancies must be remedied before the Pretreatment Plant Miscellaneous Unit Systems are covered, enclosed, or placed in use [WAC 173-303-640(3)(c) in accordance with WAC 173-303-680(2) and (3)].

III.10.G.3.b For Pretreatment Plant Miscellaneous Unit Systems or components that are placed underground and that are back-filled, the Permittees must provide a backfill material that is a non-corrosive, porous, homogeneous substance. The backfill must be installed so that it is placed completely around the miscellaneous unit and compacted to ensure that the miscellaneous unit and piping are fully and uniformly supported [WAC 173-303-640(3)(d), in accordance with WAC 173-303-680(2) and (3)].

III.10.G.3.c The Permittees must test for tightness all new Pretreatment Plant Miscellaneous Units and equipment, prior to being covered, enclosed, or placed into use. If the Pretreatment Plant Miscellaneous Unit Systems are found not to be tight, all repairs necessary to

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remedy the leak(s) in the system must be performed prior to the Pretreatment Plant Miscellaneous Units Systems being covered, enclosed, or placed in use [WAC 173-303-640(3)(e), in accordance with WAC 173-303-680(2) and (3)].

III.10.G.3.d The Permittees must ensure Pretreatment Plant Miscellaneous Unit Systems equipment is supported and protected against physical damage and excessive stress due to settlement, vibration, expansion, or contraction [WAC 173-303-640(3)(f), in accordance with WAC 173-303-680(2) and (3)].

III.10.G.3.e The Permittees must provide the type and degree of corrosion protection recommended by an independent corrosion expert, based on the information provided in Operating Unit Group 10, Appendices 8.9 and 8.11 as approved pursuant to Permit Conditions III.10.G.10.b.i, III.10.G.10.b.iv, III.10.G.10.b.v, III.10.G.10.c.i, III.10.G.10.c.iv, III.10.G.10.c.v, and III.10.G.10.d.i, III.10.G.10.d.iv, III.10.G.10.d.v, or other corrosion protection if Ecology believes other corrosion protection is necessary to ensure the integrity of the Pretreatment Plant Miscellaneous Unit Systems during use of the Pretreatment Plant Miscellaneous Unit Systems. The installation of a corrosion protection system that is field fabricated must be supervised by an independent corrosion expert to ensure proper installation [WAC 173-303-640(3)(g), in accordance with WAC 173-303-680(2) and (3)].

III.10.G.3.f Prior to initial receipt of dangerous and/or mixed waste in the WTP Unit, the Permittees will obtain, and keep on file in the WTP Unit operating record, written statements by those persons required to certify the design of the Pretreatment Plant Miscellaneous Unit Systems and supervise the installation of the Pretreatment Plant Miscellaneous Unit Systems, as specified in WAC 173-303-640(3)(b), (c), (d), (e), (f), and (g), in accordance with WAC 173-303-680, attesting that each Pretreatment Plant Miscellaneous Unit System and corresponding containment system listed in Permit Tables III.10.G.A and III.10.G.B, as approved/modified pursuant to Permit Condition III.10.G.10, were properly designed and installed, and that repairs, in accordance with WAC 173-303-640(3)(c) and (e), were performed [WAC 173-303-640(3)(a), WAC 173-303-640(3)(h), in accordance with WAC 173-303-680(3)].

III.10.G.3.g The independent Pretreatment Plant Miscellaneous Unit System installation inspection and subsequent written statements will be certified in accordance with WAC 173-303-810(13)(a) as modified pursuant to Permit Condition III.10.G.1.d, comply with all requirements of WAC 173-303-640(3)(h), in accordance with WAC 173-303-680, and will consider, but not be limited to, the following miscellaneous unit system installation documentation:

III.10.G.3.g.i Field installation report with date of installation;

III.10.G.3.g.ii Approved welding procedures;

III.10.G.3.g.iii Welder qualifications and certification;

III.10.G.3.g.iv Hydro-test reports, as applicable, in accordance with the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section VIII, Division 1, API Standard 620, or Standard 650 as applicable;

III.10.G.3.g.v Tester credentials;

III.10.G.3.g.vi Field inspector credentials;

III.10.G.3.g.vii Field inspector reports;

III.10.G.3.g.viii Field waiver reports; and

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III.10.G.3.g.ix Non-compliance reports and corrective action (including field waiver reports) and repair reports.

III.10.G.4 Integrity Assessments [WAC 173-303-340 and WAC 173-303-640, in accordance with WAC 173-303-680(2) and (3)].

III.10.G.4.a The Permittees will ensure periodic integrity assessments are conducted on the Pretreatment Plant Miscellaneous Unit Systems listed in Permit Table III.10.G.A, as approved/modified pursuant to Permit Condition III.10.G.10, over the term of this Permit in accordance with WAC 173-303-680(2) and (3) as specified in WAC 173-303-640(3)(b), following the description of the integrity assessment program and schedule in Operating Unit Group 10, Addendum E of this Permit, as approved pursuant to Permit Conditions III.10.G.10.e.i and III.10.C.5.c. Results of the integrity assessments will be included in the WTP Unit operating record until ten (10) years after post-closure, or corrective action is complete and certified, whichever is later.

III.10.G.4.b The Permittees will address problems detected during Pretreatment Plant Miscellaneous Unit Systems integrity assessments specified in Permit Condition III.10.G.4.a following the integrity assessment program in Operating Unit Group 10, Addendum E of this Permit, as approved pursuant to Permit Conditions III.10.G.10.e.i and III.10.C.5.c.

III.10.G.4.c The Permittees must immediately and safely remove from service any Pretreatment Plant Miscellaneous Unit System or secondary containment system which through an integrity assessment is found to be "unfit for use" as defined in WAC 173-303-040, following Permit Condition III.10.G.5.j.i through iv, and vi. The affected Pretreatment Plant Miscellaneous Unit or secondary containment system must be either repaired or closed in accordance with Permit Condition III.10.G.5.j.v [WAC 173-303-640(7)(e) and (f) and WAC 173-303-640(8), in accordance with WAC 173-303-680(3)].

III.10.G.5 Miscellaneous Unit Management Practices

III.10.G.5.a No dangerous and/or mixed waste will be managed in the Pretreatment Plant Miscellaneous Unit Systems unless the operating conditions, specified under Permit Condition III.10.G.5, are complied with.

III.10.G.5.b The Permittees will install and test all process and leak detection system monitoring/instrumentation, as specified in Permit Table III.10.G.C, as approved/modified pursuant to Permit Condition III.10.G.10, in accordance with Operating Unit Group 10, Appendices 8.1, 8.2, and 8.14 of this Permit, as approved pursuant to Permit Condition III.10.G.10.d.x.

III.10.G.5.c The Permittees will not place dangerous and/or mixed waste, treatment reagents, or other materials in the Pretreatment Plant Miscellaneous Unit Systems if these substances could cause the systems to rupture, leak, corrode, or otherwise fail [WAC 173-303-640(5)(a), in accordance with WAC 173-303-680(2)].

III.10.G.5.d The Permittees will operate the Pretreatment Plant Miscellaneous Unit Systems to prevent spills and overflows using the description of controls and practices, as required under WAC 173-303-640(5)(b), described in Permit Condition III.10.C.5, and Operating Unit Group 10, Appendix 8.18 of this Permit, as approved pursuant to Permit Condition III.10.G.10.e.iv [WAC 173-303-640(5)(b), in accordance with WAC 173-303-680(2) and (3) and WAC 173-303-806(4)(c)(ix)].

III.10.G.5.e For routinely non-accessible Pretreatment Plant Miscellaneous Unit Systems, as specified in Operating Unit Group 10, Chapter 4 of this Permit, as updated pursuant to Permit Condition III.10.G.10.e.vi, the Permittees will mark all routinely non-accessible

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Pretreatment Plant Miscellaneous Unit System access points with labels or signs to identify the waste contained in the units. The label, or sign, must be legible at a distance of at least fifty (50) feet and must bear a legend which identifies the waste in a manner which adequately warns employees, emergency response personnel, and the public of the major risk(s) associated with the waste being stored or treated in the miscellaneous unit system(s). For the purposes of this Permit condition, "routinely non-accessible" means personnel are unable to enter these areas while waste is being managed in them [WAC 173-303-640(5)(d), in accordance with WAC 173-303-680(2)].

III.10.G.5.f For all Pretreatment Plant Miscellaneous Unit Systems not addressed in Permit Condition III.10.G.5.e, the Permittees will mark all these miscellaneous unit systems holding dangerous and/or mixed waste with labels or signs to identify the waste contained in the unit. The labels, or sign, must be legible at a distance of at least fifty (50) feet, and must bear a legend which identifies the waste in a manner which adequately warns employees, emergency response personnel, and the public of the major risk(s) associated with the waste being stored or treated in the miscellaneous unit system(s) [WAC 173-303-640(5)(d), in accordance with WAC 173-303-680(2)].

III.10.G.5.g ~~**III.10.G.5.g**~~ The Permittees will ensure that the secondary containment systems for Pretreatment Plant Miscellaneous Unit Systems listed in Permit Tables III.10.G.A and III.10.G.B, as approved/modified pursuant to Permit Condition III.10.G.10, are free of cracks or gaps to prevent any migration of dangerous and/or mixed waste or accumulated liquid out of the system to the soil, ground water, or surface water at any time waste is in the Pretreatment Plant Miscellaneous Units System. Any indication that a crack or gap may exist in the containment systems will be investigated and repaired in accordance with Operating Unit Group 10, Appendix 8.18 of this Permit, as approved pursuant to Permit Condition III.10.G.10.e.v [WAC 173-303–640(4)(b)(i), WAC 173-303-640(4)(e)(i)(C), and WAC 173-303-640(6) in accordance with WAC 173-303-680(2) and (3), WAC 173-303-806(4)(i)(i)(B), and WAC 173-303-320].

III.10.G.5.h RESERVED

III.10.G.5.i ~~**III.10.G.5.i**~~ An impermeable coating, as specified in Operating Unit Group 10, Appendices 8.4, 8.5, 8.7, 8.9, 8.11, and 8.12 of this Permit, as approved pursuant to Permit Condition III.10.G.10.b.v of this Permit, will be maintained for all concrete containment systems and concrete portions of containment systems for each Pretreatment Plant Miscellaneous Unit System listed in Permit Tables III.10.G.A and III.10.G.B, as approved/modified pursuant to Permit Condition III.10.G.10 [concrete containment systems that do not have a liner pursuant to WAC-173-303-640(4)(e)(i), in accordance with WAC 173-303-680(2), and have construction joints, will meet the requirements of WAC 173-303-640(4)(e)(ii)(C), in accordance with WAC 173-303-680(2)]. The coating will prevent migration of any dangerous and mixed waste into the concrete. All coatings will meet the following performance standards:

III.10.G.5.i.i ~~**III.10.G.5.i.i**~~ The coating must seal the containment surface such that no cracks, seams, or other avenues through which liquid could migrate are present;

III.10.G.5.i.ii ~~**III.10.G.5.i.ii**~~ The coating must be of adequate thickness and strength to withstand the normal operation of equipment and personnel within the given area such that degradation or physical damage to the coating or lining can be identified and remedied before dangerous and mixed waste could migrate from the system; and

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III.10.G.5.i.iii ~~III.10.G.5.i.iii~~ The coating must be compatible with the dangerous and mixed waste, treatment reagents, or other materials managed in the containment system [WAC 173-303-640(4)(e)(ii)(D), in accordance with WAC 173-303-680(2) and (3) and WAC 173-303-806(4)(i)(i)(A)].

III.10.G.5.j ~~III.10.G.5.j~~ The Permittees will inspect all secondary containment systems for the Pretreatment Plant Miscellaneous Unit Systems listed in Permit Tables III.10.G.A and III.10.G.B, as approved/modified pursuant to Permit Condition III.10.G.10, in accordance with the Inspection Plan specified in Operating Unit Group 10, Chapter 6 of this Permit, as approved pursuant to Permit Conditions III.10.G.10.e.i and III.10.C.5.c, and take the following actions if a leak or spill of dangerous and/or mixed waste is detected in these containment systems [WAC 173-303-640(5)(c) and WAC 173-303-640(6), in accordance with WAC 173-303-680(2) and (3), WAC 173-303-320, and WAC 173-303-806(4)(i)(i)(B)]:

III.10.G.5.j.i ~~III.10.G.5.j.i~~ Immediately and safely stop the flow of dangerous and/or mixed waste into the miscellaneous unit system or secondary containment system;

III.10.G.5.j.ii ~~III.10.G.5.j.ii~~ Determine the source of the dangerous and/or mixed waste;

III.10.G.5.j.iii ~~III.10.G.5.j.iii~~ Remove the waste from the containment area in accordance with WAC 173-303-680(2) and (3), as specified in WAC 173-303-640(7)(b). The dangerous and/or mixed waste removed from containment areas of miscellaneous unit systems will be, as a minimum, managed as dangerous and/or mixed waste;

III.10.G.5.j.iv ~~III.10.G.5.j.iv~~ If the cause of the release was a spill that has not damaged the integrity of the miscellaneous unit system, the Permittees may return the miscellaneous unit system to service in accordance with WAC 173-303-680(2) and (3), as specified in WAC 173-303-640(7)(e)(ii). In such a case, the Permittees will take action to ensure the incident that caused liquid to enter the containment system will not reoccur [WAC 173-303-320(3)];

III.10.G.5.j.v ~~III.10.G.5.j.v~~ If the source of the dangerous and/or mixed waste is determined to be a leak from the primary Pretreatment Plant Miscellaneous Unit System into the secondary containment system, or the system is unfit for use as determined through an integrity assessment or other inspection, the Permittees must comply with the requirements of WAC 173-303-640(7), and take the following actions:

A Close the miscellaneous unit following procedures in WAC 173-303-640(7)(e)(i) and in accordance with WAC 173-303-680, and Operating Unit Group 10, Chapter 11 of this Permit, as approved pursuant to Permit Condition III.10.C.8; or

B. Repair and re-certify (in accordance with WAC 173-303-810(13)(a), as modified pursuant to Permit Condition III.10.G.1.d) the Pretreatment Plant Miscellaneous Unit System in accordance with Operating Unit Group 10, Appendix 8.18 of this Permit, as approved pursuant to Permit Condition III.10.G.10.e.v before the Pretreatment Plant Miscellaneous Unit System is placed back into service [WAC 173-303-640(7)(e)(iii) and WAC 173-303-640(7)(f), in accordance with WAC 173-303-680].

III.10.G.5.j.vi ~~III.10.G.5.j.vi~~ The Permittees will document, in the operating record, actions/procedures taken to comply with i. through v. above, as specified in WAC 173-303-640(6)(d) and in accordance with WAC 173-303-680(2) and (3).

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III.10.G.5.j.vii ~~III.10.G.5.j.vii~~ In accordance with WAC 173-303-680(2) and (3), the Permittees will notify and report releases to the environment to Ecology as specified in WAC 173-303-640(7)(d).

III.10.G.5.k ~~III.10.G.5.k~~ If liquids (e.g., Dangerous and/or mixed waste leaks and spills, precipitation, fire water, liquids from damaged or broken pipes) cannot be removed from the secondary containment system within twenty-four (24) hours, Ecology will be verbally notified within twenty-four (24) hours of discovery. The notification will provide the information in A., B., and C. listed below. The Permittees will provide Ecology with a written demonstration, within seven (7) business days, identifying at a minimum [WAC 173-303-640(4)(c)(iv) and WAC 173-303-640(7)(b)(ii), in accordance with WAC 173-303-680(3) and WAC 173-303-806(4)(i)(i)(B)]:

A. Reasons for delayed removal.

B. Measures implemented to ensure continued protection of human health and the environment.

C. Current actions being taken to remove liquids from secondary containment.

III.10.G.5.l ~~III.10.G.5.l~~ The Permittees will operate the Pretreatment Plant Miscellaneous Unit Systems in accordance with Operating Unit Group 10, Chapter 4 as updated pursuant to Permit Condition III.10.G.10.e.vi and Appendix 8.18 of this Permit, as approved pursuant to Permit Condition III.10.G.10.e, and the following:

III.10.G.5.l.i ~~III.10.G.5.l.i~~ The Permittees will operate the Pretreatment Plant Miscellaneous Unit Systems in order to maintain the systems and process parameters listed in Permit Table III.10.G.C as approved/modified pursuant to Permit Condition III.10.G.10, within the operating trips and operating ranges specified in Permit Table III.10.G.C, and consistent with assumptions and basis which are reflected in Operating Unit Group 10, Appendix 6.3, as approved pursuant to Permit Condition III.10.C.11.b [WAC 173-303-815(2)(b)(ii) and WAC 173-303-680(2) and (3)]. For the purposes of this Permit Condition, Operating Unit Group 10, Appendix 6.3. will be superseded by Appendix 6.4. upon its approval pursuant to either Permit Conditions III.10.C.11.c or III.10.C.11.d.

III.10.G.5.l.ii ~~III.10.G.5.l.ii~~ The Permittees will calibrate/function test the instruments listed in Permit Table III.10.G.C, in accordance with Operating Unit Group 10, Appendix 8.18, as approved pursuant to Permit Condition III.10.G.10.e.xii.

III.10.G.5.m ~~III.10.G.5.m~~ For any portion of the Pretreatment Plant Miscellaneous Unit Systems which have the potential for formation and accumulation of hydrogen gases, the Permittees will operate the portion to maintain hydrogen levels below the lower explosive limit [WAC 173-303-815(2)(b)(ii)].

III.10.G.5.n ~~III.10.G.5.n~~ For each miscellaneous unit holding dangerous waste which are acutely or chronically toxic by inhalation, the Permittees will operate the system to prevent escape of vapors, fumes, or other emissions into the air [WAC 173-303-806(4)(i)(i)(B) and WAC 173-303-640(5)(e), in accordance with WAC 173-303-680].

III.10.G.6 Air Emissions

III.10.G.6.a Treatment effectiveness, feed-rates, and operating rates for dangerous and mixed waste systems and sub-systems contained in the Pretreatment Plant (as specified in Permit Tables III.10.E.A, III.10.F.A, and III.10.G.A, as approved/modified pursuant to Permit Conditions III.10.E.9, III.10.F.5, III.10.G.10, respectively) will be as specified in Permit Sections III.10.E, III.10.F, and III.10.G, and consistent with the assumptions and basis

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reflected in Operating Unit Group 10, Appendix 6.3 of this Permit, as approved pursuant to Permit Condition III.10.C.11.b. For the purposes of this permit condition, Operating Unit Group 10, Appendix 6.3 will be superseded by Appendix 6.4, upon its approval, pursuant to either Permit Condition III.10.C.11.c or III.10.C.11.d [WAC 173-303-680(2) and (3), and WAC 173-303-815(2)(b)(ii)].

III.10.G.6.b Compliance with Permit Condition III.10.G.6.a of this Permit will be regarded as operating within the emission limits specified in Permit Table III.10.G.D, as approved pursuant to Permit Conditions III.10.C.11.b, III.10.C.11.c, or III.10.C.11.d of this Permit.

III.10.G.6.c All air pollution control devices and capture systems in the Pretreatment Plant Miscellaneous Unit Systems will be maintained and operated at all times in a manner so as to minimize the emissions of air contaminants and to minimize process upsets. Procedures for ensuring that the above equipment is properly operated and maintained so as to minimize the emission of air contaminants and process upsets will be established.

III.10.G.6.d The Permittees will ensure that for all dangerous and/or mixed waste areas, systems, and units contained in the Pretreatment Plant (as specified in Permit Tables III.10.E.A, III.10.F.A, and III.10.G.A, as approved pursuant to Permit Conditions III.10.E.9.e.xii, III.10.F.7.d.iv, and III.10.G.10.e.ix, respectively), the Pretreatment Vessel Vent Process System specified in Permit Table III.10.G.A.i will be in operation prior to waste being introduced into these dangerous and/or mixed waste areas, systems, and units contained in the Pretreatment Building. At any time the Pretreatment Vessel Vent Process System ceases to operate or produces insufficient vacuum to recover emissions from the areas, systems, or units, the Permittees will not commence new treatment activities within the dangerous and mixed waste areas, systems, or units contained in the Pretreatment Building, and take measures to minimize evolution of emissions from on-going treatment, and will not receive new dangerous and/or mixed waste shipments into the Pretreatment Building. The Permittees will not re-commence new treatment activities until the Pretreatment Vessel Vent Process System is operational and producing sufficient vacuum to recover emissions.

III.10.G.7 Inspections [WAC 173-303-680(3)]

III.10.G.7.a The Permittees will inspect the Pretreatment Plant Miscellaneous Unit Systems in accordance with the Inspection Plan in Operating Unit Group 10, Chapter 6A of this Permit, as modified in accordance with Permit Condition III.10.C.5.c.

III.10.G.7.b The inspection data for Pretreatment Plant Miscellaneous Unit Systems will be recorded, and the records will be placed in the WTP Unit operating record for the Pretreatment Plant Miscellaneous Unit Systems, in accordance with Permit Condition III.10.C.4.

III.10.G.8 Recordkeeping

The Permittees will record and maintain in the WTP Unit operating record for the Pretreatment Plant Miscellaneous Unit Systems, all monitoring, calibration, maintenance, test data, and inspection data compiled under the conditions of this Permit, in accordance with Permit Conditions III.10.C.4 and III.10.C.5.

III.10.G.9 Closure

The Permittees will close the Pretreatment Plant Miscellaneous Unit Systems in accordance with Operating Unit Group 10, Chapter 11, as approved pursuant to Permit Condition III.10.C.8.

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III.10.G.10 Compliance Schedule

III.10.G.10.a All information identified for submittal to Ecology in a through e of this compliance schedule must be signed and certified in accordance with requirements in WAC 173-303-810(12), as modified in accordance with Permit Condition III.10.G.1.d [WAC 173-303-806(4)].

III.10.G.10.b The Permittees will submit to Ecology, pursuant to Permit Condition III.10.C.9.f, prior to construction of each secondary containment and leak detection system for the Pretreatment Plant Miscellaneous Unit Systems (per level) as identified in Permit Tables III.10.G.A and III.10.G.B, engineering information as specified below, for incorporation into Operating Unit Group 10, Appendices 8.2, 8.4, 8.5, 8.7, 8.8, 8.9, 8.11, and 8.12 of this Permit. At a minimum, engineering information specified below will show the following as described in WAC 173-303-640, in accordance with WAC 173-303-680 (the information specified below will include dimensioned engineering drawings and information on sumps and floor drains):

III.10.G.10.b.i IQRPE Reports (specific to foundation, secondary containment, and leak detection system) will include review of design drawings, calculations, and other information on which the certification report is based and will include as applicable, but not limited to, review of such information described below. Information (drawings, specifications, etc.) already included in Operating Unit Group 10, Appendix 8.0 of this Permit may be included in the report by reference and should include drawing and document numbers. IQRPE Reports will be consistent with the information separately provided in ii. through ix. below [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)];

III.10.G.10.b.ii Design drawings (General Arrangement Drawings, in plan) and specifications for the foundation, secondary containment, including, liner installation details, and leak detection methodology [Note: leak detection systems for areas where daily, direct, or remote visual inspection is not feasible, will be continuous in accordance with WAC 173-303-640(4)(e)(iii)(C)]. These items should show the dimensions, volume calculations, and location of the secondary containment system, and should include items such as floor/pipe slopes to sumps, tanks, floor drains [WAC 173-303-640(4)(b) through (f) and WAC 173-303-640(3)(a), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)];

III.10.G.10.b.iii The Permittees will provide the design criteria (references to codes and standards, load definitions, and load combinations, materials of construction, and analysis/design methodology) and typical design details for the support of the secondary containment system. This information will demonstrate the foundation will be capable of providing support to the secondary containment system, resistance to pressure gradients above and below the system, and capable of preventing failure due to settlement, compression, or uplift [WAC 173-303-640(4)(c)(ii), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(B)];

III.10.G.10.b.iv A description of materials and equipment used to provide corrosion protection for external metal components in contact with soil, including factors affecting the potential for corrosion [WAC 173-303-640(3)(a)(iii)(B), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(A) through (B)];

III.10.G.10.b.v Secondary containment/foundation and leak detection systems materials selection documentation (including, but not limited to, concrete coatings and water stops, and liner materials), as applicable [WAC 173-303-806(4)(i)(i)(A) through (B)];

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III.10.G.10.b.vi Detailed description of how the secondary containment for each miscellaneous unit system will be installed in compliance with WAC 173-303-640(3)(c), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(A) through (B);

III.10.G.10.b.vii Submit Permit Table III.10.G.B completed to provide for all secondary containment sumps and floor drains, the information as specified in each column heading, consistent with information to be provided in i through vi above;

III.10.G.10.b.viii Documentation that secondary containment and leak detection systems will not accumulate hydrogen gas levels above the lower explosive limit for incorporation into the Administrative Record [WAC 173-303-680, WAC 173-303-806(4)(i)(i)(A), and WAC 173-303-806(4)(i)(v)];

III.10.G.10.b.ix A detailed description of how miscellaneous unit design provides access for conducting future miscellaneous unit integrity assessments [WAC 173-303-640(3)(b) and WAC 173-303-806(4)(i)(i)(B)].

III.10.G.10.c The Permittees will submit to Ecology, pursuant to Permit Condition III.10.C.9.f, prior to installation of each Pretreatment Plant Miscellaneous Unit System as identified in Permit Tables III.10.G.A and III.10.G.B, engineering information as specified below, for incorporation into Operating Unit Group 10, Appendix 8.1 through 8.18 of this Permit. At a minimum, engineering information specified below will show the following as required pursuant to WAC 173-303-640 and in accordance with WAC 173-303-680 (the information specified below will include dimensioned engineering drawings):

III.10.G.10.c.i IQRPE Reports (specific to miscellaneous unit) will include review of design drawings, calculations, and other information on which the certification report is based and will include as applicable, but not limited to, review of such information described below. Information (drawings, specifications, etc.) already included in Operating Unit Group 10, Appendix 8.0 of this Permit may be included in the report by reference and should include drawing and document numbers. The IQRPE Reports will be consistent with the information separately provided in ii. through xi. below and the IQRPE Report specified in Permit Condition III.10.G.10.b.i [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)];

III.10.G.10.c.ii Design drawings (General Arrangement Drawings in plan, Process Flow Diagrams, Piping and Instrumentation Diagrams [including pressure control systems], and Mechanical Drawings) and specifications, and other information specific to miscellaneous units (to show location and physical attributes of each miscellaneous unit), [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)];

III.10.G.10.c.iii Miscellaneous unit design criteria (references to codes and standards, load definitions, and load combinations, materials of construction, and analysis/design methodology) and typical design details for the support of the miscellaneous unit(s). Structural support calculations specific to off-specification, non-standard, and field fabricated miscellaneous units will be submitted for incorporation into the Administrative Record [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(B)];

III.10.G.10.c.iv A description of materials and equipment used to provide corrosion protection for external metal components in contact with water, including factors affecting the potential for corrosion [WAC 173-303-640(3)(a)(iii)(B), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(A) through (B)];

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III.10.G.10.c.v Miscellaneous unit materials selection documentation (e.g., physical and chemical tolerances) [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(A)];

III.10.G.10.c.vi Miscellaneous unit vendor information (including, but not limited to, required performance warranties, as available), consistent with information submitted under ii. above, will be submitted for incorporation into the Administrative Record [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2), WAC 173-303-806(4)(i)(i)(A) through (B), and WAC 173-303-806(4)(i)(v)];

III.10.G.10.c.vii System Description related to miscellaneous units will be submitted for incorporation into the Administrative Record [WAC 173-303-680, WAC 173-303-806(4)(i)(i)(A) through (B), and WAC 173-303-806(4)(i)(v)].

III.10.G.10.c.viii Mass and energy balance for normal projected operating conditions used in developing the Piping and Instrumentation Diagrams and the Process Flow Diagrams, including assumptions and formulas used to complete the mass and energy balance, so that they can be independently verified for incorporation into the Administrative Record [WAC 173-303-680(2), WAC 173-303-806(4)(i)(i)(B), and WAC 173-303-806(4)(i)(v)];

III.10.G.10.c.ix A detailed description of how the miscellaneous unit will be installed in compliance with WAC 173-303-640(3)(c), (d), and (e), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(B);

III.10.G.10.c.x Documentation that miscellaneous units are designed to prevent the accumulation of hydrogen gas levels above the lower explosive limit for incorporation into the Administrative Record [WAC 173-303-680, WAC 173-303-806(4)(i)(i)(A), and WAC 173-303-806(4)(i)(v)];

III.10.G.10.c.xi Documentation that miscellaneous units are designed to prevent escape of vapors and emissions of acutely or chronically toxic (upon inhalation) Extremely Hazardous Waste, for incorporation into the Administrative Record [WAC 173-303-640(5)(e), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(B)];

III.10.G.10.d The Permittees will submit to Ecology, pursuant to Permit Condition III.10.C.9.f, prior to installation of equipment as identified in Permit Tables III.10.G.A and III.10.G.B, not addressed in Permit Condition III.10.G.10.c, engineering information as specified below for incorporation into Operating Unit Group 10, Appendices 8.1 through 8.14 of this Permit. At a minimum, engineering information specified below will show the following as required pursuant to WAC 173-303-640, in accordance with WAC 173-303-680 (the information specified below will include dimensioned engineering drawings):

III.10.G.10.d.i IQRPE Reports (specific to equipment) will include a review of design drawings, calculations, and other information as applicable, on which the certification report is based. The reports will include, but not be limited to, review of such information described below. Information (drawings, specifications, etc.) already included in Operating Unit Group 10, Appendix 8.0 of this Permit may be included in the report by reference and should include drawing and document numbers. The IQRPE Reports will be consistent with the information provided separately in ii through xiii below and the IQRPE Reports specified in Permit Conditions III.10.G.10.b and III.10.G.10.c, [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(A) through (B)];

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III.10.G.10.d.ii Design drawings (Process Flow Diagrams, Piping and Instrumentation Diagrams [including pressure control systems]) specifications and other information specific to equipment (these drawings should include all equipment such as pipe, valves, fittings, pumps, instruments, etc.) [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(A) through (B)];

III.10.G.10.d.iii The Permittees will provide the design criteria (references to codes and standards, load definitions, and load combinations, materials of construction, and analysis/design methodology) and typical design details for the support of the equipment [WAC 173-303-640(3)(a) and WAC 173-303-640(3)(f), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(B)];

III.10.G.10.d.iv A description of materials and equipment used to provide corrosion protection for external metal components in contact with soil and water, including factors affecting the potential for corrosion [WAC 173-303-640(3)(a)(iii)(B), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(A)];

III.10.G.10.d.v Materials selection documentation for equipment (e.g., physical and chemical tolerances) [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(A)];

III.10.G.10.d.vi Vendor information (including, but not limited to, required performance warranties, as available), consistent with information submitted under ii. above, for equipment will be submitted for incorporation into the Administrative Record [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2), WAC 173-303-806(4)(i)(i)(A) through (B), and WAC 173-303-806(4)(i)(iv)];

III.10.G.10.d.vii Miscellaneous unit, equipment, and leak detection system instrument control logic narrative description (e.g., descriptions of fail-safe conditions, etc.) [WAC 173-303-680(2), WAC 173-303-806(4)(i)(i)(B), and WAC 173-303-806(4)(i)(v)].

III.10.G.10.d.viii System Descriptions related to equipment and system descriptions related to leak detection systems, for incorporation into the Administrative Record [WAC 173-303-680, WAC 173-303-806(4)(i)(i)(A) through (B), and WAC 173-303-806(4)(i)(v)];

III.10.G.10.d.ix A detailed description of how the equipment will be installed and tested [WAC 173-303-640(3)(c) through (e) and WAC 173-303-640(4)(b) and (c), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(B)];

III.10.G.10.d.x For process monitoring, control, and leak detection system instrumentation for the WTP Unit Miscellaneous Unit Systems as identified in Permit Table III.10.G.C, a detailed description of how the process monitoring, control, and leak detection system instrumentation will be installed and tested [WAC 173-303-640(3)(c) through (e), WAC 173-303-640(4)(b) and (c), WAC 173-303-806(4)(c)(vi), and WAC 173-303-806(4)(i)(i)(B)];

III.10.G.10.d.xi Mass and energy balance for projected normal operating conditions, used in developing the Piping and Instrumentation Diagrams and Process Flow Diagrams, including assumptions and formulas used to complete the mass and energy balance, so that they can be independently verified, for incorporation into the Administrative Record [WAC 173-303-680(2), WAC 173-303-806(4)(i)(i)(B), and WAC 173-303-806(4)(i)(v)];

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III.10.G.10.d.xii Documentation that miscellaneous units are designed to prevent the accumulation of hydrogen gas levels above the lower explosive limit for incorporation into the Administrative Record [WAC 173-303-680, WAC 173-303-806(4)(i)(i)(A), and WAC 173-303-806(4)(i)(v)].

III.10.G.10.d.xiii Leak detection system documentation (e.g. vendor information, etc.) consistent with information submitted under Permit Condition III.10.G.10.c.ii and Permit Conditions III.10.G.10.d.ii, vii, viii, and x above, will be submitted for incorporation into the Administrative Record.

III.10.G.10.e Prior to initial receipt of dangerous and/or mixed waste in the WTP Unit, the Permittees will submit to Ecology, pursuant to Permit Condition III.10.C.9.f, the following as specified below for incorporation into Operating Unit Group 10, Appendix 8.18, except Permit Condition III.10.G.10.e.i, which will be incorporated into Operating Unit Group 10, Chapter 6, of this Permit. All information provided under this permit condition must be consistent with information provided pursuant to Permit Conditions III.10.G.10.b, c, d, and e, III.10.C.3.e, and III.10.C.11.b, as approved by Ecology.

III.10.G.10.e.i Integrity assessment program and schedule for the Pretreatment Plant Miscellaneous Unit Systems will address the conducting of periodic integrity assessments on the Pretreatment Plant Miscellaneous Unit Systems over the life of the systems, as specified in Permit Condition III.10.G.10.b.ix and WAC 173-303-640(3)(b), in accordance with WAC 173-303-680, and descriptions of procedures for addressing problems detected during integrity assessments. The schedule must be based on past integrity assessments, age of the system, materials of construction, characteristics of the waste, and any other relevant factors [WAC 173-303-640(3)(b), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(B)];

III.10.G.10.e.ii Detailed plans and descriptions, demonstrating the leak detection system is operated so that it will detect the failure of either the primary or secondary containment structure or the presence of any release of dangerous and/or mixed waste or accumulated liquid in the secondary containment system within twenty-four (24) hours WAC 173-303-640(4)(c)(iii). Detection of a leak of at least 0.1 gallons per hour within twenty-four (24) hours is defined as being able to detect a leak within twenty-four (24) hours. Any exceptions to this criteria must be approved by Ecology in accordance with WAC 173-303-680, WAC 173-303-640(4)(c)(iii), and WAC 173-303-806(4)(i)(i)(B)];

III.10.G.10.e.iii Detailed operational plans and descriptions, demonstrating that spilled or leaked waste and accumulated liquids can be removed from the secondary containment system within twenty-four (24) hours [WAC 173-303-806(4)(i)(i)(B)];

III.10.G.10.e.iv Descriptions of operational procedures demonstrating appropriate controls and practices are in place to prevent spills and overflows from the Pretreatment Plant Miscellaneous Unit Systems, or containment systems, in compliance with WAC 173-303-640(5)(b)(i) through (iii), in accordance with WAC 173-303-680 [WAC 173-303-806(4)(i)(i)(B)];

III.10.G.10.e.v Description of procedures for investigation and repair of the Pretreatment Plant Miscellaneous Unit Systems [WAC 173-303–640(6) and WAC 173-303-640(7)(e) and (f), in accordance with WAC 173-303-680, WAC 173-303-320, WAC 173-303-806(4)(a)(v), and WAC 173-303-806(4)(i)(i)(B)];

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III.10.G.10.e.vi Updated Chapter 4, Narrative Descriptions, Tables and Figures as identified in Permit Tables III.10.G.A and III.10.G.B, as modified pursuant to Permit Condition III.10.G.10.e.ix, and updated to identify routinely non-accessible Pretreatment Plant Miscellaneous Unit Systems [WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(A) through (B)];

III.10.G.10.e.vii Descriptions of procedures for management of ignitable and reactive, and incompatible dangerous and/or mixed waste, in accordance with WAC 173-303-640(9) and (10), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(B).

III.10.G.10.e.viii A description of the tracking system used to track dangerous and/or mixed waste generated throughout the Pretreatment Plant Miscellaneous Unit Systems, pursuant to WAC 173-303-380.

III.10.G.10.e.ix Permit Table III.10.G.A, amended as follows [WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(A) through (B)]:

A. Under column 1, update and complete list of dangerous and mixed waste Pretreatment Plant Miscellaneous Unit Systems, including plant items which comprise each system (listed by item number).

B. Under column 2, update and complete system designations.

C. Under column 3, replace the "Reserved" with the Operating Unit Group 10, Appendix 8.0 subsections specific to miscellaneous unit systems as listed in column 1.

D. Under column 4, update and complete list of narrative description tables and figures.

E. Under column 5, update and complete maximum operating volume for each miscellaneous unit, as applicable.

F. Permit Table III.10.G.A.i, amended as follows:

1. Under column 1, update and complete list of plant items that comprise the Pretreatment Plant Vessel Vent System (listed by item number).
2. Under column 2, update and complete designations.
3. Under column 3, replace the "Reserved" with the Operating Unit Group 10, Appendix 8.0, subsections (e.g., 9.1, 9.2, etc.) specific to systems as listed in column 1.
4. Under column 4, update and complete list of narrative description tables and figures.

III.10.G.10.e.x Permit Table III.10.G.C will be completed for Pretreatment Plant Miscellaneous Unit System process and leak detection system monitors and instruments (to include, but not be limited to: instruments and monitors measuring and/or controlling flow, pressure, temperature, density, pH, level, humidity, and emissions) to provide the information as specified in each column heading. Process and leak detection system monitors and instruments for critical systems as specified in Operating Unit Group 10, Appendix 2.0 and as updated pursuant to Permit Condition III.10.C.9.b and for operating parameters as required to comply with Permit Condition III.10.C.3.e.iii will be addressed. Process monitors and instruments for non-waste management operations (e.g., utilities, raw chemical storage, non-contact cooling waters, etc.) are excluded from this permit condition [WAC 173-303-680, WAC 173-303-806(4)(i)(i)(A) through (B), and WAC 173-303-806(4)(i)(v)];

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III.10.G.10.e.xi Supporting documentation for operating trips and expected operating range as specified in Permit Table III.10.G.C, as approved pursuant to Permit Condition III.10.G.10.e.x [WAC 173-303-680, WAC 173-303-806(4)(i)(i)(B), WAC 173-303-806(4)(i)(iv), and WAC 173-303-806(4)(i)(v)];

III.10.G.10.e.xii Documentation of process and leak detection instruments and monitors (as listed in Permit Table III.10.G.C) for the Pretreatment Plant Miscellaneous Unit Systems to include, but not be limited to, the following [WAC 173-303-680, WAC 173-303-806(4)(i)(i)(B), and WAC 173-303-806(4)(i)(v)]:

A. Procurement Specifications.
B. Location used.
C. Range, precision, and accuracy.
D. Detailed descriptions of calibration/functionality test procedures (e.g., method number [ASTM]) or provide a copy of manufacturer's recommended calibration procedures.
E. Calibration/functionality test, inspection, and routine maintenance schedules and checklists, including justification for calibration, inspection and maintenance frequencies, criteria for identifying instruments found to be significantly out of calibration, and corrective action to be taken for instruments found to be significantly out of calibration (e.g., increasing frequency of calibration, instrument replacement, etc.).
F. Equipment instrument control logic narrative description (e.g., descriptions of fail-safe conditions, etc.) [WAC 173-303-680(2), WAC 173-303-806(4)(i)(i)(B), and WAC 173-303-806(4)(i)(v)].

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Table III.10.G.A – Pretreatment Plant Miscellaneous Unit Systems

Miscellaneous Unit System Description[a]	Miscellaneous Unit System Designation	Description Drawings	Narrative Description, Tables, & Figures	Maximum Capacity (gallons)
Waste Feed Evaporation Process System FEP-SEP-00001A (Waste Feed Evaporator Separator Vessel) FEP-SEP-00001B (Waste Feed Evaporator Separator Vessel)	FEP	**24590-PTF** -3PS-MEVV-T0001 -M5-V17T-00004001 -M5-V17T-00004002 -M6-FEP-00001001 -M6-FEP-00001002 -M6-FEP-00001003 -M6-FEP-00002001 -M6-FEP-00002002 -M6-FEP-00002003 -M6-FEP-00003001 -M6-FEP-00003002 -M6-FEP-00004001 -M6-FEP-00004002 -M6-FEP-00004003 -M6-FEP-00005001 -MVD-FEP-P0001 -MVD-FEP-P0002 -MVD-FEP-00003 -MVD-FEP-00006 -MVD-FEP-00007 -MV-FEP-P0001 -MV-FEP-P0002 -N1D-FEP-00002 -N1D-FEP-P0003 -P1-P01T-00001	Section 4D.2.2.; Table 4D-2; and Figures 4A-1, 4A-2 and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.	FEP-SEP-00001A = 14,512 FEP-SEP-00001B = 14,512

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Table III.10.G.A – Pretreatment Plant Miscellaneous Unit Systems

Miscellaneous Unit System Description[a]	Miscellaneous Unit System Designation	Description Drawings	Narrative Description, Tables, & Figures	Maximum Capacity (gallons)
		-P1-P01T-00002		
Waste Feed Evaporation Process System (Cont.) FEP-COND-00001A (Waste Evaporator Primary Condenser) FEP-COND-00001B (Waste Evaporator Primary Condenser) FEP-COND-00002A (Waste Evaporator Intercondenser) FEP-COND-00002B (Waste Evaporator Intercondenser) FEP-COND-00003A (Waste Evaporator Aftercondenser) FEP-COND-00003B (Waste Evaporator Aftercondenser)	FEP	**24590-PTF** -3PS-MEVV-T0001 -M5-V17T-00004001 -M5-V17T-00004002 -M6-FEP-00003002 -M6-FEP-00005001 -MED-FEP-P0003 -MED-FEP-P0004 -MED-FEP-P0005 -MED-FEP-P0006 -MED-FEP-P0007 -MED-FEP-P0008 -N1D-FEP-P0008 -N1D-FEP-00009 -N1D-FEP-00010 -P1-P01T-00001 -P1-P01T-00002	Section 4D.2.2.; Table 4D-2; and Figures 4A-1, 4A-2 and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.	N/A

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Table III.10.G.A – Pretreatment Plant Miscellaneous Unit Systems

Miscellaneous Unit System Description[a]	Miscellaneous Unit System Designation	Description Drawings	Narrative Description, Tables, & Figures	Maximum Capacity (gallons)
Waste Feed Evaporation Process System (Cont.) FEP-RBLR-00001A (Waste Feed Evaporator Reboiler) FEP-RBLR-00001B (Waste Feed Evaporator Reboiler)	FEP	**24590-PTF** -3PS-MEVV-T0001 -M5-V17T-00004001 -M5-V17T-00004002 -MED-FEP-00010 -N1D-FEP-P0008 -P1-P01T-00001 -P1-P01T-00002	Section 4D.2.2.; Table 4D-2; and Figures 4A-1, 4A-2 and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.	N/A
Cesium Nitric Acid Recovery Process System CNP-EVAP-00001 (Cesium Evaporator Separator Vessel)	CNP	**24590-PTF** -3PS-MEVV-T0002 -M5-V17T-00014 -M6-CNP-00001001 -M6-CNP-00001002 -M6-CNP-00001003 -M6-CNP-00002001 -M6-CNP-00002002 -M6-CNP-00002003 -M6-CNP-00008001 -M6-CNP-00008002 -M6-CNP-00010001 -M6-CNP-00010002 -MV-CNP-P0001 -MV-CNP-P0002 -MV-CNP-P0005 -MVD-CNP-P0003	Section 4D.2.6.; Table 4D-2; and Figures 4A-1, 4A-2 and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.	CNP-EVAP-00001 = RESERVED

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Table III.10.G.A – Pretreatment Plant Miscellaneous Unit Systems

Miscellaneous Unit System Description[a]	Miscellaneous Unit System Designation	Description Drawings	Narrative Description, Tables, & Figures	Maximum Capacity (gallons)
		-MVD-CNP-P0010 -MVD-CNP-00006 -N1D-CNP-P0005 -N1D-CNP-P0006 -N1D-CNP-P0009 -N1D-CNP-P0011 -P1-P01T-00001 -P1-P01T-00002 -P1-P01T-00003 -P1-P01T-00004		
Cesium Nitric Acid Recovery Process System (Cont.) CNP-HX-00001 (Cesium Evaporator Concentrate Reboiler	CNP	**24590-PTF** -3PS-MEVV-T0002 -M5-V17T-P0014 -M6-CNP-00001001 -M6-CNP-00001002 -M6-CNP-00001003 -M6-CNP-00002001 -M6-CNP-00002002 -M6-CNP-00002003 -M6-CNP-00008 -MED-CNP-00003 -MED-CNP-00004 -MED-CNP-00010 -P1-P01T-00001 -P1-P01T-00002 -P1-P01T-00003	Section 4D.2.6.; Table 4D-2; and Figures 4A-1, 4A-2 and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.	N/A

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Table III.10.G.A – Pretreatment Plant Miscellaneous Unit Systems

Miscellaneous Unit System Description[a]	Miscellaneous Unit System Designation	Description Drawings	Narrative Description, Tables, & Figures	Maximum Capacity (gallons)
		-P1-P01T-00004		
Cesium Nitric Acid Recovery Process System (Cont.) CNP-DISTC-00001 (Cesium Evaporator Nitric Acid Rectifier Column)	CNP	**24590-PTF** -M5-V17T-00014 -M6-CNP-00010001 -N1D-CNP-00001 -P1-P01T-00003 -3PS-MEVV-T0002	Section 4D.2.6.; Table 4D-2; and Figures 4A-1, 4A-2 and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.	RESERVED
Cesium Nitric Acid Recovery Process System (Cont.) CNP-HX-00002 (Cesium Evaporator Primary Condenser) CNP-HX-00003 (Cesium Evaporator Inter-Condenser) CNP-HX-00004 (Cesium Evaporator After-Condenser)	CNP	**24590-PTF** -M5-V17T-00014 -M6-CNP-00001001 -M6-CNP-00001002 -M6-CNP-00001003 -M6-CNP-00002001 -M6-CNP-00002002 -M6-CNP-00002003 -M6-CNP-00008001 -M6-CNP-00010001 -MED-CNP-00003 -MED-CNP-00004 -MED-CNP-00005 -MED-CNP-00010 -N1D-CNP-P0002 -N1D-CNP-P0003 -N1D-CNP-P0012 -P1-P01T-00001 -P1-P01T-00002	Section 4D.2.6; Table 4D-2; and Figures 4A-1, 4A-2 and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.	N/A N/A N/A

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Table III.10.G.A – Pretreatment Plant Miscellaneous Unit Systems

Miscellaneous Unit System Description[a]	Miscellaneous Unit System Designation	Description Drawings	Narrative Description, Tables, & Figures	Maximum Capacity (gallons)
		-P1-P01T-00003 -P1-P01T-00004 -3PS-MEVV-T0002		
Treated LAW Evaporation Process System TLP-SEP-00001 (Treated LAW Evaporator Separator Vessel)	TLP	**24590-PTF** -3PS-MEVV-T0001 -M5-V17T-00005 -M6-TLP-00001 -M6-TLP-00002001 -M6-TLP-00002002 -M6-TLP-00002003 -M6-TLP-00002004 -M6-TLP-00003001 -M6-TLP-00003002 -M6-TLP-00003003 -M6-TLP-00003004 -M6-TLP-00005001 -M6-TLP-00005002 -M6-TLP-00005003 -M6-TLP-00005004 -M6-TLP-00005005 -M6-TLP-00006001 -M6-TLP-00006002 -M6-TLP-00006003 -M6-TLP-00006004 -M6-TLP-00006005 -MVD-TLP-P0001	Section 4D.2.11; Table 4D-2; and Figures 4A-1, 4A-2 and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.	TLP-SEP-00001 = 13,359

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Table III.10.G.A – Pretreatment Plant Miscellaneous Unit Systems

Miscellaneous Unit System Description[a]	Miscellaneous Unit System Designation	Description Drawings	Narrative Description, Tables, & Figures	Maximum Capacity (gallons)
		-MVD-TLP-P0002 -MVD-TLP-00004 -MVD-TLP-00005 -MV-TLP-P0001 -MV-TLP-P0002 -N1D-TLP-P0001 -N1D-TLP-P0005 -N1D-TLP-P0006 -P1-P01T-00001 -P1-P01T-00002 -P1-P01T-00003		
Treated LAW Evaporation Process System (Cont.) TLP-COND-00001 (Treated LAW Primary Condenser) TLP-COND-00002 (Treated LAW Inter-condenser) TLP-COND-00003 (Treated LAW After-condenser)	TLP	**24590-PTF** -3PS-MEVV-T0001 -M5-V17T-00005 -M6-TLP-00002001 -M6-TLP-00002002 -M6-TLP-00002003 -M6-TLP-00002004 -M6-TLP-00003001 -M6-TLP-00003002 -M6-TLP-00003003 -M6-TLP-00003004 -M6-TLP-00005001 -M6-TLP-00005002 -M6-TLP-00005003 -M6-TLP-00005004	Section 4D.2.11; Table 4D-2; and Figures 4A-1, 4A-2 and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.	N/A

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Table III.10.G.A – Pretreatment Plant Miscellaneous Unit Systems

Miscellaneous Unit System Description[a]	Miscellaneous Unit System Designation	Description Drawings	Narrative Description, Tables, & Figures	Maximum Capacity (gallons)
		-M6-TLP-00005005 -M6-TLP-00006001 -M6-TLP-00006002 -M6-TLP-00006003 -M6-TLP-00006004 -M6-TLP-00006005 -MED-TLP-P0001 -MED-TLP-00002 -MED-TLP-00003 -MV-TLP-P0001 -MV-TLP-P0002 -N1D-TLP-P0002 -N1D-TLP-P0003 -P1-P01T-00001 -P1-P01T-00002 -P1-P01T-00003		
Treated LAW Evaporation Process System (Cont.) TLP-RBLR-00001 (Treated LAW Evaporator Reboiler)	TLP	**24590-PTF** -3PS-MEVV-T0001 -M5-V17T-00005 -MV-TLP-P0001 -MV-TLP-P0002 -N1D-TLP-P0011 -P1-P01T-00001 -P1-P01T-00002 -P1-P01T-00003	Section 4D.2.11; Table 4D-2; and Figures 4A-1, 4A-2 and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.	N/A

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Table III.10.G.A – Pretreatment Plant Miscellaneous Unit Systems

Miscellaneous Unit System Description[a]	Miscellaneous Unit System Designation	Description Drawings	Narrative Description, Tables, & Figures	Maximum Capacity (gallons)
Spray Decontamination and Sizing System PIH-TTBL-00001 (Spray Decontamination Turntable) PIH-TTBL-00002 (Remote Repair Turntable PIH-BENCH-00003 (Size Reduction Table) This miscellaneous unit is exempt from the requirements of WAC-173-303-640.	PIH	RESERVED	Section 4D.3.2.1; Table 4D-2; and Figure 4A-128 of Operating Unit 10, Chapter 4 of this Permit.	N/A
Hotcell Waste Management Unit Hotcell Floor This miscellaneous unit is exempt from the requirements of WAC-173-303-640.	NA	RESERVED	Section 4D.3.1; Table 4D-2; and Figure 4A-128 of Operating Unit 10, Chapter 4 of this Permit.	RESERVED

a The Pretreatment Vessel Vent Process (PVP), Process Vessel Vent Systems (PVV), Pulse Jet Mixer Exhaust System (PJV), and Pretreatment Treated LAW Evaporator Separator Vessel System (TLP) specified in Permit Table III.10.G.A.i is shared between the Pretreatment Plant Miscellaneous Unit Systems. Any references in this Permit to the individual Pretreatment Plant Miscellaneous Unit Systems are also a reference to the Pretreatment Vessel Vent Process (PVP), Process Vessel Vent Systems (PVV), Pulse Jet Mixer Exhaust System (PJV), and Pretreatment Treated LAW Evaporator Separator Vessel System (TLP) Systems. Any reference in this Permit to Permit Table III.10.G.A is also a reference to Permit Table III.10.G.A.i.

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Table III.10.G.A.i – Pretreatment Plant Vessel Vent Systems Associated with Pretreatment Plant Miscellaneous Unit Systems

Description	Designation	Description Drawings	Narrative Description, Tables & Figures
Pretreatment Vessel Vent Process System PVP-SCB-00002 (Vessel Vent Caustic Scrubber)	PVP	**24590-PTF** -M5-V17T-00021001 -M5-V17T-00021004 -M6-PVP-00002 -M6-PVP-00017001 -M6-PVP-00017002 -M6-PVP-00017003 -M6-PWD-00044 -MKD-PVP-00002 -MVD-PVP-P0001 -MV-PVP-P0002 -N1D-PVP-P0001 -P1-P01T-00003 -P1-P01T-00004	Section 4D.4.2; Table 4F-2, 4D-2; and Figures 4A-1, 4A-2 and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.
Pretreatment Vessel Vent Process System (Cont.) PVP-HEME-00001A (Vessel Vent HEME, Mist eliminator) PVP-HEME-00001B (Vessel Vent HEME, Mist Eliminator) PVP-HEME-00001C (Vessel Vent HEME, Mist Eliminator)	PVP	**24590-PTF** -M5-V17T-00021001 -M5-V17T-00021004 -P1-P01T-00001 -P1-P01T-00002 -P1-P01T-00003 -P1-P01T-00004	Section 4D.4.2; Table 4F-2, 4D-2; and Figures 4A-1, 4A-2 and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.

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Table III.10.G.A.i – Pretreatment Plant Vessel Vent Systems Associated with Pretreatment Plant Miscellaneous Unit Systems

Description	Designation	Description Drawings	Narrative Description, Tables & Figures
Pretreatment Vessel Vent Process System (Cont.) PVP-HX-00002 (Vessel Vent Scrubbing Liquid Cooler)	PVP	**24590-PTF** -M5-V17T-00021001 -M6-PVP-00017001 -M6-PVP-00017002 -M6-PVP-00017003 -P1-P01T-00002 -P1-P01T-00003 -P1-P01T-00004	Section 4D.4.2; Table 4F-2, 4D-2; and Figures 4A-1, 4A-2 and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.
Pretreatment Vessel Vent Process System (Cont.) PVP-OXID-00001 (Vessel Vent VOC Oxidizer Unit)	PVP	**24590-PTF** -M5-V17T-00021001 -M5-V17T-00021004 -M6-PVP-00017001 -M6-PVP-00017002 -M6-PVP-00017003 -M6-PVP-000018001 -M6-PVP-000018002 -N1D-PVP-P0002 -P1-P01T-00001 -P1-P01T-00002 -P1-P01T-00003 -P1-P01T-00004	Section 4D.4.2; Table 4F-2, 4D-2; and Figures 4A-1, 4A-2 and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.
Pretreatment Vessel Vent Process System (Cont.) PVP-CLR-00001 (Vessel Vent Aftercooler)	PVP	**24590-PTF** -M5-V17T-00021001 -M5-V17T-00021004 -P1-P01T-00001 -P1-P01T-00002	Section 4D.4.2; Table 4F-2, 4D-2; and Figures 4A-1, 4A-2 and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.

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Table III.10.G.A.i – Pretreatment Plant Vessel Vent Systems Associated with Pretreatment Plant Miscellaneous Unit Systems

Description	Designation	Description Drawings	Narrative Description, Tables & Figures
		-P1-P01T-00003 -P1-P01T-00004	
Pretreatment Vessel Vent Process System (Cont.) PVP-ADBR-00001A (Vessel Vent Carbon Bed Absorber) PVP-ADBR-00001B (Vessel Vent Carbon Bed Absorber)	PVP	**24590-PTF** -M5-V17T-00021001 -M5-V17T-00021004 -P1-P01T-00001 -P1-P01T-00002 -P1-P01T-00003 -P1-P01T-00004	Section 4D.4.2; Table 4F-2, 4D-2; and Figures 4A-1, 4A-2 and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.
Pretreatment Vessel Vent Process System (Cont.) PVP-FILT-00001 (Vessel Vent Adsorber Outlet Filter)	PVP	**24590-PTF** -M5-V17T-00021001 -M5-V17T-00021004 -P1-P01T-00002 -P1-P01T-00003-P1-P01T-00004	Section 4D.4.2; Table 4F-2, 4D-2; and Figures 4A-1, 4A-2 and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.
Process Vessel Vent System PVV-HEPA-00001A (Vessel Vent Primary HEPA Filter) PVV-HEPA-00001B (Vessel Vent Primary HEPA Filter) PVV-HEPA-00002A (Vessel Vent Secondary HEPA Filter)	PVV	**24590-PTF** -M5-V17T-00021001 -P1-P01T-00002	Section 4D.4.2; Table 4F-2, 4D-2; and Figures 4A-1, 4A-2 and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.

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Table III.10.G.A.i – Pretreatment Plant Vessel Vent Systems Associated with Pretreatment Plant Miscellaneous Unit Systems

Description	Designation	Description Drawings	Narrative Description, Tables & Figures
PVV-HEPA-00002B (Vessel Vent Secondary HEPA Filter)			
Process Vessel Vent System (Cont.) PVV-FAN-00001A (Vessel Vent Exhaust Fan) PVV-FAN-00001B (Vessel Vent Exhaust Fan)	PVV	**24590-PTF** -M5-V17T-00021001 -M5-V17T-00021004 -P1-P01T-00002 -P1-P01T-00003 -P1-P01T-00004	Section 4D.4.2; Table 4F-2, 4D-2; and Figures 4A-1, 4A-2 and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.
Pretreatment Pulse Jet Mixer Exhaust Vent System PJV-HEPA-00001A (PJV Primary Exhaust HEPA Filter) PJV-HEPA-00001B (PJV Primary Exhaust HEPA Filter) PJV-HEPA-00001C (PJV Primary Exhaust HEPA Filter) PJV-HEPA-00001D (PJV Primary Exhaust HEPA Filter) PJV-HEPA-00001E (PJV Primary Exhaust HEPA Filter)	PJV	**24590-PTF** -M5-V17T-00021002 -M6-PJV-00001 -M6-PJV-00002 -M6-PJV-00004001 -N1D-PJV-P0001 -P1-P01T-00001	Section 4D.4.3; Table 4F-2, 4D-2; and Figures 4A-1, 4A-2 and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.

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Table III.10.G.A.i – Pretreatment Plant Vessel Vent Systems Associated with Pretreatment Plant Miscellaneous Unit Systems

Description	Designation	Description Drawings	Narrative Description, Tables & Figures
PJV-HEPA-00001F (PJV Primary Exhaust HEPA Filter) PJV-HEPA-00001G (PJV Primary Exhaust HEPA Filter) PJV-HEPA-00002A (PJV Secondary Exhaust HEPA Filter) PJV-HEPA-00002B (PJV Secondary Exhaust HEPA Filter) PJV-HEPA-00002C (PJV Secondary Exhaust HEPA Filter) PJV-HEPA-00002D (PJV Secondary Exhaust HEPA Filter) PJV-HEPA-00002E (PJV Secondary Exhaust HEPA Filter) PJV-HEPA-00002F (PJV Secondary Exhaust HEPA Filter)			

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Table III.10.G.A.i – Pretreatment Plant Vessel Vent Systems Associated with Pretreatment Plant Miscellaneous Unit Systems

Description	Designation	Description Drawings	Narrative Description, Tables & Figures
Pretreatment Pulse Jet Mixer Exhaust Vent System (Cont.) PJV-FAN-00001A (PJV Exhaust Fan) PJV-FAN-00001B (PJV Exhaust Fan) PJV-FAN-00001C (PJV Exhaust Fan)	PJV	**24590-PTF** -M5-V17T-00021002 -M6-PJV-00001 -M6-PJV-00002 -M6-PJV-00004001 -N1D-PJV-P0001 -P1-P01T-00001	Section 4D.4.3; Table 4F-2, 4D-2; and Figures 4A-1, 4A-2 and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.
Pretreatment Pulse Jet Mixer Exhaust Vent System (Cont.) PJV-DMST-00002A (PJV Demister) PJV-DMST-00002B (PJV Demister) PJV-DMST-00002C (PJV Demisters)	PJV	**24590-PTF** -M5-V17T-00021002 -M6-PJV-00001 -M6-PJV-00002 -M6-PJV-00004001 -N1D-PJV-P0001 -P1-P01T-00003	Section 4D.4.3; Table 4F-2, 4D-2; and Figures 4A-1, 4A-2 and 4A-2A of Operating Unit Group 10, Chapter 4 of this Permit.

[a] The Pretreatment Vessel Vent Process (PVP), Process Vessel Vent Systems (PVV), and Pulse Jet Mixer Exhaust System (PJV) specified in Permit Table III.10.G.A.i are shared between the Pretreatment Plant Miscellaneous Unit Systems. Any references in this Permit to the individual Pretreatment Plant Miscellaneous Unit Systems are also a reference to the PVP, PVV, and PJV Systems. Any reference in this Permit to Permit Table III.10.G.A is also a reference to Permit Table III.10.G.A.i.

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Table III.10.G.B – Pretreatment Plant Miscellaneous Unit Secondary Containment Systems Including Sumps, Bulges, and Floor Drains

Sump, Bulge or Floor Drain I.D. # & Room Location	Maximum Sump/Bulge (gallons), or Drain Line (gallons per minute) Capacity	Sump Type/Nominal Operating Volume (gallons)	Sump, Bulge or Drain Line Dimensions[a] (inches) & Materials of Construction	Engineering Description (Drawings No.'s, Specification No.'s etc.)
PVP-ZY-00037-S11B-03, P-0105 (PVP-BULGE-00001, El. 0')			3" Stainless Steel	**24590-PTF** -M6-PVP-00017002
PVP-ZY-00036-S11B-03, P-0101A (PVP-BULGE-00002, El. 0')			3" Stainless Steel	**24590-PTF** -M6-PVP-00018002
PVP-ZY-00056-S11B-03, P-0302 (PVP-BULGE-00014, El. 56')			3" Stainless Steel	**24590-PTF** -M6-PVP-00017003
PWD-FD-00323P-0304 Drain, El. 56'	140	N/A	6" Dia 316L	**24590-PTF** -M6-PWD-00044
PWD-FD-00324 P-0304 Drain, El. 56'	140	N/A	6" Dia 316L	**24590-PTF** -M6-PWD-00044
PWD-FD-00325 P-0304 Drain, El. 56'	140	N/A	6" Dia 316L	**24590-PTF** -M6-PWD-00044
PWD-FD-00326 P-0304 Drain, El. 56'	140	N/A	6" Dia 316L	**24590-PTF** -M6-PWD-00044
PWD-FD-00327 P-0304 Drain, El. 56'	140	N/A	6" Dia 316L	**24590-PTF** -M6-PWD-00044
PWD-FD-00512 P-0320 Drain, El. 56'	140	N/A	6" Dia 316L	**24590-PTF** -M6-PWD-00043
PWD-FD-00513 P-0320 Drain, El. 56'	140	N/A	6" Dia 316L	**24590-PTF** -M6-PWD-00043
PWD-FD-00514 P-0320 Drain, El. 56'	140	N/A	6" Dia 316L	**24590-PTF** -M6-PWD-00043

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Table III.10.G.B – Pretreatment Plant Miscellaneous Unit Secondary Containment Systems Including Sumps, Bulges, and Floor Drains

Sump, Bulge or Floor Drain I.D. # & Room Location	Maximum Sump/Bulge (gallons), or Drain Line (gallons per minute) Capacity	Sump Type/Nominal Operating Volume (gallons)	Sump, Bulge or Drain Line Dimensions[a] (inches) & Materials of Construction	Engineering Description (Drawings No.'s, Specification No.'s etc.)
PWD-FD-00515 P-0325 Drain, El. 56'	140	N/A	6" Dia 316L	**24590-PTF** -M6-PWD-00043
PWD-FD-00516 P-0325 Drain, El. 56'	140	N/A	6" Dia 316L	**24590-PTF** -M6-PWD-00043
PWD-FD-00517 P-0325 Drain, El. 56'	655	N/A	8" Dia 316L	**24590-PTF** -M6-PWD-00043
PWD-FD-00557 P-0430 Drain, El. 77'	140	N/A	6" Dia 304L	**24590-PTF** -M6-PWD-00043
PWD-FD-00561 P-0430 Drain, El. 77'	140	N/A	6" Dia 304L	**24590-PTF** -M6-PWD-00043
RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

[a] Dimensions listed are based on permitted design. Actual dimensions may vary within plus or minus (TBD).

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Table III.10.G.C. – Pretreatment Plant Miscellaneous Unit System Process and Leak Detection Instruments and Parameters

Miscellaneous Unit System Locator and Name (including P&ID)	Control Parameter	Type of Measuring or Leak Detection Instrument	Location of Measuring Instrument (Tag No.)	Instrument Range	Failure State	Expected Range	Instrument Accuracy	Operating Trips (Description & Numerical Limits)	Instrument Calibration Method No. and Range
PVP-BULGE-00001[a]	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED
PVP-BULGE-00014[a]	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED
RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

[a] Sump locator (including P&ID designator) is located on Permit Table III.10.G.B – Pretreatment Plant Miscellaneous Unit Secondary Containment Systems Including Sumps, Bulges, and Floor Drains.

Table III.10.G.D. – Pretreatment Plant Miscellaneous Unit Systems Estimated Emission Rates

Chemicals	CAS Number	Emission Rates (grams/second)
RESERVED	RESERVED	RESERVED

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III.10.H LAW VITRIFICATION SYSTEM – SHORT TERM MISCELLANEOUS THERMAL TREATMENT UNIT-SHAKEDOWN, DEMONSTRATION TEST, AND POST DEMONSTRATION TEST

For purposes of Permit Section III.10.H, where reference is made to WAC 173-303-640, the following substitutions apply: substituting the terms "LAW Vitrification System" for "tank system(s)," "sub-system(s)" for "tank(s)," "sub-system equipment" for "ancillary equipment," and "sub-system(s) or sub-system equipment of a LAW Vitrification System" for "component(s)" in accordance with WAC 173-303-680.

III.10.H.1 General Conditions during Shakedown, Demonstration Test, and Post-Demonstration Test for LAW Vitrification System

III.10.H.1.a Construction and Maintenance [WAC 173-303-640, in accordance with WAC 173-303-680(2) and (3), and WAC 173-303-340].

III.10.H.1.a.i The Permittees will construct the LAW Vitrification System (listed in Permit Tables III.10.H.A and B, as approved/modified pursuant to Permit Condition III.10.H.5) as specified in Permit Condition III.10.H.1 and Operating Unit Group 10, Chapter 4 of this Permit, and Operating Unit Group 10, Appendices 9.1 through 9.15 and 9.17 of this Permit, as approved pursuant to Permit Conditions III.10.H.5.a through d, and III.10.H.5.f.

III.10.H.1.a.ii The Permittees will construct all containment systems for the LAW Vitrification System as specified in Operating Unit Group 10, Chapter 4 of this Permit, and Operating Unit Group 10, Appendices 9.2 and 9.4 through 9.14 of this Permit, as approved pursuant to Permit Conditions III.10.H.5.a through d.

III.10.H.1.a.iii The Permittees will ensure all certifications required by specialists (e.g., IQRPE, independent corrosion expert, independent qualified installation inspector, etc.) use the following statement or equivalent pursuant to Permit Condition III.10.C.10:

> "I, (Insert Name) have (choose one or more of the following: overseen, supervised, reviewed, and/or certified) a portion of the design or installation of a new LAW Vitrification System or component located at (address), and owned/operated by (name(s)). My duties were: (e.g., installation inspector, testing for tightness, etc.), for the following LAW Vitrification System components (e.g., the venting piping, etc.), as required by the Dangerous Waste Regulations, namely, WAC 173-303-640(3) (applicable paragraphs (i.e., (a) through (g)) in accordance with WAC 173-303-680).
>
> "I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

III.10.H.1.a.iv The Permittees must ensure that proper handling procedures are adhered to in order to prevent damage to the LAW Vitrification System during installation. Prior to covering, enclosing, or placing the new LAW Vitrification System or component in use, an independent qualified installation inspector or an independent qualified registered professional engineer, either of whom is trained and experienced in the proper installation of similar systems or components, must inspect the system for the presence of any of the following items:

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A. Weld breaks.
B. Punctures.
C. Scrapes of protective coatings.
D. Cracks.
E. Corrosion.
F. Other structural damage or inadequate construction/installation.

All discrepancies must be remedied before the LAW Vitrification System is covered, enclosed, or placed in use [WAC 173-303-640(3)(c), in accordance with WAC 173-303-680(2) and (3)].

III.10.H.1.a.v For the LAW Vitrification System or components that are placed underground and that are back-filled, the Permittees must provide a backfill material that is a non-corrosive, porous, homogeneous substance. The backfill must be installed so that it is placed completely around the LAW Vitrification System and compacted to ensure that the LAW Vitrification System is fully and uniformly supported [WAC 173-303-640(3)(d), in accordance with WAC 173-303-680(2) and (3)].

III.10.H.1.a.vi The Permittees must test for tightness the LAW Vitrification System or components, prior to being covered, enclosed, or placed into use. If the LAW Vitrification System or components are found not to be tight, all repairs necessary to remedy the leak(s) in the system must be performed prior to the LAW Vitrification System being covered, enclosed, or placed in use [WAC 173-303-640(3)(e), in accordance with WAC 173-303-680(2) and (3)].

III.10.H.1.a.vii The Permittees must ensure the LAW Vitrification System equipment is supported and protected against physical damage and excessive stress due to settlement, vibration, expansion, or contraction [WAC 173-303-640(3)(f), in accordance with WAC 173-303-680(2) and (3)].

III.10.H.1.a.viii The Permittees must provide the type and degree of corrosion protection recommended by an independent corrosion expert, based on the information provided in Operating Unit Group 10, Appendices 9.9 and 9.11 of this Permit, as approved pursuant to Permit Conditions III.10.H.5.b.i, III.10.H.5.b.iv, III.10.H.5.b.v, III.10.H.5.c.i, III.10.H.5.c.iv, III.10.H.5.c.v, III.10.H.5.d.i, III.10.H.5.d.iv, and III.10.H.5.d.v, or other corrosion protection if Ecology believes other corrosion protection is necessary to ensure the integrity of the LAW Vitrification System during use of the LAW Vitrification System. The installation of a corrosion protection system that is field fabricated must be supervised by an independent corrosion expert to ensure proper installation [WAC 173-303-640(3)(g), in accordance with WAC 173-303-680(2) and (3)].

III.10.H.1.a.ix Prior to initial receipt of dangerous and/or mixed waste in the WTP Unit, the Permittees will obtain and keep on file in the WTP Unit operating record, written statements by those persons required to certify the design of the LAW Vitrification System and supervise the installation of the LAW Vitrification System, as specified in WAC 173-303-640(3)(b), (c), (d), (e), (f), and (g), in accordance with WAC 173-303-680, attesting that the LAW Vitrification System and corresponding containment system listed in Permit Tables III.10.H.A and III.10.H.B, as approved/modified pursuant to Permit Condition III.10.H.5, were properly designed and installed, and that repairs, in accordance with WAC 173-303-640(3)(c) and (e) were performed [WAC 173-303-640(3)(a) and WAC 173-303-640(3)(h), in accordance with WAC 173-303-680(3)].

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III.10.H.1.a.x The independent LAW Vitrification System installation inspection and subsequent written statements will be certified in accordance with WAC 173-303-810(13)(a), as modified pursuant to Permit Condition III.10.H.1.a.iii, comply with all requirements of WAC 173-303-640(3)(h) in accordance with WAC 173-303-680, and will consider, but not be limited to, the following LAW Vitrification System installation documentation:

A. Field installation report with date of installation.
B. Approved welding procedures.
C. Welder qualification and certifications.
D. Hydro-test reports, as applicable, in accordance with the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section VIII, Division 1; API Standard 620, or Standard 650, as applicable.
E. Tester credentials.
F. Field inspector credentials.
G. Field inspector reports.
H. Field waiver reports.
I. Non-compliance reports and corrective action (including field waiver reports) and repair reports.

III.10.H.1.a.xi The Permittees will ensure periodic integrity assessments are conducted on the LAW Vitrification System, listed in Permit Table III.10.H.A, as approved/modified pursuant to Permit Condition III.10.H.5, over the term of this Permit in accordance with WAC 173-303-680(2) and (3) as specified in WAC 173-303-640(3)(b), following the description of the integrity assessment program and schedule in Operating Unit Group 10, Chapter 6 of this Permit, as approved pursuant to Permit Conditions III.10.H.5.e.i and III.10.C.5.c. Results of the integrity assessments will be included in the WTP Unit operating record until ten (10) years after post-closure, or corrective action is complete and certified, whichever is later.

III.10.H.1.a.xii The Permittees will address problems detected during the LAW Vitrification System integrity assessments specified in Permit Condition III.10.H.1.a.xi following the integrity assessment program in Operating Unit Group 10, Chapter 6 of this Permit, as approved pursuant to Permit Conditions III.10.H.5.e.i and III.10.C.5.c.

III.10.H.1.a.xiii All process monitors/instruments, as specified in Permit Table III.10.H.F, as approved/modified pursuant to Permit Condition III.10.H.5, will be equipped with operational alarms to warn of deviation, or imminent deviation from the limits specified in Permit Table III.10.H.F.

III.10.H.1.a.xiv The Permittees will install and test all process and leak detection system monitors/instrumentation as specified in Permit Tables III.10.H.C and III.10.H.F, as approved/modified pursuant to Permit Condition III.10.H.5, in accordance with Operating Unit Group 10, Appendices 9.1, 9.2, and 9.14 of this Permit, as approved pursuant to Permit Conditions III.10.H.5.d.x and III.10.H.5.f.xvi.

III.10.H.1.a.xv Except during periods of LAW Vitrification System startup and shutdown, no dangerous and/or mixed waste will be treated in the LAW Vitrification System unless the operating conditions, specified under Permit Condition III.10.H.1.c are complied with.

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III.10.H.1.a.xvi The Permittees will not place dangerous and/or mixed waste, treatment reagents, or other materials in the LAW Vitrification System if these substances could cause the subsystem, subsystem equipment, or the containment system to rupture, leak, corrode, or otherwise fail [WAC 173-303-640(5)(a), in accordance with WAC 173-303-680(2)]. This condition is not applicable to corrosion of LAW Vitrification System sub-system or sub-system equipment that are expected to be replaced as part of normal operations (e.g., melters).

III.10.H.1.a.xvii The Permittees will operate the LAW Vitrification System to prevent spills and overflows using controls and practices as required under WAC 173-303-640(5)(b) described in Permit Condition III.10.C.5 and Operating Unit Group 10, Appendix 9.18 of this Permit, as approved pursuant to Permit Condition III.10.H.5.e [WAC 173-303-640(5)(b), in accordance with WAC 173-303-680(2) and (3), and WAC 173-303-806(4)(c)(ix)].

III.10.H.1.a.xviii For routinely non-accessible LAW Vitrification System sub-systems, as specified in Operating Unit Group 10, Chapter 4 of this Permit, as updated pursuant to Permit Condition III.10.H.5.e.vi, the Permittees will mark all routinely non-accessible LAW Vitrification System sub-systems access points with labels, or signs, to identify the waste contained in each LAW Vitrification System sub-system. The label, or sign, must be legible at a distance of at least fifty (50) feet, and must bear a legend which identifies the waste in a manner which adequately warns employees, emergency response personnel, and the public of the major risk(s) associated with the waste being stored or treated in the LAW Vitrification System sub-systems. For the purposes of this permit condition, "routinely non-accessible" means personnel are unable to enter these areas while waste is being managed in them [WAC 173-303-640(5)(d), in accordance with WAC 173-303-680(2)].

III.10.H.1.a.xix For all LAW Vitrification System sub-systems not addressed in Permit Condition III.10.H.1.a.xviii, the Permittees will mark all these LAW Vitrification System sub-systems holding dangerous and/or mixed waste with labels, or signs, to identify the waste contained in the LAW Vitrification System sub-systems. The labels, or signs, must be legible at a distance of at least fifty (50) feet, and must bear a legend which identifies the waste in a manner which adequately warns employees, emergency response personnel, and the public of the major risk(s) associated with the waste being stored or treated in the LAW Vitrification System sub-systems [WAC 173-303-640(5)(d), in accordance with WAC 173-303-680(2)].

III.10.H.1.a.xx The Permittees will ensure that the secondary containment systems for the LAW Vitrification System sub-systems listed in Permit Tables III.10.H.A and III.10.H.B, as approved/modified pursuant to Permit Condition III.10.H.5, are free of cracks or gaps to prevent any migration of dangerous and/or mixed waste or accumulated liquid out of the system to the soil, groundwater, or surface water at any time during use of the LAW Vitrification System sub-systems. Any indication that a crack or gap may exist in the containment systems will be investigated and repaired in accordance with Operating Unit Group 10, Appendix 9.18 of this Permit, as approved pursuant to Permit Condition III.10.H.5.e.v [WAC 173-303–640(4)(b)(i), WAC 173-303-640(4)(e)(i)(C), and WAC 173-303-640(6), in accordance with WAC 173-303-680(2) and (3), WAC 173-303-806(4)(i)(i)(B), and WAC 173-303-320].

III.10.H.1.a.xxi The Permittees must immediately, and safely, remove from service any LAW Vitrification System or secondary containment system which through an integrity assessment is found to be "unfit for use" as defined in WAC 173-303-040, following

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Permit Conditions III.10.H.1.a.xxiii, A through D, and F. The affected LAW Vitrification System or secondary containment system must be either repaired or closed in accordance with Permit Condition III.10.H.1.a.xxiii.E [WAC 173-303-640(7)(e) and (f), WAC 173-303-640(8), in accordance with WAC 173-303-680(3)].

III.10.H.1.a.xxii An impermeable coating, as specified in Operating Unit Group 10, Appendices 9.4, 9.5, 9.7, 9.9, 9.11, and 9.12 of this Permit, as approved pursuant to Permit Condition III.10.H.5.b.v will be maintained for all concrete containment systems and concrete portions of containment systems for each LAW Vitrification System sub-systems listed in Permit Tables III.10.H.A and III.10.H.B, as approved/modified pursuant to Permit Condition III.10.H.5 (concrete containment systems that do not have a liner, pursuant to WAC 173-303-640(4)(e)(i), in accordance with WAC 173-303-680(2), and have construction joints, will meet the requirements of WAC 173-303-640(4)(e)(ii)(C), in accordance with WAC 173-303-680(2). The coating will prevent migration of any dangerous and mixed waste into the concrete. All coatings will meet the following performance standards:

A. The coating must seal the containment surface such that no cracks, seams, or other avenues through which liquid could migrate are present;

B. The coating must be of adequate thickness and strength to withstand the normal operation of equipment and personnel within the given area such that degradation or physical damage to the coating or lining can be identified and remedied before dangerous and mixed waste could migrate from the system; and

C. The coating must be compatible with the dangerous and mixed waste, treatment reagents, or other materials managed in the containment system [WAC 173-303-640(4)(e)(ii)(D), in accordance with WAC 173-303-680(2) and (3), and WAC 173-303-806(4)(i)(i)(A)].

III.10.H.1.a.xxiii The Permittees will inspect all secondary containment systems for the LAW Vitrification System sub-systems listed in Permit Tables III.10.H.A and III.10.H.B, as approved/modified pursuant to Permit Condition III.10.H.5, in accordance with the Inspection Plan specified in Operating Unit Group 10, Chapter 6A of this Permit, as approved pursuant to Permit Conditions III.10.H.5.e.i and III.10.C.5.c, and take the following actions if a leak or spill of dangerous and/or mixed waste is detected in these containment systems [WAC 173-303-640(5)(c) and WAC 173-303-640(6), in accordance with WAC 173-303-680(2) and (3), WAC 173-303-320, and WAC 173-303-806(4)(i)(i)(B)]:

A. Immediately, and safely, stop the flow of dangerous and/or mixed waste into the LAW Vitrification System sub-systems or secondary containment system.

B. Determine the source of the dangerous and/or mixed waste.

C. Remove the dangerous and/or mixed waste from the containment area in accordance with WAC 173-303-680(2) and (3) as specified in WAC 173-303-640(7)(b). The dangerous and/or mixed waste removed from containment areas of the LAW Vitrification System sub-systems will be, as a minimum, managed as mixed waste.

D. If the cause of the release was a spill that has not damaged the integrity of the LAW Vitrification System sub-system, the Permittees may return the LAW Vitrification System sub-system to service in accordance with WAC 173-303-680(2) and (3) as specified in WAC 173-303-640(7)(e)(ii). In such case, the Permittees will take action to insure the incident that caused

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the dangerous and/or mixed waste to enter the containment system will not reoccur [WAC 173-303-320(3)].

E. If the source of the dangerous and/or mixed waste is determined to be a leak from the primary LAW Vitrification System into the secondary containment system, or the system is unfit for use as determined through an integrity assessment or other inspection, the Permittees will comply with the requirements of WAC 173-303-640(7) and take the following actions:

1. Close the LAW Vitrification System sub-system following procedures in WAC 173-303-640(7)(e)(i), in accordance with WAC 173-303-680 and Operating Unit Group 10, Chapter 11 of this Permit, as approved pursuant to Permit Condition III.10.C.8, or
2. Repair and re-certify (in accordance with WAC 173-303-810(13)(a), as modified pursuant to Permit Condition III.10.H.1.a.iii) the LAW Vitrification System, in accordance with Operating Unit Group 10, Appendix 9.18 of this Permit, as approved pursuant to Permit Condition III.10.H.5.e.v, before the LAW Vitrification System is placed back into service [WAC 173-303-640(7)(e)(iii) and WAC 173-303-640(7)(f), in accordance with WAC 173-303-680].

F. The Permittees will document in the operating record actions/procedures taken to comply with A. through E. above as specified in WAC 173-303-640(6)(d), in accordance with WAC 173-303-680(2) and (3).

G. In accordance with WAC 173-303-680(2) and WAC 173-303-680 (3), the Permittees will notify and report releases to the environment to Ecology as specified in WAC 173-303-640(7)(d).

III.10.H.1.a.xxiv If liquids (e.g., dangerous and/or mixed waste leaks and spills, precipitation, fire water, liquids from damaged or broken pipes) cannot be removed from the secondary containment system within twenty-four (24) hours, Ecology will be verbally notified within twenty-four (24) hours of discovery. The notification will provide the information in A, B, and C, listed below. The Permittees will provide Ecology with a written demonstration within seven (7) business days, identifying at a minimum [WAC 173-303-640(4)(c)(iv) and WAC 173-303-640(7)(b)(ii), in accordance with WAC 173-303-680(3) and WAC 173-303-806(4)(i)(i)(B)]:

A. Reasons for delayed removal.

B. Measures implemented to ensure continued protection of human health and the environment.

C. Current actions being taken to remove liquids from secondary containment.

III.10.H.1.a.xxv All air pollution control devices and capture systems in the LAW Vitrification System will be maintained and operated at all times in a manner so as to minimize the emissions of air contaminants and to minimize process upsets. Procedures for ensuring that the air pollution control devices and capture systems in the LAW Vitrification System are properly operated and maintained so as to minimize the emission of air contaminants and process upsets will be established.

III.10.H.1.a.xxvi In all future narrative permit submittals, the Permittees will include LAW Vitrification sub-system names with the sub-system designation.

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III.10.H.1.a.xxvii Modifications to approved design, plans, and specifications in Operating Unit Group 10 of this Permit for the LAW Vitrification System will be allowed only in accordance with Permit Conditions III.10.C.2.e and f, or III.10.C.2.g, III.10.C.9.d, III.10.C.9.e, and III.10.C.9.h.

III.10.H.1.a.xxviii For any portion of the LAW Vitrification System which has the potential for formation and accumulation of hydrogen gases, the Permittees will operate the portion to maintain hydrogen levels below the lower explosive limit [WAC 173-303-815(2)(b)(ii)].

III.10.H.1.a.xxix For each LAW Vitrification System sub-system holding dangerous waste which are acutely or chronically toxic by inhalation, the Permittees will operate the system to prevent escape of vapors, fumes or other emissions into the air [WAC 173-303-806(4)(i)(i)(B) and WAC 173-303-640(5)(e), in accordance with WAC 173-303-680].

III.10.H.1.b Performance Standards

III.10.H.1.b.i The LAW Vitrification System must achieve a one-time demonstration for DRE of 99.99% for the PODCs listed below, further details are provided in III.10.H.2.b.iii.

PODC: Naphthalene and Chlorobenzene

DRE in this permit condition will be calculated in accordance with the formula given below:

$DRE=[1-(W_{out}/W_{in})] \times 100\%$

Where:

W_{in}=mass feed-rate of one PODC in a waste feed stream; and

W_{out}=mass emission rate of the same PODC present in exhaust emissions prior to release to the atmosphere.

III.10.H.1.b.ii Particulate matter emissions from the LAW Vitrification System will not exceed 34 mg/dscm (0.015 grains/dscf) [40 CFR §63.1203(b)(7), in accordance with WAC 173-303-680(2)].

III.10.H.1.b.iii Hydrochloric acid and chlorine gas emissions from the LAW Vitrification System will not exceed 21 ppmv, combined [40 CFR §63.1203(b)(6), in accordance with WAC 173-303-680(2)].

III.10.H.1.b.iv Dioxin and Furan TEQ emissions from the LAW Vitrification System will not exceed 0.2 nanograms (ng)/dscm [40 CFR §63.1203(b)(1), in accordance with WAC 173-303-680(2)].

III.10.H.1.b.v Mercury emissions from the LAW Vitrification System will not exceed 45 µg/dscm [40 CFR §63.1203(b)(2), in accordance with WAC 173-303-680(2)].

III.10.H.1.b.vi Lead and cadmium emissions from the LAW Vitrification System will not exceed 120 µg/dscm, combined [40 CFR §63.1203(b)(3), in accordance with WAC 173-303-680(2)].

III.10.H.1.b.vii Arsenic, beryllium, and chromium emissions from the LAW Vitrification System will not exceed 97 µg/dscm, combined [40 CFR §63.1203(b)(4), in accordance with WAC 173-303-680(2)].

III.10.H.1.b.viii Carbon monoxide (CO) emission from the LAW Vitrification System will not exceed 100 parts per million (ppm) by volume, over an hourly rolling average (as measured and recorded by the CMS), dry basis [40 CFR §63.1203(b)(5)(i), in accordance with WAC 173-303-680(2)].

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III.10.H.1.b.ix Hydrocarbon emission from the LAW Vitrification System will not exceed 10 parts per million (ppm) by volume, over an hourly rolling average (as measured and recorded by a temporary continuous emissions monitoring system during demonstration testing required by this Permit), dry basis, and reported as propane [40 CFR §63.1203(b)(5)(ii), in accordance with WAC 173-303-680(2)].

III.10.H.1.b.x If the emissions from the LAW Vitrification System exceed the emission rates listed in Permit Table III.10.H.E, as approved pursuant to Permit Condition III.10.C.11.b, the Permittees will notify Ecology in accordance with Permit Condition III.10.H.3.d.vii [WAC 173-303-680(2) and (3), and WAC 173-303-815(2)(b)(ii)].

The emission limits specified in Permit Conditions III.10.H.1.b.i through III.10.H.1.b.ix above, will be met for the LAW Vitrification System by limiting feed-rates as specified in Permit Tables III.10.H.D and III.10.H.F, as approved/modified pursuant to Permit Condition III.10.H.5, compliance with operating conditions specified in Permit Condition III.10.H.1.c (except as specified in Permit Condition III.10.H.1.b.xii), and compliance with Permit Condition III.10.H.1.b.xi.

III.10.H.1.b.xi Treatment effectiveness, feed-rates and operating rates for dangerous and mixed waste management units contained in the LAW Building, but not included in Permit Table III.10.H.A, as approved/modified pursuant to Permit Condition III.10.H.5, will be as specified in Permit Sections III.10.D, III.10.E, III.10.F and consistent with assumptions and basis which are reflected in Operating Unit Group 10, Appendix 6.3 of this Permit, as approved pursuant to Permit Condition III.10.C.11.b. For the purposes of this permit condition, Operating Unit Group 10, Appendix 6.3 will be superseded by Appendix 6.4 upon its approval pursuant to either Permit Conditions III.10.C.11.c or III.10.C.11.d [WAC 173-303-680(2) and (3), and WAC 173-303-815(2)(b)(ii)].

III.10.H.1.b.xii Except during periods of LAW Vitrification System startup and shutdown, compliance with the operating conditions specified in Permit Condition III.10.H.1.c, will be regarded as compliance with the required performance standards identified in Permit Conditions III.10.H.1.b.i through x. However, if it is determined that during the effective period of this Permit that compliance with the operating conditions in Permit Condition III.10.H.1.c is not sufficient to ensure compliance with the performance standards specified in Permit Conditions III.10.H.1.b.i through x, the Permit may be modified, revoked, or reissued pursuant to Permit Conditions III.10.C.2.e and III.10.C.2.f, or III.10.C.2.g.

III.10.H.1.c Operating Conditions [WAC 173-303-670(6), in accordance with WAC 173-303-680(2) and (3)].

The Permittees will operate the LAW Vitrification System in accordance with Operating Unit Group 10, Chapter 4 of this Permit, as updated pursuant to Permit Condition III.10.H.5.e.vi, Operating Unit Group 10, Appendix 9.18 of this Permit, as approved pursuant to Permit Condition III.10.H.5.e, and Operating Unit Group 10, Appendix 9.15 of this Permit, as approved pursuant to Permit Condition III.10.H.5.f, except as modified pursuant to Permit Conditions III.10.H.1.b.xii, III.10.H.2, III.10.H.3, III.10.H.4, and in accordance with the following:

III.10.H.1.c.i The Permittees will operate the LAW Vitrification System in order to maintain the systems and process parameters listed in Permit Tables III.10.H.C and III.10.H.F, as

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approved/modified pursuant to Permit Condition III.10.H.5, within the set-points specified in Permit Table III.10.H.F.

III.10.H.1.c.ii The Permittees will operate the Automatic Waste Feed Cut-off (AWFCO) systems, specified in Permit Table III.10.H.F, as approved/modified pursuant to Permit Condition III.10.H.5, to automatically cut-off and/or lock-out the dangerous and mixed waste feed to the LAW Vitrification System when the monitored operating conditions deviate from the set-points specified in Permit Table III.10.H.F.

III.10.H.1.c.iii The Permittees will operate the AWFCO systems, specified in Permit Table III.10.H.F, as approved/modified pursuant to Permit Condition III.10.H.5, to automatically cut-off and/or lock-out the dangerous and mixed waste feed to the LAW Vitrification System when all instruments specified on Permit Table III.10.H.F for measuring the monitored parameter fail or exceed its span value.

III.10.H.1.c.iv The Permittees will operate the AWFCO systems, specified in Permit Table III.10.H.F, as approved/modified pursuant to Permit Condition III.10.H.5, to automatically cut-off and/or lock out the dangerous and/or mixed waste feed to the LAW Vitrification System when any portion of the LAW Vitrification System is bypassed. The terms "bypassed" and "bypass event" as used in Permit Sections III.10.H and III.10.I will mean if any portion of the LAW Vitrification System is bypassed so that gases are not treated as during the Demonstration Test.

III.10.H.1.c.v In the event of a malfunction of the AWFCO systems listed in Permit Table III.10.H.F, as approved/modified pursuant to Permit Condition III.10.H.5, the Permittees will immediately, manually cut-off the dangerous and mixed waste feed to the LAW Vitrification System. The Permittees will not restart the dangerous and/or mixed waste feed until the problem causing the malfunction has been identified and corrected.

III.10.H.1.c.vi The Permittees will manually cut-off the dangerous and mixed waste feed to the LAW Vitrification System when the operating conditions deviate from the limits specified in Permit Condition III.10.H.1.c.i, unless the deviation automatically activates the waste feed cut-off sequence specified in Permit Conditions III.10.H.1.c.ii, III.10.H.1.c.iii, and/or III.10.H.1.c.iv.

III.10.H.1.c.vii If greater than thirty (30) dangerous and mixed waste feed cut-off, combined, to the LAW Vitrification System occur due to deviations from Permit Table III.10.H.F, as approved/modified pursuant to Permit Condition III.10.H.5, within a sixty (60) day period, the Permittees will submit a written report to Ecology within five (5) calendar days of the thirty-first exceedance including the information specified below. These dangerous and mixed waste feed cut-offs to the LAW Vitrification System, whether automatically or manually activated, are counted if the specified set points are deviated from while dangerous waste, mixed waste, and waste residues continue to be processed in the LAW Vitrification System. A cascade event is counted at a frequency of one (1) towards the first waste feed cut-off parameter, specified on Permit Table III.10.H.F, from which the set-point is deviated:

A. The parameter(s) that deviated from the set-point(s) in Permit Table III.10.H.F.
B. The magnitude, dates, and duration of the deviations.
C. Results of the investigation of the cause of the deviations.
D. Corrective measures taken to minimize future occurrences of the deviations.

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III.10.H.1.c.viii If any portion of the LAW Vitrification System is bypassed while treating dangerous and/or mixed waste it will be regarded as non-compliance with the operating conditions specified in Permit Condition III.10.H.1.c and the performance standards specified in Permit Condition III.10.H.1.b. After such a bypass event, the Permittees will perform the following actions:

A. Investigate the cause of the bypass event.
B. Take appropriate corrective measures to minimize future bypasses.
C. Record the investigation findings and corrective measures in the operating record.
D. Submit a written report to Ecology within five (5) days of the bypass event documenting the result of the investigation and corrective measures.

III.10.H.1.c.ix The Permittees will control fugitive emissions from the LAW Vitrification System by maintaining the melters under negative pressure.

III.10.H.1.c.x Except during periods of vitrification system startup and shutdown, compliance with the operating conditions specified in Permit Condition III.10.H.1.c will be regarded as compliance with the required performance standards identified in Permit Condition III.10.H.1.b. However, evidence that compliance with these operating conditions is insufficient to ensure compliance with the performance standards, will justify modification, revocation, or re-issuance of this Permit, in accordance with Permit Conditions III.10.C.2.e and III.10.C.2.f, or III.10.C.2.g.

III.10.H.1.d Inspection Requirements [WAC 173-303-680(3)]

III.10.H.1.d.i The Permittees will inspect the LAW Vitrification System in accordance with the Inspection Plan in Operating Unit Group 10, Chapter 6A of this Permit, as modified in accordance with Permit Condition III.10.C.5.c.

III.10.H.1.d.ii The inspection data for LAW Vitrification System will be recorded, and the records will be placed in the WTP Unit operating record for the LAW Vitrification System, in accordance with Permit Condition III.10.C.4.

III.10.H.1.e Monitoring Requirements [WAC 173-303-670(5), WAC 173-303-670(6), WAC 173-303-670(7) and WAC 173-303-807(2), in accordance with WAC 173-303-680(3)]

III.10.H.1.e.i Upon receipt of a written request from Ecology, the Permittees will perform sampling and analysis of the dangerous and mixed waste and exhaust emissions to verify that the operating requirements established in the Permit achieve the performance standards delineated in this Permit.

III.10.H.1.e.ii The Permittees will comply with the monitoring requirements specified in Operating Unit Group 10, Appendices 9.2, 9.3, 9.7, 9.13, 9.15 and 9.18 of this Permit, as approved pursuant to Permit Conditions III.10.H.5.c, III.10.H.5.d, III.10.H.5.e, and III.10.H.5.f, as modified by Permit Conditions III.10.H.1.b.xii, III.10.H.2, III.10.H.3, and III.10.H.4.

III.10.H.1.e.iii The Permittees will operate, calibrate, and maintain the carbon monoxide CEMS as specified in this Permit in accordance with Performance Specifications found in 40 CFR Part 60, Appendix B, in accordance with Appendix to Subpart EEE of 40 CFR Part 63, and Operating Unit Group 10 Appendix 9.15 of this Permit, as approved pursuant to Permit Condition III.10.H.5.f, and as modified by Permit Conditions III.10.H.1.b.xii, III.10.H.2, III.10.H.3, and III.10.H.4.

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III.10.H.1.e.iv The Permittees will operate, calibrate, and maintain the instruments specified on Permit Tables III.10.H.C, and F, as approved/modified pursuant to Permit Condition III.10.H.5, in accordance with Operating Unit Group 10, Appendix 9.15 of this Permit, as approved pursuant to Permit Condition III.10.H.5.f, and as modified by Permit Conditions III.10.H.1.b.xii, III.10.H.2, III.10.H.3, and III.10.H.4.

III.10.H.1.f Recordkeeping Requirements [WAC 173-303-380 and WAC 173-303-680(3)]

III.10.H.1.f.i The Permittees will record and maintain in the WTP Unit operating record for the LAW Vitrification System, all monitoring, calibration, maintenance, test data, and inspection data compiled under the conditions of this Permit, in accordance with Permit Conditions III.10.C.4 and III.10.C.5, as modified by Permit Conditions III.10.H.1.b.xii, III.10.H.2, III.10.H.3, and III.10.H.4.

III.10.H.1.f.ii The Permittees will record in the WTP Unit operating record the date, time, and duration of all automatic waste feed cutoffs and/or lockouts, including the triggering parameters, reason for the deviation, and recurrence of the incident. The Permittees will also record all incidents of AWFCO system function failures, including the corrective measures taken to correct the condition that caused the failure. In addition, if the AWFCO is engaged due to a pressure exceedance, the pressure value must be recorded.

III.10.H.1.f.iii The Permittees will submit to Ecology a report semi-annually the first calendar year, and annually thereafter each calendar year within ninety (90) days following the end of the year. The report will include the following information:

A. Total dangerous and mixed waste feed processing time for the LAW Vitrification System;

B. Date/Time of all LAW Vitrification System startups and shutdowns;

C. Date/Time/Duration/Cause/Corrective Action taken for all LAW Vitrification System shutdowns caused by malfunction of either process or control equipment; and

D. Date/Time/Duration/Cause/Corrective Action taken for all instances of dangerous and/or mixed waste feed cut-off due to deviations from Permit Table III.10.H.F, as approved/modified pursuant to Permit Condition III.10.H.5.

III.10.H.1.f.iv The Permittees will submit an annual report to Ecology each calendar year within ninety (90) days following the end of the year of all quarterly CEMS Calibration Error and Annual CEMS Performance Specification Tests conducted in accordance with Permit Condition III.10.H.1.e.iii.

III.10.H.1.g Closure

The Permittees will close the LAW Vitrification System in accordance with Operating Unit Group 10, Chapter 11 of this Permit, as approved pursuant to Permit Condition III.10.C.8.

III.10.H.2 Shakedown Period [WAC 173-303-670(5), WAC 173-303-670(6), WAC 173-303-670(7), and WAC 173-303-807(2), in accordance with WAC 173-303-680(2) and (3)].

III.10.H.2.a The shakedown period for the LAW Vitrification System will be conducted in accordance with Permit Condition III.10.H.1, Operating Unit Group 10, Appendix 9.15.

III.10.H.2.b Duration of the Shakedown Period

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III.10.H.2.b.i The shakedown period for the LAW Vitrification System will begin with the introduction of PODCs in the LAW Vitrification System and will end with the start of the demonstration test, pursuant to Permit Condition III.10.C.2.l.

III.10.H.2.b.ii Each shakedown phase will not exceed the following limits, as defined by hours, when the LAW Vitrification System is processing dangerous waste. The Permittees may petition Ecology for one extension of each shakedown phase for seven hundred and twenty (720) additional operating hours in accordance with Permit modification procedures specified in Permit Conditions III.10.C.2.e and III.10.C.2.f.

Shakedown Phase 1: 720 hours

Shakedown Phase 2: 720 hours

III.10.H.2.b.iii Emissions testing will be performed during Shakedown Phase 1 to confirm DRE for both PODCs, naphthalene and chlorobenzene. If pre-testing indicates potential failure of one of the PODCs, then testing with a single PODC may be reconsidered following approval from Ecology.

III.10.H.2.b.iv Shakedown Phase 1 will be completed when documentation has been submitted to Ecology and the Permittees have received concurrence verifying that the LAW Vitrification System has operated at a minimum of 75% of the feed-rate limit found in Permit Table III.10.H.D for two (2) separate eight (8) consecutive hour periods with no AWFCOs.

III.10.H.2.b.v A full scale emissions test will be performed during Shakedown Phase 2 to determine system capability before starting the Demonstration Test. The Permittee will submit the preliminary results of DRE and a complete emissions data-set to Ecology within 30 days of receiving the results.

III.10.H.2.b.vi Shakedown Phase 2 will be completed when documentation has been submitted to Ecology and the Permittee has received concurrence verifying that the LAW Vitrification System has operated at a minimum of 75% feed-rate limit found in Permit Table III.10.H.D for a minimum of consecutive 8-hour periods on two (2) consecutive days with no AWFCOs.

III.10.H.2.c Allowable Waste Feed during the Shakedown Period

III.10.H.2.c.i The Permittees may feed the dangerous waste specified for the LAW Vitrification System on the Part A Forms (Operating Unit Group 10, Chapter 1 of this Permit), except for those wastes outside the waste acceptance criteria specified in the WAP, Attachment 1, Chapter 3 of this Permit, as approved pursuant to Permit Condition III.10.C.3, except Permit Conditions III.10.H.2.c.ii through iv also apply.

III.10.H.2.c.ii The Permittees will not feed mixed waste to the LAW Vitrification System during the Shakedown period.

III.10.H.2.c.iii The feed-rates to the LAW Vitrification System shall not exceed the limits in Permit Table III.10.H.D, in accordance with the automatic waste feed cut offs specified in Table III.10.H.F.

III.10.H.2.c.iv The Permittees will conduct sufficient analysis of the dangerous waste treated in the LAW Vitrification System to verify that the waste feed is within the physical and chemical composition limits specified in this Permit.

III.10.H.3 Demonstration Test Period [WAC 173-303-670(5), WAC 173-303-670(6), WAC 173-303-670(7), and WAC 173-303-807(2), in accordance with WAC 173-303-680(2) and (3)]

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III.10.H.3.a Demonstration Test Period

III.10.H.3.a.i The Permittees will operate, monitor, and maintain the LAW Vitrification System as specified in Permit Condition III.10.H.1, and Operating Unit Group 10, Appendix 9.15 of this Permit.

III.10.H.3.a.ii The Demonstration Test Plan, located in Operating Unit Group 10, Appendix 9.15 of this Permit, will be resubmitted to Ecology for approval by the Permittees as a permit modification pursuant to Permit Conditions III.10.C.2.e and III.10.C.2.f at least one hundred and eighty (180) days prior to the start date of the demonstration test. The Revised Demonstration Test Plan (RDTP) will include applicable EPA promulgated test methods and procedures in effect at the time of the re-submittal and projected commencement and completion dates for the Demonstration Test.

III.10.H.3.a.iii The Demonstration Test period will begin once the Permittees have received concurrence from Ecology that Shakedown Phase 2 has been completed.

III.10.H.3.a.iv Upon completion of the Demonstration Test, PODC and metals spiking shall be discontinued and purged from the LAW Vitrification System.

III.10.H.3.a.v During the purge of the LAW Vitrification System, the feed-rates to the LAW Vitrification System will not exceed the limits in Permit Table III.10.H.D in accordance with the waste feed cut offs in Table III.10.H.F.

III.10.H.3.a.vi Once 7,200 gallons of non-dangerous feed material is processed through each melter, the PODC listed codes are no longer applicable to the LAW Vitrification System or waste generated thereafter.

III.10.H.3.b Performance Standards

The Permittees will demonstrate compliance with the performance standards specified in Permit Condition III.10.H.1.b during the Demonstration Test Period.

III.10.H.3.c Allowable Waste Feed during the Demonstration Test Period

III.10.H.3.c.i The Permittees may feed the dangerous waste specified for the LAW Vitrification System in Part A Forms (Operating Unit Group 10, Chapter 1 of this Permit), except for those waste outside the waste acceptance criteria specified in the WAP, Operating Unit Group 10, Chapter 3 of this Permit, as approved pursuant to Permit Condition III.10.C.3, except Permit Conditions III.10.H.3.c.ii through iv also apply.

III.10.H.3.c.ii The Permittees will not feed mixed waste to the LAW Vitrification System.

III.10.H.3.c.iii The dangerous waste feed-rates to the LAW Vitrification System will not exceed the limits in Permit Tables III.10.H.D in accordance with the waste feed cut offs in Permit Table III.10.H.F.

III.10.H.3.c.iv The Permittees will conduct sufficient analysis of the dangerous waste treated in the LAW Vitrification System to verify that the dangerous waste is within the physical and chemical composition limits specified in this Permit.

III.10.H.3.d Demonstration Data Submissions and Certifications

III.10.H.3.d.i The Permittees will submit to Ecology a complete demonstration test report within one-hundred eighty (180) calendar days of completion of the Demonstration Test including all data collected during the Demonstration Test and updated Permit Tables III.10.I.D, III.10.I.E and III.10.I.F.

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III.10.H.3.d.ii The Permittees must submit the following information to Ecology within sixty (60) calendar days of completion of the Demonstration Test:

A. A summary of data collected as required by the Demonstration Test Plan.

B. A certification that the Demonstration Test has been carried out in accordance with the approved Demonstration Test Plan and approved modifications within sixty (60) days of the completion of the Demonstration Test [WAC 173-303-807(8)].

C. Calculations and analytical data showing compliance with the performance standards specified in Permit Conditions III.10.H.1.b.i, III.10.H.1.b.iv, III.10.H.1.b.v, III.10.H.1.b.vi, and III.10.H.1.b.vii.

D. Laboratory data QA/QC summary for the information provided in III.10.H.3.d.ii.C.

III.10.H.3.d.iii The Permittees shall submit a permit modification request proposing the changes to the post Demonstration Test period AWFCO settings (Permit Table III.10.H.F) and waste feed rates (Permit Table III.10.H.D), within ninety (90) calendar days following completion of the Demonstration Test.

III.10.H.3.d.iv RESERVED

III.10.H.3.d.v After successful completion of the Demonstration Test, Permittees submittal of the following to Ecology and the Permittees receipt of approval of the following in writing, the Permittees will be authorized to feed mixed waste to the LAW Vitrification System pursuant to Permit Section III.10.I.

A. A complete Demonstration Test Report for the LAW Vitrification System and updated Permit Tables III.10.I.D, III.10.I.E, and III.10.I.F, as approved/modified pursuant to Permit Conditions III.10.H.5 and III.10.C.11.c or III.10.C.11.d. The test report will be certified in accordance with WAC 173-303-807(8) and WAC 173-303-680(2) and (3).

B. A Final Risk Assessment Report completed pursuant to Permit Conditions III.10.C.11.c or III.10.C.11.d.

III.10.H.3.d.vi If any calculations or testing results show that one or more of the performance standards listed in Permit Condition III.10.H.1.b, with the exception of Permit Condition III.10.H.1.b.x, for the LAW Vitrification System were not met during the Demonstration Test, the Permittees will perform the following actions:

A. Immediately stop dangerous and mixed waste feed to the LAW Vitrification System under the mode of operation that resulted in not meeting the performance standard(s).

B. Verbally notify Ecology within twenty-four (24) hours of discovery of not meeting the performance standard(s) as specified in Permit Condition I.E.21.

C. Investigate the cause of the failure and submit a report of the investigation findings to Ecology within fifteen (15) days of discovery of not meeting the performance standard(s).

D. Submit to Ecology within fifteen (15) days of discovery of not meeting the performance standard(s), documentation supporting a mode of operation where all performance standards listed in Permit Condition III.10.H.1.b, with the exception of Permit Condition III.10.H.1.b.x, for the LAW Vitrification System were met during the demonstration test, if any such mode was demonstrated.

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E. Based on the information provided to Ecology by the Permittees pursuant to Permit Conditions III.10.H.3.d.vi.A through D above, and any additional information, Ecology may provide in writing, direction to the Permittees to stop dangerous and/or mixed waste feed to the LAW Vitrification System and/or amend the mode of operation the Permittees are allowed to continue operations prior to Ecology approval of a compliance schedule and/or RDTP pursuant to Permit Conditions III.10.H.3.d.vi.F and G.

F. If the performance standard listed in Permit Condition III.10.H.1.b.i was not met during the Demonstration Test, the Permittees will submit within one hundred and twenty (120) days of discovery of not meeting the performance standard, a RDTP (if appropriate), and a compliance schedule for Ecology approval to address this deficiency. If a RDTP is submitted, it will be accompanied by a request for approval to retest as a permit modification pursuant to Permit Conditions III.10.C.2.e and III.10.C.2.f. The RDTP (if submitted) must include substantive changes to prevent failure from reoccurring.

G. If any of the performance standards listed in Permit Condition III.10.H.1.b, with the exception of Permit Conditions III.10.H.1.b.i or III.10.H.1.b.x, were not met during the Demonstration Test the Permittees will submit to Ecology within one hundred twenty (120) days of discovery of not meeting the performance standard(s), a RDTP requesting approval to retest as a permit modification pursuant to Permit Conditions III.10.C.2.e and III.10.C.2.f. The RDTP must include substantive changes to prevent failure from reoccurring.

III.10.H.3.d.vii If any calculations or testing results show that any emission rate for any constituent listed in Permit Table III.10.H.E, as approved pursuant to Permit Condition III.10.C.11.b, is exceeded for LAW Vitrification System during the Demonstration Test, the Permittees will perform the following actions:

A. Verbally notify Ecology within twenty-four (24) hours of the discovery of exceeding the emission rate(s) as specified in Permit Condition I.E.21.

B. Submit to Ecology additional risk information to indicate that the increased emissions impact is offset by decreased emission impact from one or more constituents expected to be emitted at the same time, and/or investigate the cause and impact of the exceedance of the emission rate(s) and submit a report of the investigation findings to Ecology within fifteen (15) days of the discovery of exceeding the emission rate(s); and

C. Based on the notification and any additional information, Ecology may provide, in writing, direction to the Permittees to stop dangerous and/or mixed waste feed to the LAW Vitrification System and/or to submit a RDTP as a permit modification pursuant to Permit Conditions III.10.C.2.e and III.10.C.2.f, or III.10.C.2.g. The RDTP must include substantive changes to prevent failure from reoccurring.

III.10.H.4 Post Demonstration Test Period [WAC 173-303-670(5), WAC 173-303-670(6), and WAC 173-303-807(2), in accordance with WAC 173-303-680(2) and (3)].

III.10.H.4.a The Permittees will operate, monitor, and inspect the LAW Vitrification System as specified in Permit Condition III.10.H.1.

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III.10.H.4.b After successful completion of the Demonstration Test, the Permittees will submit to Ecology a request to enter the Post Demonstration Test Period. Ecology has seven (7) calendar days from the receipt of the request to approve or deny the Permittees' request to enter the Post Demonstration Test Period. If the Permittees have not received a notification from Ecology to approve or deny the request, the Permittees may operate during the Post Demonstration Test Period at risk.

III.10.H.4.c After receipt of approval of Permit Conditions III.10.H.3.d.ii and III.10.H.3.d.iii the Permittees will be authorized to feed mixed waste feed to the LAW Vitrification System.

III.10.H.4.d Allowable Waste Feed during the Post-Demonstration Test Period

III.10.H.4.d.i The Permittees may feed the dangerous and/or mixed waste specified for the LAW Vitrification System on the Part A Forms (Operating Unit Group 10, Chapter 1 of this Permit), except for those wastes outside the waste acceptance criteria specified in the WAP, Operating Unit Group 10, Chapter 3 of this Permit, as approved pursuant to Permit Condition III.10.C.3, and except Permit Conditions III.10.H.4.d.ii and III.10.H.4.d.iv also apply.

III.10.H.4.d.ii The dangerous waste and mixed waste feed-rates to the LAW Vitrification System will not exceed the limits in Permit Table III.10.H.D.

III.10.H.4.d.iii During the Post Demonstration Test Period, the Permittees may accept and treat up to 3 million gallons of Hanford tank waste feed in the LAW Vitrification System.

III.10.H.4.d.iv The Permittees will conduct sufficient analysis of the dangerous waste and mixed waste treated in the LAW Vitrification System to verify that the waste feed is within the physical and chemical composition limits specified in this Permit.

III.10.H.5 Compliance Schedules

III.10.H.5.a All information identified for submittal to Ecology in III.10.H.5.a. through III.10.H.5.f of this compliance schedule must be signed and certified in accordance with requirements in WAC 173-303-810(12), as modified in accordance with Permit Condition III.10.H.1.a.iii [WAC 173-303-806(4)].

III.10.H.5.b The Permittees will submit to Ecology, pursuant to Permit Condition III.10.C.9.f, prior to construction of each secondary containment and leak detection system for the LAW Vitrification System (per level) as identified in Permit Tables III.10.H.A and III.10.H.B, engineering information as specified below, for incorporation into Operating Unit Group 10, Appendices 9.2, 9.4, 9.5, 9.7, 9.8, 9.9, 9.11, and 9.12 of this Permit. At a minimum, engineering information specified below will show the following as described in WAC 173-303-640, in accordance with WAC 173-303-680 (the information specified below will include dimensioned engineering drawings and information on sumps and floor drains):

III.10.H.5.b.i IQRPE Reports (specific to foundation, secondary containment, and leak detection system) will include review of design drawings, calculations, and other information on which the certification report is based and will include as applicable, but not limited to, review of such information described below. Information (drawings, specifications, etc.) already included in Operating Unit Group 10, Appendix 9.0 of this Permit, may be included in the report by reference and should include drawing and document numbers. IQRPE Reports will be consistent with the information separately provided in ii through ix below [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)];

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III.10.H.5.b.ii Design drawings (General Arrangement Drawings, in plan) and specifications for the foundation, secondary containment including liner installation details, and leak detection methodology. These items should show the dimensions, volume calculations, and location of the secondary containment system, and should include items such as floor/pipe slopes to sumps, tanks, floor drains [WAC 173-303-640(4)(b) through (f) and WAC 173-303-640(3)(a), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)];

III.10.H.5.b.iii The Permittees will provide the design criteria (references to codes and standards, load definitions, and load combinations, materials of construction, and analysis/design methodology) and typical design details for the support of the secondary containment system. This information will demonstrate the foundation will be capable of providing support to the secondary containment system, resistance to pressure gradients above and below the system, and capable of preventing failure due to settlement, compression, or uplift [WAC 173-303-640(4)(c)(ii), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(B)];

III.10.H.5.b.iv A description of materials and equipment used to provide corrosion protection for external metal components in contact with soil, including factors affecting the potential for corrosion [WAC 173-303-640(3)(a)(iii)(B), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(A) through (B)];

III.10.H.5.b.v Secondary containment/foundation, and leak detection system, materials selection documentation (including, but not limited to, concrete coatings and water stops, and liner materials) as applicable [WAC 173-303-806(4)(i)(i)(A) through (B)];

III.10.H.5.b.vi Detailed description of how the secondary containment for the LAW Vitrification System will be installed in compliance with WAC 173-303-640(3)(c), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(A) through (B);

III.10.H.5.b.vii Submit Permit Tables III.10.H.B and III.10.I.B completed to provide for all secondary containment sumps and floor drains the information as specified in each column heading consistent with information to be provided in i. through vi., above;

III.10.H.5.b.viii Documentation that secondary containment and leak detection systems will not accumulate hydrogen gas levels above the lower explosive limit for incorporation into the Administrative Record [WAC 173-303-680, WAC 173-303-806(4)(i)(i)(A), and WAC 173-303-806(4)(i)(v)];

III.10.H.5.b.ix A detailed description of how LAW Vitrification System design provides access for conducting future LAW Vitrification System integrity assessments [WAC 173-303-640(3)(b) and WAC 173-303-806(4)(i)(i)(B)].

III.10.H.5.c The Permittees will submit to Ecology, pursuant to Permit Condition III.10.C.9.f, prior to installation of each sub-system as identified in Permit Table III.10.H.A, engineering information as specified below, for incorporation into Operating Unit Group 10, Appendices 9.1 through 9.14, and 9.17 of this Permit. At a minimum, engineering information specified below will show the following, as required pursuant to WAC 173-303-640, in accordance with WAC 173-303-680 (the information specified below will include dimensioned engineering drawings):

III.10.H.5.c.i IQRPE Reports (specific to sub-system) will include review of design drawings, calculations, and other information on which the certification report is based and will include as applicable, but not limited to, review of such information described below. Information (drawings, specifications, etc.) already included in Operating Unit

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Group 10, Appendix 9.0 of this Permit, may be included in the report by reference and should include drawing and document numbers. The IQRPE Reports will be consistent with the information separately provided in ii. through xii. below, and the IQRPE Report specified in Permit Condition III.10.H.5.b [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)];

III.10.H.5.c.ii Design drawings [General Arrangement Drawings in plan and, Process Flow Diagrams, Piping and Instrumentation Diagrams (including pressure control systems), Mechanical Drawings, and specifications, and other information specific to subsystems (to show location and physical attributes of each subsystem)] [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)];

III.10.H.5.c.iii Sub-system design criteria (references to codes and standards, load definitions, and load combinations, materials of construction, and analysis/design methodology) and typical design details to support the subsystems. Structural support calculations specific to off-specification, non-standard and field fabricated subsystems will be submitted for incorporation into the Administrative Record. Documentation will include but not limited to, supporting specifications, test data, treatment effectiveness report, etc. supporting projected operational capability (e.g., WESP projected removal efficiency for individual metals, halogens, particulates, etc.) and compliance with performance standards specified in Permit Condition III.10.H.1.b [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(B)];

III.10.H.5.c.iv A description of materials and equipment used to provide corrosion protection for external metal components in contact with water, including factors affecting the potential for corrosion [WAC 173-303-640(3)(a)(iii)(B), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(A) through (B)];

III.10.H.5.c.v Sub-system materials selection documentation (e.g., physical and chemical tolerances) [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(A)];

III.10.H.5.c.vi Sub-system vendor information (including, but not limited to, required performance warranties, as available), consistent with information submitted under ii. above, will be submitted for incorporation into the Administrative Record [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2), WAC 173-303-806(4)(i)(i)(A) through (B), and WAC 173-303-806(4)(i)(v)];

III.10.H.5.c.vii System descriptions related to sub-system units will be submitted for incorporation into the Administrative Record [WAC 173-303-680, WAC 173-303-806(4)(i)(i)(A) through (B), and WAC 173-303-806(4)(i)(v)];

III.10.H.5.c.viii Mass and energy balance for normal projected operating conditions used in developing the Piping and Instrumentation Diagrams and Process Flow Diagrams, including assumptions and formulas used to complete the mass and energy balance, so that they can be independently verified for incorporation into the Administrative Record [WAC 173-303-680(2), WAC 173-303-806(4)(i)(i)(B), and WAC 173-303-806(4)(i)(v)];

III.10.H.5.c.ix Detailed description of all potential LAW Vitrification System bypass events including:

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A. A report which includes an analysis of credible potential bypass events and recommendations for prevention/minimization of the potential, impact, and frequency of the bypass event to include at a minimum:
   1. Operating procedures.
   2. Maintenance procedures.
   3. Redundant equipment.
   4. Redundant instrumentation.
   5. Alternate equipment.
   6. Alternate materials of construction.

III.10.H.5.c.x A detailed description of how the sub-systems will be installed in compliance with WAC 173-303-640(3)(c), (d), and (e), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(B);

III.10.H.5.c.xi Sub-system design to prevent escape of vapors and emissions of acutely or chronically toxic (upon inhalation) extremely hazardous waste, for incorporation into the Administrative Record [WAC 173-303-640(5)(e), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(B)];

III.10.H.5.c.xii Documentation that sub-systems are designed to prevent the accumulation of hydrogen gases levels above the lower explosive limit for incorporation into the Administrative Record [WAC 173-303-680, WAC 173-303-806(4)(i)(i)(A), and WAC 173-303-806(4)(i)(v)].

III.10.H.5.d The Permittees will submit to Ecology, pursuant to Permit Condition III.10.C.9.f, prior to installation of equipment for each sub-system as identified in Permit Tables III.10.H.A and III.10.H.B, not addressed in Permit Conditions III.10.H.5.b or III.10.H.5.c, engineering information as specified below, for incorporation into Operating Unit Group 10, Appendices 9.1 through 9.14 of this Permit. At a minimum, engineering information specified below will show the following as required pursuant to WAC 173-303-640, in accordance with WAC 173-303-680 (the information specified below will include dimensioned engineering drawings):

III.10.H.5.d.i IQRPE Reports (specific to sub-system equipment) will include a review of design drawings, calculations, and other information as applicable on which the certification report is based. The reports will include, but not be limited to, review of such information described below. Information (drawings, specifications, etc.) already included in Operating Unit Group 10, Appendix 9.0 of this Permit, may be included in the report by reference and should include drawing and document numbers. The IQRPE Reports will be consistent with the information provided separately in ii through xiii below and the IQRPE Reports specified in Permit Conditions III.10.H.5.b and III.10.H.5.c [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(A) through (B)];

III.10.H.5.d.ii Design drawings [Process Flow Diagrams, Piping and Instrumentation Diagrams (including pressure control systems), specifications and other information specific to equipment (these drawings should include all equipment such as pipes, valves, fittings, pumps, instruments, etc.)] [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(A) through (B)];

III.10.H.5.d.iii Sub-system equipment design criteria (references to codes and standards, load definitions, and load combinations, materials of construction, and analysis/design methodology) and typical design details for the support of the sub-system equipment

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[WAC 173-303-640(3)(a) and WAC 173-303-640(3)(f), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(B)];

III.10.H.5.d.iv A description of materials and equipment used to provide corrosion protection for external metal components in contact with soil and water, including factors affecting the potential for corrosion [WAC 173-303-640(3)(a)(iii)(B), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(A)];

III.10.H.5.d.v Materials selection documentation for equipment for each sub-system (e.g., physical and chemical tolerances) [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(A)];

III.10.H.5.d.vi Vendor information (including, but not limited to, required performance warranties, as available), consistent with information submitted under ii. above, for sub-system equipment will be submitted for incorporation into the Administrative Record. [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2), WAC 173-303-806(4)(i)(i)(A) through (B), and WAC 173-303-806(4)(i)(iv)];

III.10.H.5.d.vii Sub-system, sub-system equipment, and leak detection system instrument control logic narrative description (e.g., descriptions of fail-safe conditions, etc.) [WAC 173-303-680(2), WAC 173-303-806(4)(i)(i)(B), and WAC 173-303-806(4)(i)(v)].

III.10.H.5.d.viii System description related to sub-system equipment, and system descriptions related to leak detection systems, for incorporation into the Administrative Record [WAC 173-303-680, WAC 173-303-806(4)(i)(i)(A) through (B), and WAC 173-303-806(4)(i)(v)];

III.10.H.5.d.ix A detailed description of how the sub-system equipment will be installed and tested [WAC 173-303-640(3)(c) through (e), WAC 173-303-640(4)(b) and (c), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(B)];

III.10.H.5.d.x For process monitoring, control, and leak detection system instrumentation for the LAW Vitrification System as identified in Permit Tables III.10.H.C and III.10.H.F, a detailed description of how the process monitoring, control, and leak detection system instrumentation, will be installed and tested [WAC 173-303-640(3)(c) through (e), WAC 173-303-640(4)(b) and (c), WAC 173-303-806(4)(c)(vi), and WAC 173-303-806(4)(i)(i)(B)];

III.10.H.5.d.xi Mass and energy balance for projected normal operating conditions used in developing the Piping and Instrumentation Diagrams and Process Flow Diagrams, including assumptions and formulas used to complete the mass and energy balance, so that they can be independently verified, for incorporation into the Administrative Record [WAC 173-303-680(2), WAC 173-303-806(4)(i)(i)(B), and WAC 173-303-806(4)(i)(v)];

III.10.H.5.d.xii Documentation that sub-systems equipment are designed to prevent the accumulation of hydrogen gas levels above the lower explosive limit for incorporation into the Administrative Record [WAC 173-303-680, WAC 173-303-806(4)(i)(i)(A), and WAC 173-303-806(4)(i)(v)];

III.10.H.5.d.xiii Leak detection system documentation (e.g. vendor information, etc.) consistent with information submitted under Permit Condition III.10.H.5.c.ii and Permit Conditions III.10.H.5.d.ii, vii, viii, and x above, will be submitted for incorporation into the Administrative Record.

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III.10.H.5.e Prior to initial receipt of dangerous and/or mixed waste in the WTP Unit, the Permittees will submit to Ecology, pursuant to Permit Condition III.10.C.9.f, the following as specified below for incorporation into Operating Unit Group 10, Appendix 9.18 of this Permit, except Permit Condition III.10.H.5.e.i, which will be incorporated into Operating Unit Group 10, Chapter 6 of this Permit. All information provided under this permit condition must be consistent with information provided pursuant to Permit Conditions III.10.H.5.b, c, d, e, and f, III.10.C.3.e and III.10.C.11.b, as approved by Ecology:

III.10.H.5.e.i Integrity assessment program and schedule for the LAW Vitrification System will address the conducting of periodic integrity assessments on the LAW Vitrification System over the life of the system, as specified in Permit Condition III.10.H.5.b.ix and WAC 173-303-640(3)(b), in accordance with WAC 173-303-680, and descriptions of procedures for addressing problems detected during integrity assessments. The schedule must be based on past integrity assessments, age of the system, materials of construction, characteristics of the waste, and any other relevant factors [WAC 173-303-640(3)(b), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(B)].

III.10.H.5.e.ii Detailed plans and descriptions, demonstrating the leak detection system is operated so that it will detect the failure of either the primary or secondary containment structure or the presence of any release of dangerous and/or mixed waste or accumulated liquid in the secondary containment system within twenty-four (24) hours [WAC 173-303-640(4)(c)(iii)]. Detection of a leak of at least 0.1 gallons per hour within twenty-four (24) hours is defined as being able to detect a leak within twenty-four (24) hours. Any exceptions to this criteria must be approved by Ecology in accordance with WAC 173-303-680, WAC 173-303-640(4)(c)(iii), and WAC 173-303-806(4)(i)(i)(b).

A. Dangerous waste pipe penetrations that require a penetration seal in accordance with the IBC and DOE-STD-1066, DOE Standard for Fire Protection Design Criteria, or meet ventilation sealing requirements identified in Permit Table III.10.H.G, are not required to meet the 0.1 gallons per hour within twenty-four (24) hours leak detection rate for those sections of piping that are in contact with approved silicone or equivalent low-permeability seal material.

B. Piping on either side of the penetration seal must meet the requirements of III.10.H.5.e.ii.

C. Revisions (including additions or deletions) to Permit Table III.10.H.G will be submitted to Ecology for review and approval pursuant to Conditions III.10.C.2.e and III.10.C.2.f. Addition of penetration seal locations to Permit Table III.10.H.G will be approved by Ecology prior to installation of the penetration seal.

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Table III.10.H.G – LAW Plant Penetration Seal Location

Row Number	Room Number	Orientation	Discipline	Sequence Number
1.	L-0112	E	PD	02097
2.	L-0123	E	PD	01823
3.	L-0123	E	PD	01834
4.	L-0123	E	PD	01828
5.	L-0123	E	PD	01837
6.	L-0123	E	PD	01822
7.	L-0123	E	PD	01824
8.	L-0123	E	PD	01826
9.	L-0123	E	PD	01821
10.	L-0123	E	PD	01825
11.	L-0123	E	PD	01827
12.	L-0123	E	PD	01836
13.	L-0123	E	PD	01820
14.	L-0123	E	PD	01832
15.	L-0123	S	PD	01797
16.	L-0124	E	PD	01843
17.	L-0124	E	PD	01844
18.	L-0124	E	PD	01845
19.	L-0124	E	PD	01842
20.	L-0124	E	PD	01847
21.	L-0124	E	PD	01841
22.	L-0124	E	PD	01846
23.	L-0124	E	PD	01850
24.	L-0124	E	PD	01848
25.	L-0124	E	PD	01852
26.	L-0124	E	PD	01840
27.	L-0124	E	PD	01839
28.	L-0124	E	PD	01849
29.	L-0124	S	PD	01801
30.	L-0125	E	PD	01858
31.	L-0125	E	PD	01859
32.	L-0125	E	PD	01860
33.	L-0125	E	PD	01857
34.	L-0125	E	PD	01862
35.	L-0125	E	PD	01856
36.	L-0125	E	PD	01861

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Table III.10.H.G – LAW Plant Penetration Seal Location

Row Number	Room Number	Orientation	Discipline	Sequence Number
37.	L-0125	E	PD	01865
38.	L-0125	E	PD	01863
39.	L-0125	E	PD	01867
40.	L-0125	E	PD	01855
41.	L-0125	E	PD	01854
42.	L-0125	E	PD	01864
43.	L-0126	S	PD	01807
44.	L-0201	F	PD	02405
45.	L-0201	S	PD	02406
46.	L-0202	F	PD	02495
47.	L-0216	W	PD	02674
48.	L-0220	E	PD	02709
49.	L-0301	F	PD	03319
50.	L-0301	S	PD	03437
51.	L-0301	S	PD	04149
52.	L-0301	S	PD	04141
53.	L-0101A	F	PD	01291
54.	L-0101A	F	PD	01292
55.	L-0101A	W	PD	01971
56.	L-0226B	F	PD	02445
57.	L-0226B	F	PD	02444
58.	L-0304F	F	PD	03278
59.	L-0304F	F	PD	03277
60.	L-B001B	E	EQ	80908
61.	L-B001B	S	PD	00196
62.	L-B001B	S	PD	00201
63.	L-C0201	F	PD	02430
64.	L-0124	W	PD	01410
65.	L-0125	W	PD	01428
66.	L-0126	W	PD	01454

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III.10.H.5.e.iii Detailed operational plans and descriptions, demonstrating that spilled or leaked waste and accumulated liquids can be removed from the secondary containment system within twenty-four (24) hours [WAC 173-303-806(4)(i)(i)(B)].

III.10.H.5.e.iv Descriptions of operational procedures demonstrating appropriate controls and practices are in place to prevent spills and overflows from the LAW Vitrification System or containment systems in compliance with WAC 173-303-640(5)(b)(i) through (iii), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(B);

III.10.H.5.e.v Description of procedures for investigation and repair of the LAW Vitrification System [WAC 173-303–640(6) and WAC 173-303-640(7)(e) and (f), in accordance with WAC 173-303-680, WAC 173-303-320, WAC 173-303-806(4)(a)(v), and WAC 173-303-806(4)(a)(ii)(B)].

III.10.H.5.e.vi Updated Chapter 4, Narrative Description, Tables and Figures as identified in Permit Tables III.10.H.A and III.10.H.B, as modified pursuant to Permit Condition III.10.H.5.e.x and updated to identify routinely non-accessible LAW Vitrification sub-systems.

III.10.H.5.e.vii Description of procedures for management of ignitable and reactive, and incompatible dangerous and/or mixed waste as specified in WAC 173-303-640(9) and (10), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(B).

III.10.H.5.e.viii A description of the tracking system used to track dangerous and/or mixed waste generated throughout the LAW Vitrification system, pursuant to WAC 173-303-380.

III.10.H.5.e.ix Permit Tables III.10.H.C and III.10.I.C will be completed for LAW Vitrification System process and leak detection system monitors and instruments (to include, but not be limited to: instruments and monitors measuring and/or controlling flow, pressure, temperature, density, pH, level, humidity, and emissions) to provide the information as specified in each column heading. Process and leak detection system monitors and instruments for critical systems as specified in Operating Unit Group 10, Appendix 2.0 and as updated pursuant to Permit Condition III.10.C.9.b, and for operating parameters as required to comply with Permit Condition III.10.C.3.e.iii will be addressed. Process monitors and instruments for non-waste management operations (e.g., utilities, raw chemical storage, non-contact cooling waters, etc.) are excluded from this permit condition [WAC 173-303-680, WAC 173-303-806(4)(i)(i)(A) through (B), and WAC 173-303-806(4)(i)(v)];

III.10.H.5.e.x Permit Tables III.10.H.A and III.10.I.A amended as follows [WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(A) through (B)]:

A. Under column 1, update and complete list of dangerous and mixed waste LAW Vitrification System sub-systems, including plant items that comprise each system (listed by item number).

B. Under column 2, update and complete system designations.

C. Under column 3, replace the “Reserved” with Operating Unit Group 10, Appendix 9.0 subsections (e.g., 9.1, 9.2, etc.) designated in Permit Conditions III.10.H.5.b, c, and d specific to LAW Vitrification System sub-system as listed in column 1.

D. Under column 4, update and complete list of narrative description, tables, and figures.

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III.10.H.5.e.xi The permittees will incorporate operational parameters/controls required for the underground transfer line LCP-PB-03368-S32B-03 in the operating permit prior to the transfer of waste from the Effluent Management Facility evaporator system to the LAW Facility (LCP-VSL-00001/2). The operational controls will meet the mitigating requirements provided in the Design Guide Case-Specific Exception (DGCE) (number 24590-BOF-DGCE-MS-16-00022) dated 28 February 2017.

III.10.H.5.f One hundred and eighty (180) days prior to initial receipt of dangerous and/or mixed waste in the WTP Unit, the Permittees will submit for review and receive approval for incorporation into Operating Unit Group 10, Appendix 9.15 of this Permit, a Demonstration Test Plan for the LAW Vitrification System to demonstrate that the LAW Vitrification Systems meets the performance standards specified in Permit Condition III.10.H.1.b. In order to incorporate the Demonstration Test Plan for the LAW Vitrification System into Operating Unit Group 10, Appendix 9.15, Permit Condition III.10.C.2.g process will be followed. The Demonstration Test Plan will include, but not be limited to, the following information. The Demonstration Test Plan will also be consistent with the information provided pursuant to Permit Conditions III.10.H.5.b, c, d, and e, III.10.C.3.e, and III.10.C.11.b, as approved by Ecology and consistent with the schedule described in Operating Unit Group 10, Appendix 1.0 of this Permit. The documentation required pursuant to Permit Condition III.10.H.5.f.x, in addition to being incorporated into Operating Unit Group 10, Appendix 9.15, will be incorporated by reference in Operating Unit Group 10, Chapter 6 of this Permit.

Notes: (1) The following should be consulted to prepare this Demonstration Test Plan: *Guidance on Setting Permit Conditions and Reporting Trial Burn Results Volume II of the Hazardous Waste Incineration Guidance Series,* (EPA/625/6-89/019) and *Risk Burn Guidance For Hazardous Waste Combustion Facilities, (EPA-R-01-001,* July 2001), WAC 173-303-807(2), WAC 173-303-670(5), WAC-173-303-670(6), 40 CFR §63.1207(f)(2), 40 CFR §63.1209, and Appendix to 40 CFR Part 63 EEE.

(2) Cross-referencing to the information provided pursuant to permit Conditions III.H.5.b, c, d, e, and III.10.C.3.e.v, as approved by Ecology, that are redundant to elements of the Demonstration Test Plan for the LAW Vitrification System is acceptable.

III.10.H.5.f.i Analysis of each feed-stream to be fed during the demonstration test, including dangerous waste, glass formers, and reductants, process streams that includes:

A. Levels of ash, metals, total chlorine (organic and inorganic), other halogens and radionuclide surrogates.

B. Description of the physical form of the feed-streams.

C. An identification and quantification of organics that are present in the feed-stream, including constituents proposed for DRE demonstration.

A comparison of the proposed demonstration test feed streams to the mixed waste feed envelopes to be processed in the melters must be provided that documents that the proposed demonstration test feed streams will serve as worst case surrogates for organic destruction, formation of products of incomplete oxidation, and metals, total chlorine (organic and inorganic), other halogens, particulate formation, and radionuclides.

III.10.H.5.f.ii Specification of trial PODCs for which destruction and removal efficiencies are proposed to be calculated during the demonstration test and for inclusion in Permit Conditions III.10.H.1.b.i and III.10.I.1.b.i. These trial PODCs will be specified based

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on destructibility, concentration or mass in the waste and the dangerous waste constituents or constituents in WAC 173-303-9905;

III.10.H.5.f.iii A description of the blending procedures, prior to introducing the feed-streams into the melter, including analysis of the materials prior to blending, and blending ratios;

III.10.H.5.f.iv A description of how the surrogate feeds are to be introduced for the demonstration. This description should clearly identify the differences and justify how any of differences would impact the surrogate feed introduction as representative of how mixed waste feeds will be introduced;

III.10.H.5.f.v A detailed engineering description of the LAW Vitrification System, including:

A. Manufacturer's name and model number for each sub-system.

B. Design capacity of each sub-system including documentation (engineering calculations, manufacturer/vendor specifications, operating data, etc.) supporting projected operational efficiencies (e.g., WESP projected removal efficiency for individual metals, halogens, particulates, etc.) and compliance with performance standards specified in Permit Condition III.10.H.1.b.

C. Detailed scaled engineering drawings, including Process Flow Diagrams, Piping and Instrumentation Diagrams, Vessel Drawings (plan, and elevation with cross sections) and General Arrangement Drawings.

D. Process Engineering Descriptions.

E. Mass and energy balance for each projected operating condition and each demonstration test condition, including assumptions and formulas used to complete the mass and energy balance, so that they can be independently verified for incorporation into the Administrative Record.

F. Engineering Specifications/data sheets (materials of construction, physical and chemical tolerances of equipment, and fan curves).

G. Detailed Description of Automatic Waste Feed Cutoff System addressing critical operating parameters for all performance standards specified in Permit Condition III.10.H.1.b.

H. Documentation to support compliance with performance standards specified in Permit Condition III.10.H.1.b, including engineering calculations, test data, and manufacturer/vendor's warranties, etc.

I. Detailed description of the design, operation, and maintenance practices for air pollution control system.

J. Detailed description of the design, operation, and maintenance practices of any stack gas monitoring and pollution control monitoring system.

III.10.H.5.f.vi Detailed description of sampling and monitoring procedures including sampling and monitoring locations in the system, the equipment to be used, sampling and monitoring frequency, and planned analytical procedures for sample analysis including, but not limited to:

A. A short summary narrative description of each stack sample method should be included within the main body of the demonstration test plan, which references an appendix to the plan that would include for each sampling train: (1) detailed sample method procedures, (2) sampling train configuration schematic, (3) sampling recovery flow sheet, (4) detailed analytical method procedures, and (5) sampling preparation and analysis flow sheet. The detailed procedures should clearly flag where the method

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has provided decision points (e.g., choices of equipment materials of construction, choices of clean-up procedures or whether additional clean-up procedures will be incorporated, whether pretest surveys or laboratory validation work will be performed, enhancements to train to accommodate high moisture content in stack gas, etc.) and what is being proposed along with the basis for the decision.

B. A short summary narrative description of the feed and residue sampling methods should be included within the main body of the demonstration test plan, which references an appendix that would include for each sample type: (1) detailed sample method procedures, (2) sampling recovery/compositing procedures, and (3) detailed analytical method procedures. The detailed procedures should clearly flag where the method has provided decision points (e.g., choices of equipment materials of construction, choices of clean-up procedures or whether additional clean-up procedures will be incorporated, whether pretest surveys or laboratory validation work will be performed, etc.) and what is being proposed along with the basis for the decision.

III.10.H.5.f.vii A detailed test schedule for each condition for which the demonstration test is planned, including projected date(s), duration, quantity of dangerous waste to be fed, and other relevant factors.

III.10.H.5.f.viii A detailed test protocol including, for each test condition, the ranges of feed-rate for each feed system, and all other relevant parameters that may affect the ability of the LAW Vitrification System to meet performance standards specified in Permit Condition III.10.H.1.b.

III.10.H.5.f.ix A detailed description of planned operating conditions for each demonstration test condition, including operating conditions for shakedown, demonstration test, post-demonstration test and normal operations. This information will also include submittal of Permit Tables III.10.H.D, III.10.H.F, III.10.I.D, and III.10.I.F completed with the information as specified in each column heading for each LAW Vitrification System waste feed cutoff parameter and submittal of supporting documentation for Permit Tables III.10.H.D, III.10.H.F, III.10.I.D, and III.10.I.F set-point values.

III.10.H.5.f.x The test conditions proposed must demonstrate meeting the performance standards specified in Permit Condition III.10.H.1.b with the simultaneous operation of both melters at capacity and input from the LAW Vitrification Vessel Ventilation System at capacity to simulate maximum loading to the LAW Vitrification System off-gas treatment system and to establish the corresponding operating parameter ranges. To the extent that operation of one (1) melter or two (2) melters cannot be sustained within the operating parameter range established at this maximum load, additional demonstration test conditions must be included in the plan and performed to establish operating parameter ranges for each proposed operating mode while demonstrating meeting the performance standards specified in Permit Condition III.10.H.1.b.

III.10.H.5.f.xi Detailed description of procedures for start-up and shutdown of waste feed and controlling emissions in the event of an equipment malfunction, including off-normal and emergency shutdown procedures.

III.10.H.5.f.xii A calculation of waste residence time.

III.10.H.5.f.xiii Any request to extrapolate metal feed-rate limits from Demonstration Test levels must include:

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A. A description of the extrapolation methodology and rationale for how the approach ensures compliance with the performance standards as specified in Permit Condition III.10.H.1.b.

B. Documentation of the historical range of normal metal feed-rates for each feed stream.

C. Documentation that the level of spiking recommended during the demonstration test will mask sampling and analysis imprecision and inaccuracy to the extent that extrapolation of feed-rates and emission rates from the Demonstration Test data will be as accurate and precise as if full spiking were used.

III.10.H.5.f.xiv Documentation of the expected levels of constituents in LAW Vitrification System input streams including, but not limited to, waste feed, glass former and reactants, control air, process air, steam, sparge bubbler air, air in-Leakage from melter cave, gases from LAW Vitrification Vessel Ventilation System, and process water.

III.10.H.5.f.xv Documentation justifying the duration of the conditioning required to ensure the LAW Vitrification System had achieved steady-state operations under Demonstration Test operating conditions.

III.10.H.5.f.xvi Documentation of LAW Vitrification System process and leak detection system instruments and monitors as listed on Permit Tables III.10.H.C, III.10.H.F, III.10.I.C, and III.10.I.F to include:

A. Procurement specifications.

B. Location used.

C. Range, precision, and accuracy.

D. Detailed descriptions of calibration/functionality test procedures (either method number ASTM) or provide a copy of manufacturer's recommended calibration procedures.

E. Calibration/functionality test, inspection, and routine maintenance schedules and checklists, including justification for calibration, inspection and maintenance frequencies, criteria for identifying instruments found to be significantly out of calibration, and corrective action to be taken for instruments found to be significantly out of calibration (e.g., increasing frequency of calibration, instrument replacement, etc.).

F. Equipment instrument control logic narrative description (e.g., descriptions of failsafe conditions, etc.) [WAC 173-303-680(2), WAC 173-303-806(4)(i)(i)(B), and WAC 173-303-806(4)(i)(v)].

III.10.H.5.f.xvii Outline of demonstration test report.

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Table III.10.H.A – LAW Plant Miscellaneous Unit System Description

Sub-system Description	Sub-system Designation	Engineering Description (Drawing Nos., Specification Nos., etc.)	Narrative Description, Tables and Figures
LAW Melter Process System LMP-MLTR-00001 (LAW Melter 1) LMP-MLTR-00002 (LAW Melter 2)	LMP	**24590-LAW** -CM-HC4-HXYG-00240-02-00014 -M0D-LMP-00001 -M0D-LMP-00002 -M6-LMP-00001001 -M6-LMP-00002001 -M6-LMP-00002002 -M6-LMP-00031001 -M6-LMP-00032001 -M6-LMP-00032002 -MF-LMP-00001 -MF-LMP-00002 -MF-LMP-00003 -MF-LMP-00004 -3PS-AE00-T0001 -3PN-LMP-00002 -N1D-LMP-00001 -P1-P01T-00002	Section 4E.2.2, Table 4E-2, and Figures 4A-1, 4A-3 and 4A-21 in Operating Unit Group 10, Chapter 4 of this Permit.
LAW Primary Offgas Process System LOP-FCLR-00001 (Melter 1 Primary Film Cooler) LOP-FCLR-00002 (Melter 1 Standby Film Cooler No. 2) LOP-FCLR-00003 (Melter 2 Primary Film Cooler)	LOP	**24590-LAW** -P1-P01T-00002 -M6-LOP-00004001 -M6-LOP-00004002 -M6-LOP-00005001 -M6-LOP-00005002	Section 4E.4.2.1, Table 4E-2, and Figures 4A-1, 4A-3 and 4A-21 in Operating Unit Group 10, Chapter 4 of this Permit.

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Table III.10.H.A – LAW Plant Miscellaneous Unit System Description

Sub-system Description	Sub-system Designation	Engineering Description (Drawing Nos., Specification Nos., etc.)	Narrative Description, Tables and Figures
LOP-FCLR-00004 (Melter 2 Standby Film Cooler)			
LAW Primary Offgas Process System (Cont.) LOP-SCB-00001 (Melter 1 Submerged Bed Scrubber) LOP-SCB-00002 (Melter 2 Submergered Bed Scrubber)	LOP	**24590-LAW** -M5-V17T-P0007 -M5-V17T-P0008 -M6-LOP-00001001 -M6-LOP-00002001 -MK-LOP-P0001001 -MK-LOP-P0001002 -MK-LOP-P0001003 -MKD-LOP-00008 -NID-LOP-P0001 -P1-P01T-00002	Section 4E.4.2.1, Table 4E-2, and Figures 4A-1 and 4A-3 in Operating Unit Group 10, Chapter 4 of this Permit.
LAW Primary Offgas Process System (Cont.) LOP-WESP-00001 (Melter 1 Wet Electrostatic Precipitator – WESP) LOP-WESP-00002 (Melter 2 Wet Electrostatic Precipitator – WESP)	LOP	**24590-LAW** -M5-V17T-P0007 -M5-V17T-P0008 -M6-LOP-00001004 -M6-LOP-00002004 -NID-LOP-00003 -P1-P01T-00002 **24590-WTP** -3PS-MKE0-T0001 24590-QL-POA-MKE0-00001-06-32	Section 4E.4.2.1, Table 4E-2, and Figures 4A-1 and 4A-3 in Operating Unit Group 10, Chapter 4 of this Permit.

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Table III.10.H.A – LAW Plant Miscellaneous Unit System Description

Sub-system Description	Sub-system Designation	Engineering Description (Drawing Nos., Specification Nos., etc.)	Narrative Description, Tables and Figures
LAW Secondary Offgas/Vessel Vent Process System LVP-HEPA-00001A (Melter Offgas HEPA Filter) LVP-HEPA-00001B (Melter Offgas HEPA Filter) LVP-HEPA-00002A (Melter Offgas HEPA Filter) LVP-HEPA-00002B (Melter Offgas HEPA Filter) LVP-HEPA-00003A (Melter Offgas HEPA Filter)	LVP	**24590-LAW** -M5-V17T-00010 -M6-LVP-00001003 -P1-P01T-00005 24590-QL-POA-MKH0-00001-04-00148	Section 4E.4.2.2, Table 4E-2, Figures 4A-1 and 4A-3 in Operating Unit Group 10, Chapter 4 of this Permit.
LAW Secondary Offgas/Vessel Vent Process System (Cont.) LVP-SCO-00001 (Thermal Catalytic Oxidizer – located on LVP-SKID-00002)	LVP	**24590-LAW** -M6-LVP-00005002 24590-CD-POC-MBT0-00007-01-00353	Section 4E.4.2.2, Table 4E-2, Figures 4A-1 and 4A-3 in Operating Unit Group 10, Chapter 4 of this Permit.
LAW Secondary Offgas/Vessel Vent Process System (Cont.) LVP-SCR-00001 (NOx Selective Catalytic Reduction Unit – located on LVP-SKID-00002) LVP-HX-00001 (Catalytic Oxidizer Heat Exchanger – located on LVP-SKID-00002) LVP-HTR-00002 (Catalytic Oxidizer Electric Heater – located on LVP-SKID-00002)	LVP	**24590-LAW** -M6-LVP-00005002 24590-CD-POC-MBT0-00007-01-00353	Section 4E.4.2.2, Table 4E-2, and Figures 4A-1, and 4A-3 in Operating Unit Group 10, Chapter 4 of this Permit.

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Table III.10.H.A – LAW Plant Miscellaneous Unit System Description

Sub-system Description	Sub-system Designation	Engineering Description (Drawing Nos., Specification Nos., etc.)	Narrative Description, Tables and Figures
LAW Secondary Offgas/Vessel Vent Process System (Cont.) LVP-ADBR-00001A (Offgas Mercury Adsorber – located on LVP-SKID-00001) LVP-ADBR-00001B (Offgas Mercury Adsorber – located on LVP-SKID-00001)	LVP	**24590-LAW** -M5-V17T-00011 -M6-LVP-00004001 -M6-LVP-00004002 -M6-LVP-00004003 -P1-P01T-00005 24590-QL-POA-MWK0-00001-05-00198	Section 4E.4.2.2, Table 4E-2, and Figures 4A-1 and 4A-3 in Operating Unit Group 10, Chapter 4 of this Permit.
LAW Secondary Offgas/Vessel Vent Process System (Cont.) LVP-SCB-00001 (Melter Offgas Caustic Scrubber)	LVP	**24590-LAW** -P1-P01T-00005 -M6-LVP-00002001 -M6-LVP-00002002 **24590-QL-POA-MKAS** -00003-04-00050 -00003-04-00051 -00003-04-00052	Section 4E.4.2.2, Table 4E-2, and Figures 4A-1 and 4A-3 in Operating Unit Group 10, Chapter 4 of this Permit.
LAW Secondary Offgas/Vessel Vent Process System (Cont.) LVP-HTR-00001A (Melter Offgas HEPA Preheater) LVP-HTR-00003A (Melter Offgas HEPA Preheater)	LVP	**24590-LAW** -M5-V17T-00010 -M6-LVP-00001002 -P1-P01T-00005 24590-CD-POA-MEE0-00003-03-00005	Section 4E.4.2.2, Table 4E-2, and Figures 4A-1 and 4A-3 in Operating Unit Group 10, Chapter 4 of this Permit.

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Table III.10.H.A – LAW Plant Miscellaneous Unit System Description

Sub-system Description	Sub-system Designation	Engineering Description (Drawing Nos., Specification Nos., etc.)	Narrative Description, Tables and Figures
LAW Secondary Offgas/Vessel Vent Process System (Cont.) LVP-EXHR-00001A (Melter Offgas Exhauster) LVP-EXHR-00001B (Melter Offgas Exhauster) LVP-EXHR-00001C (Melter Offgas Exhauster)	LVP	**24590-LAW** -M5-V17T-00010 -M6-LVP-00001004 -M6-LVP-00001005 -M6-LVP-00001006 -M6-LVP-00002006 -P1-P01T-00005 24590-QL-POA-MACS-00007-06-00009	Section 4E.4.2.2, Table 4E-2, and Figures 4A-1 and 4A-3 in Operating Unit Group 10, Chapter 4 of this Permit.

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Table III.10.H.B – LAW Vitrification Miscellaneous Unit System Secondary Containment Sumps and Floor Drains

Sump/Floor Drain I.D. # & Room Location	Maximum Sump Capacity (gallons)	Sump Dimensions[a] (feet) & Materials of Construction	Engineering Description (Drawing Nos., Specification Nos., etc.)
RLD-SUMP-00029 L-0123 (Process Cell, El. +3')	37	30" Dia. x 12" deep Stainless Steel (6% Mo)	**24590-LAW** -M6-RLD-00003002 -P1-P01T-00002
RLD-SUMP-00030 L-0123 (Process Cell, El. +3')	37	30" Dia. x 12" deep Stainless Steel (6% Mo)	**24590-LAW** -M6-RLD-00003002 -P1-P01T-00002
RLD-SUMP-00031 L-0124 (Process Cell Sump, El. +3')	37	30" Dia. x 12" deep Stainless Steel (6% Mo)	**24590-LAW** -M6-RLD-00003002 -P1-P01T-00002
RLD-SUMP-00032 L-0124 (Process Cell, El. +3')	37	30" Dia. x 12" deep Stainless Steel (6% Mo)	**24590-LAW** -M6-RLD-00003002 -P1-P01T-00002
LOP-FD-00001 L-0123 (LOP-BULGE-00001 Drain El. +3')	N/A	2" Dia. 6% Mo	**24590-LAW** -M6-LOP-00001003
RLD-WS-20037-S11B-01 L-0123 (Melter 1 Encasement Assembly Drain, El. +3')	N/A	1" Dia. 316L	**24590-LAW** -M6-LMP-00012001
LOP-FD-00002 L-0124 (LOP-BULGE-00002 Drain, El. +3')	N/A	2" Dia. 6% Mo	**24590-LAW** -M6-LOP-00002003

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Table III.10.H.B – LAW Vitrification Miscellaneous Unit System Secondary Containment Sumps and Floor Drains

Sump/Floor Drain I.D. # & Room Location	Maximum Sump Capacity (gallons)	Sump Dimensions[a] (feet) & Materials of Construction	Engineering Description (Drawing Nos., Specification Nos., etc.)
RLD-WS-20033-S11B-01 L-0124 (Melter 2 Encasement Assembly Drain, El. +3')	N/A	1" Dia. 316L	**24590-LAW** -M6-LMP-00042001
RLD-FD-00025 L-0304F (Curb Floor Drain for Caustic Scrubber, El. 48')	N/A	4" Dia. 316L	**24590-LAW** -M6-RLD-00003001

[a] Dimensions listed are based on permitted design. Actual dimensions may vary within acceptable design tolerances.

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Table III.10.H.C – LAW Vitrification System Process and Leak Detection System Instruments and Parameters

Item No.	P&ID (24590-LAW-M6-)	Control Parameter	Measuring Instrument	Instrument Tag	Instrument Range	Failure State	Expected Range	Instrument Accuracy	Instrument Calibration Method and Range
1.	LMP-00005001	Melter 1 Plenum Temperature Average	Temperature Element	LMP-TE-1263C through LMP-TE-1280C[a]	-454 to 2,300ºF	Redundant	650-2,012ºF	Greater of +/- 2.2ºC or +/- -0.75%	Scheduled replacement, run to failure
			Temperature Transmitter	LMP-TT-1263A (8 transmitters)					
			Temperature Indicator	LMP-TI-1263G					
2.	LMP-00035001	Melter 2 Plenum Temperature Average	Temperature Element (N type thermocouple)	LMP-TE-2263C through LMP-TE-2280C[a]	-454 to 2,300ºF	Redundant	650-2,012ºF	Greater of +/- 2.2ºC or +/- -0.75%	Scheduled replacement, run to failure
			Temperature Transmitter	LMP-TT-2263A[a] (8 transmitters)					
			Temperature Indicator	LMP-TI2263G					
3.	LMP-00002002	Melter 1 Glass Pool Density	Density Transmitter	LMP-DT-1404	+/- 30 in. WC	Reports Signal Failure	2.4 SpG	+/- .05% span	TBD[c]
			Density Indicator	LMP-DI-1404	0-3 SpG				
4.	LMP-00032002	Melter 2 Glass Pool Density	Density Transmitter	LMP-DT-2404	+/- 30 in. WC	Reports Signal Failure	2.4 SpG	+/- .05% span	TBD[c]
			Density Indicator	LMP-DI-2404	0-3 SpG				

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Table III.10.H.C – LAW Vitrification System Process and Leak Detection System Instruments and Parameters

Item No.	P&ID (24590-LAW-M6-)	Control Parameter	Measuring Instrument	Instrument Tag	Instrument Range	Failure State	Expected Range	Instrument Accuracy	Instrument Calibration Method and Range
5.	LMP-00002002	Melter 1 Glass Pool Level	Level Transmitter	LMP-LT-1403, LMP-LT-1405[a]	+/-200 in. WC	Fails High	27.0-33.0 in.	+/-.05% span	TBD[c]
			Level Indicator	LMP-LI-1403A	0 to 100 in.				
6.	LMP-00032002	Melter 2 Glass Pool Level	Level Transmitter	LMP-LT-2403, LMP-LT-2405[a]	+/-200 in. WC	Fails High	27.0-33.0 in.	+/-.05% span	TBD[c]
			Level Indicator	LMP-LI-2403A	0 to 100 in.				
7.	LMP-00002002	Melter 1 Plenum Pressure	Pressure Differential Transmitter	LMP-PDT-1410, LMP-PDT-1411[a]	+/- 30 in. WC	Fails High	-5.0 in. WC	+/- .05% span	TBD[c]
			Pressure Differential Indicator	LMP-PDI-1410, LMP-PDI-1411[a]					
8.	LMP-00032002	Melter 2 Plenum Pressure	Pressure Differential Transmitter	LMP-PDT-2410, LMP-PDT-2411[a]	+/- 30 in. WC	Fails High	-5.0 in. WC	+/- .05% span	TBD[c]
			Pressure Differential Indicator	LMP-PDI-2410, LMP-PDI-2411[a]					
9.	LMP-00007002	Melter 1 West Canister Level	Level Element (IR Camera)	LMP-LE-1466	0-90 in.	Reports Signal Failure	0-78 in.	TBD[c]	TBD[c]
			Level Transmitter	LMP-LT-1466					
			Level Indication	LMP-LI-1466B					

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Table III.10.H.C – LAW Vitrification System Process and Leak Detection System Instruments and Parameters

Item No.	P&ID (24590-LAW-M6-)	Control Parameter	Measuring Instrument	Instrument Tag	Instrument Range	Failure State	Expected Range	Instrument Accuracy	Instrument Calibration Method and Range
10.	LMP-00007001	Melter 1 East Canister Level	Level Element (IR Camera)	LMP-LE-1511	0-90 in.	Reports Signal Failure	0-78 in.	TBD [c]	TBD [c]
			Level Transmitter	LMP-LT-1511					
			Level Indication	LMP-LI-1511B					
11.	LMP-00037002	Melter 2 West Canister Level	Level Element (IR Camera)	LMP-LE-2466	0-90 in.	Reports Signal Failure	0-78 in.	TBD [c]	TBD [c]
			Level Transmitter	LMP-LT-2466					
			Level Indication	LMP-LI-2466					
12.	LMP-00037001	Melter 2 East Canister Level	Level Element (IR Camera)	LMP-LE-2511	0-90 in.	Reports Signal Failure	0-78 in.	TBD [c]	TBD [c]
			Level Transmitter	LMP-LT-2511					
			Level Indication	LMP-LI-2511B					
13.	LMP-00010001	Melter 1 West Discharge Air Lift	On/Off Plug Valve	LMP-YV-1125	Open/Closed	Fail Closed	Open	N/A	N/A
			Valve Control	LMP-YC-1125					
14.	LMP-00008001	Melter 1 East Discharge Air Lift	On/Off Plug Valve	LMP-YV-1047	Open/Closed	Fail Closed	Open	N/A	N/A
			Valve Control	LMP-YC-1047					
15.	LMP-00040001	Melter 2 West Discharge Air Lift	On/Off Plug Valve	LMP-YV-2125	Open/Closed	Fail Closed	Open	N/A	N/A
			Valve Control	LMP-YC-2125					

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Table III.10.H.C – LAW Vitrification System Process and Leak Detection System Instruments and Parameters

Item No.	P&ID (24590-LAW-M6-)	Control Parameter	Measuring Instrument	Instrument Tag	Instrument Range	Failure State	Expected Range	Instrument Accuracy	Instrument Calibration Method and Range
16.	LMP-00038001	Melter 2 East Discharge Air Lift	On/Off Plug Valve	LMP-YV-2047	Open/Closed	Fail Closed	Open	N/A	N/A
			Valve Control	LMP-YC-2047					
17.	LMP-00012001	Melter 1 Feed Encasement Assembly Leak Detection	Cable Type Conductivity Element	LMP-LE-1632	Low/High	Fail Low	Low	N/A	TBD [c]
			Level Alarm High	LMP-LAH-1632					
18.	LMP-00042001	Melter 2 Feed Encasement Assembly Leak Detection	Cable Type Conductivity Element	LMP-LE-2632	Low/High	Fail Low	Low	N/A	TBD [c]
			Level Alarm High	LMP-LAH-2632					
19.	LMP-00013002 and LMP-00005001	Melter 1 Lid Cooling	Temperature Element (RTD 100% Pt Sensor)	LMP-TE-1639, LMP-TE-1640	0-212ºF	Reports Signal Failure	103 ºF	±(0.3+.005|t)ºC [b]	TBD [c]
			Temperature Transmitter	LMP-TT-1293					
			Temperature Indicator	LMP-TI-1639, LMP-TI-1640					
20.	LMP-00043002 and LMP-00035001	Melter 2 Lid Cooling	Temperature Element	LMP-TE-2639, LMP-TE-2640	0-212ºF	Reports Signal Failure	103 ºF	±(0.3+.005|t)ºC [b]	TBD [c]
			Temperature Transmitter	LMP-TT-2293					

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Table III.10.H.C – LAW Vitrification System Process and Leak Detection System Instruments and Parameters

Item No.	P&ID (24590-LAW-M6-)	Control Parameter	Measuring Instrument	Instrument Tag	Instrument Range	Failure State	Expected Range	Instrument Accuracy	Instrument Calibration Method and Range
			Temperature Indicator	LMP-TI-2639, LMP-TI-2640					
21.	LMP-00001001 LMP-00002001	Melter 1 Bubbler Airflow Total	Flow Element	LMP-FE-1329-1397	0-5 scfm	Fail Open	0.75 scfm	1% span >30% FS	TBD [c]
			Flow Indicator	LMP-FI-TBD	0-90 scfm	Reports Signal Failure	13.5 scfm		
22.	LMP-00031001 and LMP-00032001	Melter 2 Bubbler Airflow Total	Flow Element	LMP-FE-2329-2397	0-5 scfm	Fail Open	0.75 scfm	1% span >30% FS	TBD [c]
			Flow Indicator	LMP-FI-TBD	0-90 scfm	Reports Signal Failure	13.5 scfm		
23.	LOP-00001001	SBS Temperature Melter 1	Temperature Element (RTD 100% Pt Sensor)	LOP-TE-1038	-328-1562ºF	Fail Low	122ºF	±(0.3+.005|t|) ºC [b]	TBD [c]
			Temperature Transmitter	LOP-TT-1038					
			Temperature Indicator	LOP-TI-1038					
24.	LOP-00002001	SBS Temperature Melter 2	Temperature Element (RTD 100% Pt Sensor)	LOP-TE-2038	-328-1562ºF	Fail Low	122ºF	±(0.3+.005|t|) ºC [b]	TBD [c]
			Temperature Transmitter	LOP-TT-2038					
			Temperature Indicator	LOP-TI-2038					

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Table III.10.H.C – LAW Vitrification System Process and Leak Detection System Instruments and Parameters

Item No.	P&ID (24590-LAW-M6-)	Control Parameter	Measuring Instrument	Instrument Tag	Instrument Range	Failure State	Expected Range	Instrument Accuracy	Instrument Calibration Method and Range
25.	LOP-00001004	WESP Temperature Melter 1	Temperature Element (RTD 100% Pt Sensor)	LOP-TE-1047	-328-1562ºF	Fail Low	122ºF	±(0.3+.005|t|) ºC[b]	TBD [c]
			Temperature Transmitter	LOP-TT-1047					
			Temperature Indicator	LOP-TI-1047					
26.	LOP-00002004	WESP Temperature Melter 2	Temperature Element (RTD 100% Pt Sensor)	LOP-TE-2047	-328-1562ºF	Fail Low	125ºF	±(0.3+.005|t|) ºC[b]	TBD [c]
			Temperature Transmitter	LOP-TT-2047					
			Temperature Transmitter	LOP-TI-2047					
27.	LVP-00001002	HEPA Inlet Temperature	Temperature Element (RTD 100% Pt Sensor)	LVP-TE-0104	0-900ºF	Reports Signal Failure	160ºF	±(0.3+.005|t|) ºC[b]	TBD [c]
			Temperature Transmitter	LVP-TT-0104					
			Temperature Transmitter	LVP-TI-0104					

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Table III.10.H.C – LAW Vitrification System Process and Leak Detection System Instruments and Parameters

Item No.	P&ID (24590-LAW-M6-)	Control Parameter	Measuring Instrument	Instrument Tag	Instrument Range	Failure State	Expected Range	Instrument Accuracy	Instrument Calibration Method and Range
28.	LVP-00005002	TCO Discharge Temperature	Temperature Element (Type J Thermocouple)	LVP-TE-0511	32-900ºF	Reports Signal Failure	720-750ºF	±(0.3+.005|t|) ºC[b]	TBD [c]
			Temperature Transmitter	LVP-TT-0511					
			Temperature Transmitter	LVP-TI-0511					
29.	LVP-00002006	Stack Maximum CO Concentration (Hourly Rolling Average)	Analysis Element	SDJ-AE-2110, SDJ-AE-2124	Dual Range Analyzer: 0-200 ppm 0-3000 ppm	Drive Output Low, Activate Alarm	0.3-61.6 ppm	1% span	Automated Calibration with Alarms
			Analysis Transmitter	SDJ-AT-2110, SDJ-AT-2124					
			Analysis Indication	SDJ-AI-2110, SDJ-AI-2124					

Footnotes:

N/A – not applicable; TBD = to be determined

[a] These instruments sets are duplicates. Only one instrument set is required to remain functioning during waste feed operations.

[b] Resistance temperature detector (RTD) class B.

[c] To be determined by Plant Engineering as each instrument calibration package is developed. All TBD items will be replaced with actual values in the required 180-day resubmittal of the EPDT Plan in accordance with III.10.H.3.a.ii.

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Table III.10.H.D – Maximum Feed-Rates to LAW Vitrification System

Description of Waste	Individual Rate (lb/hr)	Total Rate (lb/hr)
PODC (as total organic carbon)[2]	--	13.64
Naphthalene	11.6	--
Chlorobenzene	2.04	--
Dangerous and Mixed Waste Feed-rate	--	68.76
Total Chlorine/Chloride Feed-rate	--	40.73
Chlorine (from simulant)	TBD	--
Chlorine (from metals spiking)	TBD	--
Chlorine (from PODC spiking)	0.64	--
Total Metal Feed-rates	--	14.39
Lead (from spiking)	4.91	--
Chromium (from spiking)	9.48	--
EMF Effluent Return Metal Feed-rates[1]	TBD	TBD

Footnotes:

[1] Process samples will be taken in accordance with Section 5.1.4.2 of Appendix 9.15, Environmental Performance Demonstration Test Plan.

[2] Feed sufficient to demonstrate 99.99% DRE plus a safety factor of 10.

Table III.10.H.E – LAW Vitrification System Estimated Emission Rates

Analyte	Performance Standard
2,3,7,8 -like Dioxins/furans, ng-TEQ/dscm	0.20 ng/dscm
Low-volatile Metals, **total**	97 µg/dscm
• Arsenic	_
• Beryllium	_
• Chromium	_
Semivolatile Metals, **total**	120 µg/dscm
• Lead	_

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Table III.10.H.E – LAW Vitrification System Estimated Emission Rates

Analyte	Performance Standard
• Cadmium	_
Mercury	45 µg/dscm
Hydrogen chloride and chlorine gas (total chlorine)	21 ppmv
Particulate Matter	0.015 gr/dscf
Carbon Monoxide	100 ppmv
Hydrocarbon (as propane)[1]	10 ppmv

Footnotes:

[1] Hydrocarbon are only applicable during the Demonstration Test Period and is measured by a temporary continuous monitoring system.

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Table III.10.H.F – LAW Vitrification System Automatic Waste Feed Cutoff Parameters During Short Term Treatment Operations

Item	Sub-system	Parameter Description	Type of Indicator	Instrument Tag Number	AWFCO Setpoint
1.	Bubblers Melter 1	Total Air Flow Maximum	Flow Indicator	LMP-FI-TBD	24.0 scfm
2.	Bubblers Melter 2	Total Air Flow Maximum	Flow Indicator	LMP-FI-TBD	24.0 scfm
3.	Plenum Melter 1	Plenum vs. Annulus Pressure Differential Maximum	Pressure Differential	LMP-PDI-1410A, LMP-PDSHH-1410A	-0.5 in. WC
4.	Plenum Melter 2	Plenum vs. Annulus Pressure Differential Maximum	Pressure Differential	LMP-PDI-2410A, LMP-PDSHH-2410A	-0.5 in. WC
5.	SBS Melter 1	Maximum Gas Temperature	Temperature Indicator	LOP-TI-1038	150ºF
6.	SBS Melter 2	Maximum Gas Temperature	Temperature Indicator	LOP-TI-2038	150ºF
7.	WESP Melter 1	Maximum Gas Temperature	Temperature Indicator	LOP-TI-1047	155ºF
8.	WESP Melter 2	Maximum Gas Temperature	Temperature Indicator	LOP-TI-2047	155ºF
9.	HEPA Inlet Temperature	Maximum Gas Temperature	Temperature Indicator	LVP-TI-0104	191ºF
10.	TCO Temperature	Minimum Gas Temperature	Temperature Indicator	LVP-TI-0511	698ºF
11.	LAW Stack	Maximum CO Concentration (Hourly Rolling Average)	Concentration Analyzer Indicator	SDJ-AI-2110D	100 ppm ROHA

Footnotes:

NOTE: Maintenance, at a minimum, is in accordance with equipment manufacturer's recommendations. Dangerous and mixed waste treatment may continue during maintenance activities conducted with site-specific standard operating procedures, for a maximum of 24 hours after instrument malfunction/failure. Also, dangerous and mixed waste treatment may continue during calibrations and "blowback cycles" in accordance with manufacturer's recommendations.

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III.10.I LAW VITRIFICATION SYSTEM – LONG TERM MISCELLANEOUS THERMAL TREATMENT UNIT

For purposes of Permit Section III.10.I, where reference is made to WAC 173-303-640, the following substitutions apply: substitute the terms "LAW Vitrification System" for "tank system(s)," "sub-system(s)" for "tank(s)," "sub-system equipment" for "ancillary equipment," and "sub-system(s) or sub-system equipment of a LAW Vitrification System" for "component(s)," in accordance with WAC 173-303-680.

III.10.I.1 Requirements for LAW Vitrification System Beginning Normal Operation

Prior to commencing normal operations provided in Permit Section III.10.I, all requirements in Permit Section III.10.H will have been met by the Permittees and approved by Ecology, including the following: The LAW Vitrification System Demonstration Test results and the revised Final Risk Assessment provided for in Permit Condition III.10.C.11.c or III.10.C.11.d and Permit Section III.10.H, will have been evaluated and approved by Ecology, Permit Tables III.10.I.D and F, as approved/modified pursuant to Permit Condition III.10.H.5, will have been completed, submitted and approved pursuant to Permit Condition III.10.H.3.d.v and Permit Table III.10.I.E, as approved/modified pursuant to Permit Condition III.10.H.5, will have been completed, submitted and approved pursuant to Permit Condition III.10.C.11.c or d.

III.10.I.1.a Construction and Maintenance [WAC 173-303-640, in accordance with WAC 173-303-680(2) and (3) and WAC 173-303-340].

III.10.I.1.a.i The Permittees will maintain the design and construction of the LAW Vitrification System as specified in Permit Condition III.10.I.1, Operating Unit Group 10, Chapter 4 of this Permit, and Operating Unit Group 10, Appendices 9.1 through 9.17 of this Permit, as approved pursuant to Permit Conditions III.10.H.5.a through d and III.10.H.5.f.

III.10.I.1.a.ii The Permittees will maintain the design and construction of all containment systems for the LAW Vitrification System, as specified in Operating Unit Group 10, Chapter 4 of this Permit, and Operating Unit Group 10, Appendices 9.2 and 9.4 through 9.14 of this Permit, as approved pursuant to Permit Conditions III.10.H.5.a through d.

III.10.I.1.a.iii Modifications to approved design, plans, and specifications in Operating Unit Group 10 of this Permit for the LAW Vitrification System will be allowed only in accordance with Permit Conditions III.10.C.2.e and f, or III.10.C.2.g, III.10.C.9.d, e, and h.

III.10.I.1.a.iv The Permittees will ensure all certifications required by specialists (e.g., independent qualified registered professional engineer; registered professional engineer; independent corrosion expert; independent qualified installation inspector; installation inspector; etc.) use the following statement or equivalent pursuant to Permit Condition III.10.C.10:

> "I, (Insert Name) have (choose one or more of the following: overseen, supervised, reviewed, and/or certified) a portion of the design or installation of a new LAW Vitrification system or component located at (address), and owned/operated by (name(s)). My duties were: (e.g., installation inspector, testing for tightness, etc.), for the following LAW Vitrification System components (e.g., the venting piping, etc.), as required by the Dangerous Waste Regulations, namely, WAC 173-303-640(3) (applicable paragraphs [i.e., (a) through (g)], in accordance with WAC 173-303-680.

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"I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

III.10.I.1.a.v The Permittees will ensure periodic integrity assessments are conducted on the LAW Vitrification System listed in Permit Table III.10.I.A, as approved/modified pursuant to Permit Condition III.10.H.5, over the term of this Permit in accordance with WAC 173-303-680(2) and (3) as specified in WAC 173-303-640(3)(b), following the description of the integrity assessment program and schedule in Operating Unit Group 10, Chapter 6 of this Permit, as approved pursuant to Permit Conditions III.10.H.5.e.i and III.10.C.5.c. Results of the integrity assessments will be included in the WTP Unit operating record until ten (10) years after post closure, or corrective action is complete and certified, whichever is later.

III.10.I.1.a.vi The Permittees will address problems detected during the LAW Vitrification System integrity assessments specified in Permit Condition III.10.I.1.a.v following the description of the integrity assessment program in Operating Unit Group 10, Chapter 6 of this Permit, as approved pursuant to Permit Conditions III.10.H.5.e.i and III.10.C.5.c.

III.10.I.1.a.vii All process monitors/instruments as specified in Permit Table III.10.I.F, as approved/modified pursuant to Permit Conditions III.10.H.5 and III.10.H.3.d.v, will be equipped with operational alarms to warn of deviation, or imminent deviation from the limits specified in Permit Table III.10.I.F.

III.10.I.1.a.viii The Permittees will install and test all process and leak detection system monitors/instruments, as specified in Permit Tables III.10.I.C and III.10.I.F, as approved/modified pursuant to Permit Condition III.10.H.5 and III.10.H.3.d.v, in accordance with Operating Unit Group 10, Appendices 9.1, 9.2, and 9.14 of this Permit, as approved pursuant to Permit Conditions III.10.H.5.d.x and III.10.H.5.f.xvi.

III.10.I.1.a.ix No dangerous and/or mixed waste will be treated in the LAW Vitrification System unless the operating conditions, specified under Permit Condition III.10.I.1.c are complied with.

III.10.I.1.a.x The Permittees will not place dangerous and/or mixed waste, treatment reagents, or other materials in the LAW Vitrification System if these substances could cause the sub-system, sub-system equipment, or the containment system to rupture, leak, corrode, or otherwise fail [WAC 173-303-640(5)(a), in accordance with WAC 173-303-680(2)]. This condition is not applicable to corrosion of LAW Vitrification System sub-system or sub-system equipment that are expected to be replaced as part of normal operations (e.g., melters).

III.10.I.1.a.xi The Permittees will operate the LAW Vitrification System to prevent spills and overflows using description of controls and practices as required under WAC 173-303-640(5)(b), described in Permit Condition III.10.C.5 and Operating Unit Group 10, Appendix 9.18 of this Permit, as approved pursuant to Permit Condition III.10.H.5.e [WAC 173-303-640(5)(b), in accordance with WAC 173-303-680(2) and (3), and WAC 173-303-806(4)(c)(ix)].

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III.10.I.1.a.xii For routinely non-accessible LAW Vitrification System sub-systems, as specified in Operating Unit Group 10, Chapter 4 of this Permit, as updated pursuant to Permit Condition III.10.H.5.e.vi, the Permittees will mark all routinely non-accessible LAW Vitrification System sub-systems access points with labels or signs to identify the waste contained in each LAW Vitrification System sub-system. The label, or sign, must be legible at a distance of at least fifty (50) feet and must bear a legend which identifies the waste in a manner which adequately warns employees, emergency response personnel, and the public of the major risk(s) associated with the waste being stored or treated in the LAW Vitrification System sub-systems. For the purposes of this permit condition, "routinely non-accessible" means personnel are unable to enter these areas while waste is being managed in them [WAC 173-303-640(5)(d), in accordance with WAC 173-303-680(2)].

III.10.I.1.a.xiii For the LAW Vitrification System sub-systems not addressed in Permit Condition III.10.I.1.a.xi, the Permittees will mark these LAW Vitrification System sub-systems holding dangerous and/or mixed waste with labels or signs to identify the waste contained in the LAW Vitrification System sub-systems. The labels, or signs, must be legible at a distance of at least fifty (50) feet and must bear a legend which identifies the waste in a manner which adequately warns employees, emergency response personnel, and the public of the major risk(s) associated with the waste being stored or treated in the LAW Vitrification System sub-systems [WAC 173-303-640(5)(d), in accordance with WAC 173-303-680(2)].

III.10.I.1.a.xiv The Permittees will ensure that the secondary containment systems for the LAW Vitrification System sub-systems listed in Permit Tables III.10.I.A and III.10.I.B, as approved/modified pursuant to Permit Condition III.10.H.5, are free of cracks or gaps to prevent any migration of dangerous and/or mixed waste or accumulated liquid out of the system to the soil, groundwater, or surface water at any time during use of the LAW Vitrification System sub-systems. Any indication that a crack or gap may exist in the containment systems will be investigated and repaired in accordance with Operating Unit Group 10, Appendix 9.18 of this Permit, as approved pursuant to Permit Condition III.10.H.5.e.v [WAC 173-303-640(4)(b)(i), WAC 173-303-640(4)(e)(i)(C), and WAC 173-303-640(6), in accordance with WAC 173-303-680(2) and (3), WAC 173-303-806(4)(i)(i)(B), and WAC 173-303-320].

III.10.I.1.a.xv The Permittees must immediately, and safely, remove from service any LAW Vitrification System or secondary containment system which through an integrity assessment is found to be "unfit for use" as defined in WAC 173-303-040, following Permit Condition III.10.I.1.a.xvii A through D, and F. The affected LAW Vitrification System or secondary containment system must be either repaired or closed in accordance with Permit Condition III.10.I.1.a.xvii.E [WAC 173-303-640(7)(e) and (f) and WAC 173-303-640(8), in accordance with WAC 173-303-680(3)].

III.10.I.1.a.xvi An impermeable coating, as specified in Operating Unit Group 10, Appendices 9.4, 9.5, 9.7, 9.9, 9.11, and 9.12 of this Permit, as approved pursuant to Permit Condition III.10.H.5.b.v, will be maintained for all concrete containment systems and concrete portions of containment systems for the LAW Vitrification System sub-systems listed in Permit Tables III.10.I.A and III.10.I.B, as approved/modified pursuant to Permit Condition III.10.H.5 (concrete containment systems that do not have a liner, pursuant to WAC 173-303-640(4)(e)(i), in accordance with WAC 173-303-680(2), and have construction joints, will meet the requirements of WAC 173-303-640(4)(e)(ii)(C), in accordance with WAC 173-303-680(2). The coating will prevent migration of any

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dangerous and/or mixed waste into the concrete. All coatings will meet the following performance standards:

A. The coating must seal the containment surface such that no cracks, seams, or other avenues through which liquid could migrate are present.

B. The coating must be of adequate thickness and strength to withstand the normal operation of equipment and personnel within the given area such that degradation or physical damage to the coating or lining can be identified and remedied before dangerous and mixed waste could migrate from the system.

C. The coating must be compatible with the dangerous and/or mixed waste, treatment reagents, or other materials managed in the containment system [WAC 173-303-640(4)(e)(ii)(D), in accordance with WAC 173-303-680(2) and (3) and WAC 173-303-806(4)(i)(i)(A)].

III.10.I.1.a.xvii The Permittees inspect all secondary containment systems for the LAW Vitrification System sub-systems listed in Permit Tables III.10.I.A and III.10.I.B, as approved/modified pursuant to Permit Condition III.10.H.5, in accordance with the Inspection Plan specified in Operating Unit Group 10, Chapter 6A of this Permit, as approved pursuant to Permit Conditions III.10.H.5.e.i and III.10.C.5.c, and take the following actions if a leak or spill of dangerous and/or mixed waste is detected in these containment systems [WAC 173-303-640(5)(c) and WAC 173-303-640(6), in accordance with WAC 173-303-680(2) and (3), WAC 173-303-320, and WAC 173-303-806(4)(i)(i)(B)].

A. Immediately, and safely, stop the flow of dangerous and/or mixed waste into the LAW Vitrification System sub-systems or secondary containment system.

B. Determine the source of the dangerous and/or mixed waste.

C. Remove the waste from the containment area in accordance with WAC 173-303-680(2) and (3) as specified in WAC 173-303-640(7)(b). The waste removed from containment areas of the LAW Vitrification System sub-systems will be, as a minimum, managed as dangerous and/or mixed waste.

D. If the cause of the release was a spill that has not damaged the integrity of the LAW Vitrification System sub-system, the Permittees may return the LAW Vitrification System sub-system to service in accordance with WAC 173-303-680(2) and (3) as specified in WAC 173-303-640(7)(e)(ii). In such case, the Permittees will take action to ensure the incident that caused the dangerous and/or mixed waste to enter the containment system will not reoccur.

E. If the source of the dangerous and/or mixed waste is determined to be a leak from the primary LAW Vitrification System into the secondary containment system, or the system is unfit for use as determined through an integrity assessment or other inspection, the Permittees will comply with the requirements of WAC 173-303-640(7) and take the following actions:

1. Close the LAW Vitrification System sub-system following procedures in WAC 173-303-640(7)(e)(i), in accordance with WAC 173-303-680 and Operating Unit Group 10, Chapter 11 of this Permit, as approved pursuant to Permit Condition III.10.C.8.

2. Repair and re-certify (in accordance with WAC 173-303-810(13)(a), as modified pursuant to Permit Condition III.10.I.1.a.iii) the LAW

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Vitrification System in accordance with Operating Unit Group 10, Appendix 9.18 of this Permit, as approved pursuant to Permit Condition III.10.H.5.e.v, before the LAW Vitrification System is placed back into service [WAC 173-303-640(7)(e)(iii) and WAC 173-303-640(7)(f), in accordance with WAC 173-303-680].

F. The Permittees will document in the WTP Unit operating record actions/procedures taken to comply with A through E above, as specified in WAC 173-303-640(6)(d), in accordance with WAC 173-303-680(2) and (3).

G. In accordance with WAC 173-303-680(2) and (3), the Permittees will notify and report releases to the environment to Ecology, as specified in WAC 173-303-640(7)(d).

III.10.I.1.a.xviii If liquids (e.g., dangerous and/or mixed waste, leaks and spills, precipitation, fire water, liquids from damaged or broken pipes) cannot be removed from the secondary containment system within twenty-four (24) hours, Ecology will be verbally notified within twenty-four (24) hours of discovery. The notification will provide the information in A, B, and C, listed below. The Permittees will provide Ecology with a written demonstration within seven (7) business days, identifying at a minimum [WAC 173-303-640(4)(c)(iv) and WAC 173-303-640(7)(b)(ii), in accordance with WAC 173-303-680(3) and WAC 173-303-806(4)(i)(i)(B)]:

A. Reasons for delayed removal.

B. Measures implemented to ensure continued protection of human health and the environment.

C. Current actions being taken to remove liquids from secondary containment.

III.10.I.1.a.xix All air pollution control devices and capture systems in the LAW Vitrification System will be maintained and operated at all times in a manner so as to minimize the emissions of air contaminants and to minimize process upsets. Procedures for ensuring that the air pollution control devices and capture systems in the LAW Vitrification System are properly operated and maintained so as to minimize the emission of air contaminants and process upsets will be established.

III.10.I.1.a.xx In all future narrative permit submittals, the Permittees will include LAW Vitrification sub-system names with the sub-system designation.

III.10.I.1.a.xxi For any portion of the LAW Vitrification System that has the potential for formation and accumulation of hydrogen gases, the Permittees will operate the portion to maintain hydrogen levels below the lower explosive limit [WAC 173-303-815(2)(b)(ii)].

III.10.I.1.a.xxii For each LAW Vitrification System sub-system holding dangerous and/or mixed waste that are acutely or chronically toxic by inhalation, the Permittees will operate the system to prevent escape of vapors, fumes, or other emissions into the air [WAC 173-303-806(4)(i)(i)(B) and WAC 173-303-640(5)(e), in accordance with WAC 173-303-680].

III.10.I.1.a.xxiii The existing LAW building will retain capability to install the third melter before or after hot start-up. No permanent systems, structures, or components shall be installed in the melter cell, pour cave or wet process cell for the third melter that would preclude future installation of the third melter.

III.10.I.1.b Performance Standards

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III.10.I.1.b.i The LAW Vitrification System must achieve a DRE of 99.99% for the PODCs listed below [40 CFR §63.1203(c)(1) and 40CFR §63.1203(c)(2), in accordance with WAC 173-303-680(2)]:

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DRE in this permit condition will be calculated in accordance with the formula given below:

DRE=[1-(Wout/Win)] x 100%

Where:

Win=mass feed rate of one PODC in a waste feed stream; and

Wout=mass emission rate of the same PODC present in exhaust emissions prior to release to the atmosphere.

III.10.I.1.b.ii Particulate matter emissions from the LAW Vitrification System will not exceed 34 mg/dscm (0.015 grains/dscf) [40 CFR §63.1203(b)(7), in accordance with WAC 173-303-680(2)];

III.10.I.1.b.iii Hydrochloric acid and chlorine gas emissions from the LAW Vitrification System will not exceed 21 ppmv, combined [40 CFR §63.1203(b)(6), in accordance with WAC 173-303-680(2)];

III.10.I.1.b.iv Dioxin and Furan TEQ emissions from the LAW Vitrification System will not exceed 0.2 nanograms (ng)/dscm, [40 CFR §63.1203(b)(1), in accordance with WAC 173-303-680(2)];

III.10.I.1.b.v Mercury emissions from the LAW Vitrification System will not exceed 45 µg/dscm [40 CFR §63.1203(b)(2), in accordance with WAC 173-303-680(2)];

III.10.I.1.b.vi Lead and cadmium emissions from the LAW Vitrification System will not exceed 120 µg/dscm, combined [40 CFR §63.1203(b)(3), in accordance with WAC 173-303-680(2)];

III.10.I.1.b.vii Arsenic, beryllium, and chromium emissions from the LAW Vitrification System will not exceed 97 µg/dscm, combined [40 CFR §63.1203(b)(4), in accordance with WAC 173-303-680(2)];

III.10.I.1.b.viii Carbon monoxide (CO) emission from the LAW Vitrification System will not exceed 100 parts per million (ppm) by volume, over an hourly rolling average (as measured and recorded by the CMS), dry basis [40 CFR §63.1203(b)(5)(i), in accordance with WAC 173-303-680(2) and (3)];

III.10.I.1.b.ix RESERVED

III.10.I.1.b.x If the emissions from the LAW Vitrification System exceed the emission rates listed in Permit Table III.10.I.E, as approved pursuant to Permit Condition III.10.C.11.c or d, the Permittees will perform the following actions [WAC 173-303-680(2) and (3), and WAC 173-303-815(2)(b)(ii)]:

A. Verbally notify Ecology within twenty-four (24) hours of the discovery of exceeding the emission rate(s) as specified in Permit Condition I.E.21.

B. Submit to Ecology additional risk information to indicate that the increased emissions impact is offset by decreased emission impact from one or more constituents expected to be emitted at the same time, and/or investigate the cause and impact of the exceedance of the emission rate(s) and submit a

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report of the investigation findings to Ecology within fifteen (15) days of the discovery of exceeding the emission rate(s).

C. Based on the notification and any additional information, Ecology may provide, in writing, direction to the Permittees to stop dangerous and/or mixed waste feed to the LAW Vitrification System and/or to submit a RDTP as a permit modification pursuant to Permit Conditions III.10.C.2.e through g. The RDTP must include substantive changes to prevent failure from reoccurring.

The emission limits specified in Permit Conditions III.10.I.1.b.i through III.10.I.1.b.ix above, will be met for the LAW Vitrification System by limiting feed rates as specified in Permit Tables III.10.I.D and III.10.I.F, as approved/modified pursuant to Permit Conditions III.10.H.5 and III.10.H.3.d.v, compliance with operating conditions specified in Permit Condition III.10.I.1.c (except as specified in Permit Condition III.10.I.1.b.xii), and compliance with Permit Condition III.10.I.1.b.xi;

III.10.I.1.b.xi Treatment effectiveness, feed-rates and operating rates for dangerous and/or mixed waste management units contained in the LAW Building, but not included in Permit Table III.10.I.A, as approved/modified pursuant to Permit Condition III.10.H.5, will be as specified in Permit Sections III.10.D through F and consistent with assumptions and basis which are reflected in Operating Unit Group 10, Appendix 6.3 of this Permit, as approved pursuant to Permit Condition III.10.C.11.b. For the purposes of this permit condition, Operating Unit Group 10, Appendix 6.3 will be superseded by Appendix 6.4 upon its approval pursuant to either Permit Condition III.10.C.11.c or III.10.C.11.d [WAC 173-303-680(2) and (3), and WAC 173-303-815(2)(b)(ii)];

III.10.I.1.b.xii Except during periods of LAW Vitrification System startup and shutdown, compliance with the operating conditions specified in Permit Condition III.10.I.1.c, will be regarded as compliance with the required performance standards identified in Permit Conditions III.10.I.1.b.i through x. However, if it is determined that during the effective period of this Permit that compliance with the operating conditions in Permit Condition III.10.I.1.c is not sufficient to ensure compliance with the performance standards specified in Permit Conditions III.10.I.1.b.i through x, the Permit may be modified, revoked, or reissued pursuant to Permit Conditions III.10.C.2.e and f, or III.10.C.2.g.

III.10.I.1.c Operating Conditions [WAC 173-303-670(6), in accordance with WAC 173-303-680(2) and (3)]

The Permittees will operate the LAW Vitrification System in accordance with Operating Unit Group 10, Chapter 4 of this Permit, as updated pursuant to Permit Condition III.10.H.5.e.vi and Operating Unit Group 10, Appendix 9.18 of this Permit, as approved pursuant to Permit Condition III.10.H.5.e, and Operating Unit Group 10, Appendix 9.15 of this Permit, as approved pursuant to Permit Condition III.10.H.5.f, except as modified pursuant to Permit Conditions III.10.H.3, III.10.I.1.b.x, III.10.I.1.b.xii, III.10.I.1.h, and in accordance with and the following:

III.10.I.1.c.i The Permittees will operate the LAW Vitrification System in order to maintain the systems and process parameters listed in Permit Tables III.10.I.C and III.10.I.F, as approved/modified pursuant to Permit Conditions III.10.H.5 and III.10.H.3.d.v, within the set-points specified in Permit Table III.10.I.F.

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III.10.I.1.c.ii The Permittees will operate the AWFCO systems, specified in Permit Table III.10.I.F, as approved/modified pursuant to Permit Conditions III.10.H.5 and III.10.H.3.d.v, to automatically cut-off and/or lock-out the dangerous and/or mixed waste feed to LAW Vitrification System when the monitored operating conditions deviate from the set-points specified in Permit Table III.10.I.F.

III.10.I.1.c.iii The Permittees will operate the AWFCO systems, specified in Permit Table III.10.I.F, as approved/modified pursuant to Permit Conditions III.10.H.5 and III.10.H.3.d.v, to automatically cut-off and/or lock-out the dangerous and/or mixed waste feed to LAW Vitrification System when all instruments specified in Permit Table III.10.H.F for measuring the monitored parameters fails or exceeds its span value.

III.10.I.1.c.iv The Permittees will operate the AWFCO systems, specified in Permit Table III.10.I.F, as approved/modified pursuant to Permit Conditions III.10.H.5 and III.10.H.3.d.v, to automatically cut-off and/or lock out the dangerous waste and/or mixed waste feed to the LAW Vitrification System when any portion of the LAW Vitrification System is bypassed. The terms "bypassed" and "bypass event," as used in Permit Sections III.10.H and III.10.I, will mean if any portion of the LAW Vitrification System is bypassed so that gases are not treated as during the Demonstration Test.

III.10.I.1.c.v In the event of a malfunction of the AWFCO systems listed in Permit Table III.10.I.F, as approved/modified pursuant to Permit Conditions III.10.H.5 and III.10.H.3.d.v, the Permittees will immediately, manually cut-off the dangerous and/or mixed waste feed to the LAW Vitrification System. The Permittees will not restart the dangerous and/or mixed waste feed until the problem causing the malfunction has been identified and corrected.

III.10.I.1.c.vi The Permittees will manually cut-off the dangerous and/or mixed waste feed to the LAW Vitrification System when the operating conditions deviate from the limits specified in Permit Condition III.10.I.1.c.i, unless the deviation automatically activates the waste feed cut-off sequence specified in Permit Conditions III.10.I.1.c.ii, iii, and/or iv.

III.10.I.1.c.vii If greater than thirty (30) dangerous and/or mixed waste feed cut-off, combined, to the LAW Vitrification System occur due to deviations from Permit Table III.10.I.F, as approved/modified pursuant to Permit Conditions III.10.H.5 and III.10.H.3.d.v, within a sixty (60) day period, the Permittees will submit a written report to Ecology within five (5) calendar days of the thirty-first exceedance, including the information specified below. These dangerous and/or mixed waste feed cut-offs to the LAW Vitrification System, whether automatically or manually activated, are counted if the specified set-points are deviated from while dangerous and/or mixed waste and waste residues continue to be processed in the LAW Vitrification System. A cascade event is counted at a frequency of one (1) towards the first waste feed cut-off parameter, specified in Permit Table III.10.I.F, from which the set-point is deviated:

A. The parameter(s) that deviated from the set-point(s) in Permit Table III.10.I.F.
B. The magnitude, dates, and duration of the deviations.
C. Results of the investigation of the cause of the deviations.
D. Corrective measures taken to minimize future occurrences of the deviations.

III.10.I.1.c.viii If greater than thirty (30) dangerous and/or mixed waste feed cut-off, combined, to the LAW Vitrification System occur due to deviations from Permit Table III.10.I.F, as approved/modified pursuant to Permit Conditions III.10.H.5 and III.10.H.3.d.v, within

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a thirty (30) day period, the Permittees will submit the written report required to be submitted pursuant to Permit Condition III.10.I.1.c.vii to Ecology on the first business day following the thirty-first exceedance. These dangerous and/or mixed waste feed cut-offs to the LAW Vitrification System, whether automatically or manually activated, are counted if the specified set-points are deviated from while dangerous and/or mixed waste and waste residues continue to be processed in the LAW Vitrification System. A cascade event is counted at a frequency of one (1) towards the first waste feed cut-off parameter, specified on Permit Table III.10.I.F, from which the set-point is deviated:

In accordance with WAC 173-303-680(2) and (3), the Permittees may not resume dangerous and/or mixed waste feed to the LAW Vitrification System until this written report has been submitted, and

A. Ecology has authorized the Permittees, in writing, to resume dangerous and/or mixed waste feed, or

B. Ecology has not, within seven (7) days, notified the Permittees in writing of the following:

1. The Permittees written report does not document that the corrective measures taken will minimize future exceedances.

2. The Permittees must take further corrective measures and document that these further corrective measures will minimize future exceedances.

III.10.I.1.c.ix If any portion of the LAW Vitrification System is bypassed while treating dangerous and/or mixed waste, it will be regarded as non-compliance with the operating conditions specified in Permit Condition III.10.I.1.c and the performance standards specified in Permit Condition III.10.I.1.b. After such a bypass event, the Permittees will perform the following actions:

A. Investigate the cause of the bypass event.

B. Take appropriate corrective measures to minimize future bypasses.

C. Record the investigation findings and corrective measures in the WTP Unit operating record.

D. Submit a written report to Ecology within five (5) days of the bypass event documenting the result of the investigation and corrective measures.

III.10.I.1.c.x The Permittees will control fugitive emissions from the LAW Vitrification System by maintaining the melters under negative pressure.

III.10.I.1.c.xi Except during periods of vitrification system startup and shutdown, compliance with the operating conditions specified in Permit Condition III.10.I.1.c will be regarded as compliance with the required performance standards identified in Permit Condition III.10.I.1.b. However, evidence that compliance with these operating conditions is insufficient to ensure compliance with the performance standards, will justify modification, revocation, or re-issuance of this Permit, in accordance with Permit Conditions III.10.C.2.e and f, or III.10.C.2.g.

III.10.I.1.d Inspection Requirements [WAC 173-303-680(3)]

III.10.I.1.d.i The Permittees will inspect the LAW Vitrification System in accordance with the Inspection Plan in Operating Unit Group 10, Chapter 6A of this Permit, as modified in accordance with Permit Condition III.10.C.5.c.

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III.10.I.1.d.ii The inspection data for LAW Vitrification System will be recorded, and the records will be placed in the WTP Unit operating record for LAW Vitrification System, in accordance with Permit Condition III.10.C.4.

III.10.I.1.d.iii The Permittees will comply with the inspection requirements specified in Operating Unit Group 10, Appendix 9.15 of this Permit, as approved pursuant to Permit Condition III.10.H.5.f and as modified by Permit Conditions III.10.H.3, III.10.I.1.b.x, III.10.I.1.b.xii, and III.10.I.1.h.

III.10.I.1.e Monitoring Requirements [WAC 173-303-670(5), WAC 173-303-670(6), WAC 173-303-670(7), and WAC 173-303-807(2), in accordance with WAC 173-303-680(3)]

III.10.I.1.e.i Upon receipt of a written request from Ecology, the Permittees will perform sampling and analysis of the dangerous and/or mixed waste and exhaust emissions to verify that the operating requirements established in the Permit achieve the performance standards delineated in this Permit.

III.10.I.1.e.ii The Permittees will comply with the monitoring requirements specified in the Operating Unit Group 10, Appendices 9.2, 9.3, 9.7, 9.13, 9.15 and 9.18 of this Permit, as approved pursuant to Permit Condition III.10.H.5, and as modified by Permit Conditions III.10.H.3, III.10.I.1.h, III.10.I.1.b.x, and III.10.I.1.b.xii.

III.10.I.1.e.iii The Permittees will operate, calibrate, and maintain the carbon monoxide and CEMS as specified in this Permit in accordance with Performance Specifications found in 40 CFR Part 60, Appendix B, in accordance with Appendix to Subpart EEE of 40 CFR Part 63, and Operating Unit Group 10 Appendix 9.15 of this Permit, as approved pursuant to Permit Condition III.10.H.5.f, and as modified by Permit Conditions III.10.H.3, III.10.I.1.h, III.10.I.1.b.x, and III.10.I.1.b.xii.

III.10.I.1.e.iv The Permittees will operate, calibrate, and maintain the instruments specified in Permit Tables III.10.I.C and F, as approved/modified pursuant to Permit Conditions III.10.H.5 and III.10.H.3.d.v, in accordance with Operating Unit Group 10, Appendix 9.15 of this Permit, as approved pursuant to Permit Condition III.10.H.5.f, and as modified by Permit Conditions III.10.H.3, III.10.I.1.h, III.10.I.1.b.x, and III.10.I.1.b.xii.

III.10.I.1.e.v The Permittees shall calibrate, inspect, and maintain or replace the following Melter 1 and Melter 2 cooling water flow and temperature instruments in accordance with manufacturer's recommendations, or as specified in this permit, or otherwise agreed to by Ecology (Melter 1: FT/TI&FI-1206, FT/TI&FI-1209, FT/TI&FI-1215, FT/TI&FI-1218, FT/TI&FI-1221, FT/TI&FI-1224, FT/TI&FI-1227, FT/TI&FI-1233, FT/TI&FI-1236, FT/TI&FI-1536, FT/TI&FI-1539; Melter 2: FT/TI&FI-2206, FT/TI&FI-2209, FT/TI&FI-2215, FT/TI&FI-2218, FT/TI&FI-2221, FT/TI&FI-2224, FT/TI&FI-2227, FT/TI&FI-2233, FT/TI&FI-2236, FT/TI&FI-2536, FT/TI&FI-2539).

III.10.I.1.f Recordkeeping Requirements [WAC 173-303-380 and WAC 173-303-680(3)]

III.10.I.1.f.i The Permittees will record and maintain in the WTP Unit operating record for the LAW Vitrification System, all monitoring, calibration, maintenance, test data, and inspection data compiled under the conditions of this Permit, in accordance with Permit Conditions III.10.C.4 and 5, as modified by Permit Conditions III.10.H.3, III.10.I.1.h, III.10.I.1.b.x, and III.10.I.1.b.xii.

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III.10.I.1.f.ii The Permittees will record in the WTP Unit operating record the date, time, and duration of all automatic waste feed cutoffs and/or lockouts, including the triggering parameters, reason for the deviation, and recurrence of the incident. The Permittees will also record all incidents of AWFCO system function failures, including the corrective measures taken to correct the condition that caused the failure.

III.10.I.1.f.iii The Permittees will submit to Ecology an annual report each calendar year within ninety (90) days following the end of the year. The report will include the following information:

A. Total dangerous and/or mixed waste feed processing time for the LAW Vitrification System.

B. Date/Time of all LAW Vitrification System startups and shutdowns.

C. Date/Time/Duration/Cause/Corrective Action taken for all LAW Vitrification System shutdowns caused by malfunction of either process or control equipment.

D. Date/Time/Duration/Cause/Corrective Action taken for all instances of dangerous and/or mixed waste feed cut-off due to deviations from Permit Table III.10.I.F, as approved/modified pursuant to Permit Conditions III.10.H.5 and III.10.H.3.d.v.

III.10.I.1.f.iv The Permittees will submit an annual report to Ecology each calendar year within ninety (90) days following the end of the year of all quarterly CEMS Calibration Error and Annual CEMS Performance Specification Tests conducted, in accordance with Permit Condition III.10.I.1.e.iii.

III.10.I.1.f.v The Permittees shall maintain operating and calibration/maintenance records for Ecology's inspection for the following Melter 1 and Melter 2 cooling water flow and temperature instruments (Melter 1: FT/TI&FI-1206, FT/TI&FI-1209, FT/TI&FI-1215, FT/TI&FI-1218, FT/TI&FI-1221, FT/TI&FI-1224, FT/TI&FI-1227, FT/TI&FI-1233, FT/TI&FI-1236, FT/TI&FI-1536, FT/TI&FI-1539; Melter 2: FT/TI&FI-2206, FT/TI&FI-2209, FT/TI&FI-2215, FT/TI&FI-2218, FT/TI&FI-2221, FT/TI&FI-2224, FT/TI&FI-2227, FT/TI&FI-2233, FT/TI&FI-2236, FT/TI&FI-2536, FT/TI&FI-2539).

III.10.I.1.f.vi The Permittees shall maintain refractory thermocouple temperature data for Ecology inspection.

III.10.I.1.g Closure

The Permittees will close the LAW Vitrification System in accordance with Operating Unit Group 10, Chapter 11 of this Permit, as approved pursuant to Permit Condition III.10.C.8.

III.10.I.1.h Periodic Emission Re-testing Requirements [WAC 173-303-670(5), WAC 173-303-670(7), and WAC 173-303-807(2), in accordance with WAC 173-303-680(2) and (3)]

III.10.I.1.h.i The Permittees must perform re-testing in accordance with the methods and frequencies described below or may submit proposed alternative test methods (e.g. CEMS) for consideration. This submittal must be provided no less than 6 months prior to any required re-testing and must be approved by Ecology prior to implementation.

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III.10.I.1.h.ii Dioxin and Furan Emission Testing

A. Within eighteen (18) months of commencing operation pursuant to Permit Section III.10.I, the Permittees will submit to Ecology for approval, a Dioxin and Furan Emission Test Plan (DFETP) for the performance of emission testing of the LAW Vitrification System gases for dioxin and furans during "Normal Operating Conditions" as a permit modification in accordance with Permit Conditions III.10.C.2.e and III.10.C.2.f. The DFETP will include all elements applicable to dioxin and furan emission testing included in the "Previously Approved Demonstration Test Plan," applicable EPA promulgated test methods and procedures in effect at the time of the submittal, and projected commencement and completion dates for dioxin and furan emission test. "Normal Operating Conditions" will be defined for the purposes of this permit condition as follows:

1. Carbon monoxide emissions, dangerous and/or mixed waste feed-rate, and automatic waste feed cut-off parameters specified in Permit Table III.10.I.F (as approved/modified pursuant to Permit Conditions III.10.H.5 and III.10.H.3.d.v), that were established to maintain compliance with Permit Condition III.10.I.1.b.iv as specified in Operating Unit Group 10, Appendix 9.15 of this Permit (as approved pursuant to Permit Condition III.10.H.3.d, and in accordance with III.10.I.1.b.xii and III.10.I.1.c.xi), are held within the range of the average value over the previous twelve (12) months and the set-point value specified in Permit Table III.10.I.F. The average value is defined as the sum of the rolling average values recorded over the previous twelve (12) months divided by the number of rolling averages recorded during that time. The average value will not include calibration data, malfunction data, and data obtained when not processing dangerous and/or mixed waste.
2. Feed-rate of metals, ash, and chlorine/chloride are held within the range of the average value over the previous twelve (12) months and the set-point value specified on Permit Table III.10.I.D (as approved/modified pursuant to Permit Conditions III.10.H.5 and III.10.H.3.d.v). Feed-rate of organics as measured by TOC are held within the range of the average value over the previous twelve (12) months. The average value is defined as the sum of the rolling average values recorded over the previous twelve (12) months divided by the number of rolling averages recorded during that time. The average value will not include data obtained when not processing dangerous and/or mixed waste.

For purposes of this permit condition, the "Previously Approved Demonstration Test Plan" is defined to include the Demonstration Test Plan approved pursuant to Permit Condition III.10.H.5.f.

B. Within sixty (60) days of Ecology's approval of the DFETP, or within thirty-one (31) months of commencing operation pursuant to Permit Section III.10.I, whichever is later, the Permittees will implement the DFETP approved pursuant to Permit Condition III.10.I.1.h.ii.A.

C. The Permittees will resubmit the DFETP, approved pursuant to Permit Condition III.10.I.1.h.ii.A, revised to include applicable EPA promulgated test methods and procedures in effect at the time of the submittal, and projected commencement and completion dates for dioxin and furan emission test as a permit modification in accordance with Permit Conditions

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III.10.C.2.e and III.10.C.2.f at twenty-four (24) months from the implementation date of the testing required pursuant to Permit Condition III.10.I.1.h.ii.A and at reoccurring eighteen (18) month intervals from the implementation date of the previously approved DFETP. The Permittees will implement these newly approved revised DFETPs, every thirty-one (31) months from the previous approved DFETP implementation date or within sixty (60) days of the newly Ecology approved revised DFETP, whichever is later, for the duration of this Permit.

D. The Permittees will submit a summary of operating data collected pursuant to the DFETPs in accordance with Permit Conditions III.10.I.1.h.ii.A and C to Ecology upon completion of the tests. The Permittees will submit to Ecology the complete test report within ninety (90) calendar days of completion of the testing. The test reports will be certified as specified in WAC 173-303-807(8), in accordance with WAC 173-303-680(2) and (3).

E. If any calculations or testing results collected pursuant to the DFETPs in accordance with Permit Conditions III.10.I.1.h.ii.A and C show that one or more of the performance standards listed in Permit Condition III.10.I.1.b, with the exception of Permit Condition III.10.I.1.b.x, for the LAW Vitrification System were not met during the emission test, the Permittees will perform the following actions:

1. Immediately stop dangerous and/or mixed waste feed to the LAW Vitrification System under the mode of operation that resulted in not meeting the performance standard(s).
2. Verbally notify Ecology within twenty-four (24) hours of discovery of not meeting the performance standard(s), as specified in Permit Condition I.E.21.
3. Investigate the cause of the failure and submit a report of the investigation findings to Ecology within fifteen (15) days of discovery of not meeting the performance standard(s).
4. Submit to Ecology within fifteen (15) days of discovery of not meeting the performance standard(s) documentation supporting a mode of operation where all performance standards listed in Permit Condition III.I.1.b, with the exception of Permit Condition III.10.I.1.b.x, for the LAW Vitrification System were met during the demonstration test, if any such mode was demonstrated.
5. Based on the information provided to Ecology by the Permittees pursuant to Permit Conditions III.10.I.1.h.ii.E.1 through 4 above, and any additional information, Ecology may provide in writing, direction to the Permittees to stop dangerous waste and mixed waste feed to the LAW Vitrification System and/or amend the mode of operation the Permittees are allowed to continue operations prior to Ecology approval of the RDTP pursuant to Permit Condition III.10.I.1.h.ii.E.6.
6. Submit to Ecology within one hundred and twenty (120) days of discovery of not meeting the performance standard(s) a RDTP requesting approval to retest as a permit modification pursuant to Permit Conditions III.10.C.2.e and III.10.C.2.f. The RDTP must include substantive changes to prevent failure from reoccurring reflecting performance under operating conditions representative of the extreme range of normal conditions, and include revisions to Permit Tables III.10.I.D and F.

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F. If any calculations or testing results collected pursuant to the DFETPs in accordance with Permit Conditions III.10.I.1.h.ii.A and C show that any emission rate for any constituent listed in Permit Table III.10.I.E, as approved/modified pursuant to Permit Conditions III.10.C.11.c or d is exceeded for LAW Vitrification System during the emission test, the Permittees will perform the following actions:

1. Verbally notify Ecology within twenty-four (24) hours of the discovery of exceeding the emission rate(s), as specified in Permit Condition I.E.21.
2. Submit to Ecology additional risk information to indicate that the increased emissions impact is off-set by decreased emission impact from one or more constituents expected to be emitted at the same time, and/or investigate the cause and impact of the exceedance and submit a report of the investigation findings to Ecology within fifteen (15) days of this discovery of exceeding the emission rate(s).
3. Based on the notification and any additional information, Ecology may provide, in writing, direction to the Permittees to stop dangerous and/or mixed waste feed to the LAW Vitrification System and/or to submit a RDTP as a permit modification pursuant to Permit Conditions III.10.C.2.e and f, or III.10.C.2.g. The RDTP must include substantive changes to prevent failure from reoccurring reflecting performance under operating conditions representative of the extreme range of normal conditions, and include revisions to Permit Tables III.10.I.D and III.10.I.F.

III.10.I.1.h.iii Non-organic Emission Testing

A. Within forty-eight (48) months of commencing operation pursuant to Permit Section III.10.I, the Permittees will resubmit to Ecology for approval the "Previously Approved Demonstration Test Plan" revised as a permit modification in accordance with Permit Conditions III.10.C.2.e and III.10.C.2.f. The RDTP will include applicable EPA promulgated test methods and procedures in effect at the time of the submittal, projected commencement and completion dates for emission testing to demonstrate performance standards specified in Permit Conditions III.10.I.1.b.ii, iii, v, vi, and vii, and non-organic emissions as specified in Permit Table III.10.I.E, as approved/modified pursuant to Permit Conditions III.10.H.3.d and III.10.C.11.c or d, under "Normal Operating Conditions." "Normal Operating Conditions" will be defined for the purposes of this permit condition as follows:

1. Carbon monoxide emissions, dangerous and/or mixed waste feed-rate, and automatic waste feed cut-off parameters specified in Permit Table III.10.I.F, as approved/modified pursuant to Permit Conditions III.10.H.3.d and III.10.C.11.c or d, that were established to maintain compliance with Permit Conditions III.10.I.1.b.ii, iii, v, vi, and vii, and non-organic emissions, as specified in Permit Table III.10.I.E, as specified in Operating Unit Group 10, Appendix 9.15 of this Permit (as approved pursuant to Permit Conditions III.10.H.3.d and III.10.C.11.c or d), are held within the range of the average value over the previous twelve (12) months and the set-point value specified in Permit Table III.10.I.F. The average value is defined as the sum of the rolling average

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values recorded over the previous twelve (12) months divided by the number of rolling averages recorded during that time. The average value will not include calibration data, malfunction data, and data obtained when not processing dangerous or mixed waste.

2. Feed-rate of metals, ash, and chlorine/chloride are held within the range of the average value over the previous twelve (12) months and the set-point value specified in Permit Table III.10.I.D, as approved/modified pursuant to Permit Conditions III.10.H.3.d and III.10.C.11.c or d. The average value is defined as the sum of all rolling average values recorded over the previous twelve (12) months divided by the number of rolling averages recorded during that time. The average value will not include data obtained when not processing dangerous or mixed waste.

For purposes of this permit condition, the "Previously Approved Demonstration Test Plan" is defined to include the Demonstration Test Plan approved pursuant to Permit Condition III.10.H.5.f.

B. Within sixty (60) days of Ecology's approval of the RDTP, or within sixty (60) months of commencing operation pursuant to Permit Section III.10.I, whichever is later, the Permittees will implement the RDTP approved pursuant to Permit Condition III.10.I.1.h.ii.A.

C. The Permittees will resubmit the RDTP, approved pursuant to Permit Condition III.10.I.1.h.ii.A, revised to include applicable EPA promulgated test methods and procedures in effect at the time of the submittal, and projected commencement and completion dates for emission test as a permit modification in accordance with Permit Conditions III.10.C.2.e and f at forty-eight (48) months from the implementation date of the testing required pursuant to Permit Condition III.10.I.1.h.ii.A and at reoccurring forty-eight (48) month intervals from the implementation date of the previously approved RDTP. The Permittees will implement these newly approved revised RDTP, every sixty (60) months from the previous approved RDTP implementation date or within sixty (60) days of the newly Ecology approved revised RDTP, whichever is later, for the duration of this Permit.

D. The Permittees will submit a summary of operating data collected pursuant to the RDTPs in accordance with Permit Conditions III.10.I.1.h.ii.A and C to Ecology upon completion of the tests. The Permittees will submit to Ecology the complete test report within ninety (90) calendar days of completion of the testing. The test reports will be certified pursuant to WAC 173-303-807(8), in accordance with WAC 173-303-680(2) and (3).

E. If any calculations or testing results collected pursuant to the RDTPs in accordance with Permit Conditions III.10.I.1.h.ii.A and C show that any emission rate for any constituent listed in Permit Table III.10.I.E, as approved/modified pursuant to Permit Conditions III.10.H.3.d and III.10.C.11.c or d, is exceeded for LAW Vitrification System during the emission test, the Permittees will perform the following actions:

1. Verbally notify Ecology within twenty-four (24) hours of the discovery of exceeding the emission rate(s), as specified in Permit Condition I.E.21;

2. Submit to Ecology additional risk information to indicate that the increased emissions impact is off-set by decreased emission impact from one or more constituents expected to be emitted at the same time, and/or

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investigate the cause and impact of the exceedance and submit a report of the investigation findings to Ecology within fifteen (15) days of this discovery of exceeding the emission rate(s); and

3. Based on the notification and any additional information, Ecology may provide, in writing, direction to the Permittees to stop dangerous and/or mixed waste feed to the LAW Vitrification System and/or to submit a RDTP as a permit modification pursuant to Permit Conditions III.10.C.2.e and f, or III.10.C.2.g. The RDTP must include substantive changes to prevent failure from reoccurring reflecting performance under operating conditions representative of the extreme range of normal conditions, and include revisions to Permit Tables III.10.I.D and III.10.I.F.

F. If any calculations or testing results collected pursuant to the RDTPs in accordance with Permit Conditions III.10.I.1.h.ii.A and C show that one or more of the performance standards listed in Permit Condition III.10.I.1.b, with the exception of Permit Condition III.10.I.1.b.x, for the LAW Vitrification System were not met during the emission test, the Permittees will perform the following actions:

1. Immediately stop dangerous and/or mixed waste feed to the LAW Vitrification System under the mode of operation that resulted in not meeting the performance standard(s);
2. Verbally notify Ecology within twenty-four (24) hours of discovery of not meeting the performance standard(s), as specified in Permit Condition I.E.21;
3. Investigate the cause of the failure and submit a report of the investigation findings to Ecology within fifteen (15) days of discovery of not meeting the performance standard(s);
4. Submit to Ecology within fifteen (15) days of discovery of not meeting the performance standard(s) documentation supporting a mode of operation where all performance standards listed in Permit Condition III.I.1.b, with the exception of Permit Condition III.10.I.1.b.x, for the LAW Vitrification System were met during the demonstration test, if any such mode was demonstrated;
5. Based on the information provided to Ecology by the Permittees pursuant to Permit Conditions III.10.I.1.h.ii.F.1 through 4 above, and any additional information, Ecology may provide in writing, direction to the Permittees to stop dangerous and/or mixed waste feed to the LAW Vitrification System and/or amend the mode of operation the Permittees are allowed to continue operations prior to Ecology approval of the RDTP pursuant to Permit Condition III.10.I.1.h.ii.F.6; and
6. Submit to Ecology within one hundred and twenty (120) days of discovery of not meeting the performance standard(s) a RDTP requesting approval to retest as a permit modification pursuant to Permit Conditions III.10.C.2.e and f. The RDTP must include substantive changes to prevent failure from reoccurring reflecting performance under operating conditions representative of the extreme range of normal conditions, and include revisions to Permit Tables III.10.I.D and F.

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III.10.I.1.h.iv Other Emission Testing

A. Within seventy-eight (78) months of commencing operation pursuant to Permit Section III.10.I, the Permittees will resubmit to Ecology for approval the "Previously Approved Demonstration Test Plan" revised as a permit modification in accordance with Permit Conditions III.10.C.2.e and f. The RDTP will include applicable EPA promulgated test methods and procedures in effect at the time of the submittal, projected commencement and completion dates for emission testing to demonstrate performance standards as specified in Permit Conditions III.10.I.1.b.viii and ix, and emissions as specified in Permit Table III.10.I.E, as approved/modified pursuant to Permit Conditions III.10.H.3.d and III.10.C.11.c or d, not addressed under Permit Conditions III.10.I.1.h.ii or iii under "Normal Operating Conditions." "Normal Operating Conditions" will be defined for the purposes of this permit condition as follows:

1. Carbon monoxide emissions, dangerous and/or mixed waste feed-rate, and automatic waste feed cut-off parameters specified in Permit Table III.10.I.F, as approved/modified pursuant to Permit Condition III.10.H.3.d and III.10.C.11.c or d, that were established to maintain compliance with Permit Conditions III.10.I.1.b.viii and ix, and emissions as specified in Permit Table III.10.I.E, not addressed under Permit Conditions III.10.I.1.h.ii or iii as specified in Operating Unit Group 10, Appendix 9.15 of this Permit, as approved pursuant to Permit Condition III.10.H.3.d, and in accordance with Permit Conditions III.10.I.1.b.xii and III.10.I.1.c.xi are held within the range of the average value over the previous twelve (12) months and the set-point value specified on Permit Table III.10.I.F. The average value is defined as the sum of all rolling average values recorded over the previous twelve (12) months divided by the number of rolling averages recorded during that time. The average value will not include calibration data, malfunction data, and data obtained when not processing dangerous and/or mixed waste.
2. Feed-rate of metals, ash, and chlorine/chloride are held within the range of the average value over the previous twelve (12) months and the set-point value specified in Permit Table III.10.I.D, as approved/modified pursuant to Permit Conditions III.10.H.3.d and III.10.C.11.c or d. Feed-rate of organics as measured by TOC are held within the range of the average value over the previous twelve (12) months. The average value is defined as the sum of the rolling average values recorded over the previous twelve (12) months divided by the number of rolling averages recorded during that time. The average value will not include data obtained when not processing dangerous and/or mixed waste.

For purposes of this permit condition, the "Previously Approved Demonstration Test Plan" is defined to include the Demonstration Test Plan approved pursuant to Permit Condition III.10.H.5.f.

B. Within sixty (60) days of Ecology's approval of the RDTP, or within ninety-one (91) months of commencing operation pursuant to Permit Section III.10.I, whichever is later, the Permittees will implement the RDTP approved pursuant to Permit Condition III.10.I.1.h.iv.A.

C. The Permittees will submit a summary of operating data collected pursuant to the RDTPs in accordance with Permit Condition III.10.I.1.h.iv.A to Ecology

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upon completion of the tests. The Permittees will submit to Ecology the complete test report within ninety (90) calendar days of completion of the testing. The test reports will be certified as specified in WAC 173-303-807(8), in accordance with Permit Condition WAC 173-303-680(2) and (3).

D. If any calculations or testing results show that one or more of the performance standards listed in Permit Condition III.10.I.1.b, with the exception of Permit Condition III.10.I.1.b.x, for the LAW Vitrification System were not met during the emission test, the Permittees will perform the following actions:

1. Immediately stop dangerous and/or mixed waste feed to the LAW Vitrification System under the mode of operation that resulted in not meeting the performance standard(s);
2. Verbally notify Ecology within twenty-four (24) hours of discovery of not meeting the performance standard(s), as specified in Permit Condition I.E.21.
3. Investigate the cause of the failure and submit a report of the investigation findings to Ecology within fifteen (15) days of discovery of not meeting the performance standard(s).
4. Submit to Ecology within fifteen (15) days of discovery of not meeting the performance standard(s) documentation supporting a mode of operation where all performance standards listed in Permit Condition III.I.1.b, with the exception of Permit Condition III.10.I.1.b.x, for the LAW Vitrification System were met during the demonstration test, if any such mode was demonstrated.
5. Based on the information provided to Ecology by the Permittees pursuant to Permit Conditions III.10.I.1.h.iv.D.1 through 4 above, and any additional information, Ecology may provide in writing, direction to the Permittees to stop dangerous and/or mixed waste feed to the LAW Vitrification System and/or amend the mode of operation the Permittees are allowed to continue operations prior to Ecology approval of the RDTP, pursuant to Permit Condition III.10.I.h.1.iv.D.6.
6. Submit to Ecology within one hundred and twenty (120) days of discovery of not meeting the performance standard(s) a RDTP requesting approval to retest as a permit modification pursuant to Permit Conditions III.10.C.2.e and f. The RDTP must include substantive changes to prevent failure from reoccurring reflecting performance under operating conditions representative of the extreme range of normal conditions, and include revisions to Permit Tables III.10.I.D and III.10.I.F.

E. If any calculations or testing results show that any emission rate for any constituent listed in Permit Table III.10.I.E, as approved/modified pursuant to Permit Conditions III.10.C.11.c or d, is exceeded for LAW Vitrification System during the emission test, the Permittees will perform the following actions:

1. Verbally notify Ecology within twenty-four (24) hours of the discovery of exceeding the emission rate(s), as specified in Permit Condition I.E.21.
2. Submit to Ecology additional risk information to indicate that the increased emissions impact is off-set by decreased emission impact from

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one or more constituents expected to be emitted at the same time, and/or investigate the cause and impact of the exceedance of the emission rate(s) and submit a report of the investigation findings to Ecology within fifteen (15) days of the discovery of the exceedance of the emission rate(s).

3. Based on the notification and any additional information, Ecology may provide, in writing, direction to the Permittees to stop dangerous and/or mixed waste feed to the LAW Vitrification System and/or to submit a RDTP as a permit modification pursuant to Permit Conditions III.10.C.2.e and f, or III.10.C.2.g. The RDTP must include substantive changes to prevent failure from reoccurring reflecting performance under operating conditions representative of the extreme range of normal conditions, and include revisions to Permit Tables III.10.I.D and F.

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Table III.10.I.A – LAW Vitrification System Description[a]

Sub-system Description	Sub-system Designation	Engineering Description (Drawing Nos, Specification Nos, etc.)	Narrative Description, Tables and Figures
RESERVED	RESERVED	RESERVED	RESERVED

[a] Permit Table III.10.I.A will be completed in accordance with Permit Condition III.10.H.5.e.x, prior to initiating Permit Condition III.10.I.1. See Permit Table III.10.H.A for the current LAW Vitrification System Description.

Table III.10.I.B – LAW Vitrification System Secondary Containment Systems Including Sumps and Floor Drains

Sump/Floor Drain I.D. # & Room Location	Maximum Sump Capacity (gallons)	Sump Dimensions[b] (feet) & Materials of Construction	Engineering Description (Drawing Nos, Specification Nos, etc.)
RESERVED	RESERVED	RESERVED	RESERVED

[a] Permit Table III.10.I.B will be completed in accordance with Permit Condition III.10.H.5.b.vii, prior to initiating Permit Condition III.10.I.1. See Permit Table III.10.H.B for the current LAW Vitrification System Secondary Containment Systems Including Sumps and Floor Drains.

[b] Dimensions listed are based on permitted design. Actual dimensions may vary within plus or minus (TBD).

Table III.10.I.C – LAW Vitrification Systems Process and Leak Detection System Instruments and Parameters

Sub-system Locator and Name (Including P&ID)	Control Parameter	Type of Measuring or Leak Detection Instrument	Location of Measuring Instrument (Tag No.)	Instrument Range	Failure State	Expected Range	Instrument Accuracy	Instrument Calibration Method No. and Range
RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

[a] Permit Table III.10.I.C will be completed in accordance with Permit Condition III.10.H.5.e.ix, prior to initiating Permit Condition III.10.I.1. See Permit Table III.10.H.C for the current LAW Vitrification Systems Process and Leak Detection System Instruments and Parameters.

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Table III.10.I.D – Maximum Feed-rates to LAW Vitrification System (RESERVED)

Description of Waste	Normal Operation
Dangerous and/or Mixed Waste Feed Rate	RESERVED
Ash Feed Rate	RESERVED
Total Chlorine/Chloride Feed Rate	RESERVED
Total Metal Feedrates	RESERVED

Table III.10.I.E – LAW Vitrification System Estimated Emission Rates (RESERVED)

Chemicals	CAS Number	Emission Rates (grams/second)
RESERVED	RESERVED	RESERVED

TABLE III.10.I.F – LAW Vitrification System Waste Feed Cut-off Parameters* [1] (RESERVED)

Sub-system Designation	Instrument Tag Number	Parameter Description	Set-points During Normal Operation
RESERVED	RESERVED	RESERVED	RESERVED

*A CMS will be used as defined in Permit Section III.10.C.1.

[1]Maximum Feed-rate will be set based on not exceeding any of the constituent (e.g., metals, ash, and chlorine/chloride) feed limits specified on Table III.10.I.D of this Permit.

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III.10.J HLW VITRIFICATION SYSTEM – SHORT TERM MISCELLANEOUS THERMAL TREATMENT UNIT-SHAKEDOWN, DEMONSTRATION TEST, AND POST DEMONSTRATION TEST

For purposes of Permit Section III.10.J, where reference is made to WAC 173-303-640, the following substitutions apply: substituting the terms "HLW Vitrification System" for "tank system(s)," "sub-system(s)" for "tank(s)," "sub-system equipment" for "ancillary equipment," and "sub-system(s) or sub-system equipment of a HLW Vitrification System" for "component(s)," in accordance with WAC 173-303-680.

III.10.J.1 General Conditions during Shakedown, Demonstration Test, and Post-Demonstration Test for HLW Vitrification System

III.10.J.1.a Construction and Maintenance [WAC 173-303-640, in accordance with WAC 173-303-680(2) and (3), and WAC 173-303-340].

III.10.J.1.a.i The Permittees will construct the HLW Vitrification System (listed in Permit Tables III.10.J.A and III.10.J.B, as approved/modified pursuant to Permit Condition III.10.J.5) as specified in Permit Condition III.10.J.1 and Operating Unit Group 10, Chapter 4 of this Permit, and Operating Unit Group 10, Appendices 10.1 through 10.15 and 10.17 of this Permit, as approved pursuant to Permit Conditions III.10.J.5.a through d, and III.10.J.5.f.

III.10.J.1.a.ii The Permittees will construct all containment systems for the HLW Vitrification System as specified in Operating Unit Group 10, Chapter 4 of this Permit, and Operating Unit Group 10, Appendices 10.2, 10.4, through 10.14 of this Permit, as approved pursuant to Permit Conditions III.10.J.5.a through d.

III.10.J.1.a.iii The Permittees will ensure all certifications required by specialists (e.g., independent qualified registered professional engineer, independent corrosion expert, independent qualified installation inspector, etc.) use the following statement or equivalent pursuant to Permit Condition III.10.C.10:

"I, (Insert Name) have (choose one or more of the following: overseen, supervised, reviewed, and/or certified) a portion of the design or installation of a new HLW Vitrification system or component located at (address), and owned/operated by (name(s)). My duties were: (e.g., installation inspector, testing for tightness, etc.), for the following HLW Vitrification system components (e.g., the venting piping, etc.), as required by the Dangerous Waste Regulations, namely, WAC 173-303-640(3) (applicable paragraphs (i.e., (a) through (g)) in accordance with WAC 173-303-680).

"I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

III.10.J.1.a.iv The Permittees must ensure that proper handling procedures are adhered to in order to prevent damage to the HLW Vitrification System during installation. Prior to covering, enclosing, or placing the new HLW Vitrification System or component in use, an independent qualified installation inspector or an independent qualified registered professional engineer, either of whom is trained and experienced in the proper installation of similar systems or components, must inspect the system for the presence of any of the following items:

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A. Weld breaks.
B. Punctures.
C. Scrapes of protective coatings.
D. Cracks.
E. Corrosion.
F. Other structural damage or inadequate construction/installation.

All discrepancies must be remedied before the HLW Vitrification system is covered, enclosed, or placed in use [WAC 173-303-640(3)(c), in accordance with WAC 173-303-680(2) and (3)].

III.10.J.1.a.v For the HLW Vitrification System or components that are placed underground and that are back-filled, the Permittees must provide a backfill material that is a non-corrosive, porous, homogeneous substance. The backfill must be installed so that it is placed completely around the HLW Vitrification System and compacted to ensure that the HLW Vitrification System is fully and uniformly supported [WAC 173-303-640(3)(d), in accordance with WAC 173-303-680(2) and (3)].

III.10.J.1.a.vi The Permittees must test for tightness the HLW Vitrification System or components, prior to being covered, enclosed, or placed into use. If the HLW Vitrification System or components are found not to be tight, all repairs necessary to remedy the leak(s) in the system must be performed prior to the HLW Vitrification System being covered, enclosed, or placed in use [WAC 173-303-640(3)(e), in accordance with WAC 173-303-680(2) and (3)].

III.10.J.1.a.vii The Permittees must ensure the HLW Vitrification System equipment is supported and protected against physical damage and excessive stress due to settlement, vibration, expansion, or contraction [WAC 173-303-640(3)(f), in accordance with WAC 173-303-680(2) and (3)].

III.10.J.1.a.viii The Permittees must provide the type and degree of corrosion protection recommended by an independent corrosion expert, based on the information provided in Operating Unit Group 10, Appendices 10.9 and 10.11 of this Permit, as approved pursuant to Permit Conditions III.10.J.5.b.i, III.10.J.5.b.iv, III.10.J.5.b.v, III.10.J.5.c.i, III.10.J.5.c.iv, III.10.J.5.c.v, III.10.J.5.d.i, III.10.J.5.d.iv, and III.10.J.5.d.v, or other corrosion protection if Ecology believes other corrosion protection is necessary to ensure the integrity of the HLW Vitrification System during use of the HLW Vitrification System. The installation of a corrosion protection system that is field fabricated must be supervised by an independent corrosion expert to ensure proper installation [WAC 173-303-640(3)(g), in accordance with WAC 173-303-680(2) and (3)].

III.10.J.1.a.ix Prior to initial receipt of dangerous and/or mixed waste in the WTP Unit, the Permittees will obtain and keep on file in the WTP Unit operating record, written statements by those persons required to certify the design of the HLW Vitrification System and supervise the installation of the HLW Vitrification System, as specified in WAC 173-303-640(3)(b), (c), (d), (e), (f), and (g), in accordance with WAC 173-303-680, attesting that the HLW Vitrification system and corresponding containment system listed in Permit Tables III.10.J.A and III.10.J.B, as approved/modified pursuant to Permit Condition III.10.J.5, were properly designed and installed, and that repairs, in accordance with WAC 173-303-640(3)(c) and (e), were performed [WAC 173-303-640(3)(a) and WAC 173-303-640(3)(h), in accordance with WAC 173-303-680(3)].

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III.10.J.1.a.x The independent HLW Vitrification System installation inspection and subsequent written statements will be certified in accordance with WAC 173-303-810(13)(a), as modified pursuant to Permit Condition III.10.J.1.a.iii, comply with all requirements of WAC 173-303-640(3)(h) in accordance with WAC 173-303-680, and will consider, but not be limited to, the following LAW Vitrification System installation documentation:

A. Field installation report with date of installation.
B. Approved welding procedures.
C. Welder qualification and certifications.
D. Hydro-test reports, as applicable, in accordance with the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section VIII, Division 1; API Standard 620, or Standard 650, as applicable.
E. Tester credentials.
F. Field inspector credentials.
G. Field inspector reports.
H. Field waiver reports.
I. Non-compliance reports and corrective action (including field waiver reports) and repair reports.

III.10.J.1.a.xi The Permittees will ensure periodic integrity assessments are conducted on the HLW Vitrification System, listed in Permit Table III.10.J.A, as approved/modified pursuant to Permit Condition III.10.J.5, over the term of this Permit, in accordance with WAC 173-303-680(2) and (3) as specified in WAC 173-303-640(3)(b), following the description of the integrity assessment program and schedule in Operating Unit Group 10, Addendum E of this Permit, as approved pursuant to Permit Conditions III.10.J.5.e.i and III.10.C.5.c. Results of the integrity assessments will be included in the WTP Unit operating record until ten (10) years after post-closure, or corrective action is complete and certified, whichever is later.

III.10.J.1.a.xii The Permittees will address problems detected during the HLW Vitrification System integrity assessments specified in Permit Condition III.10.J.1.a.xi following the integrity assessment program in Operating Unit Group 10, Addendum E of this Permit, as approved pursuant to Permit Conditions III.10.J.5.e.i and III.10.C.5.c.

III.10.J.1.a.xiii All process monitors/instruments as specified in Permit Table III.10.J.F, as approved/modified pursuant to Permit Condition III.10.J.5, will be equipped with operational alarms to warn of deviation, or imminent deviation from the limits specified in Permit Table III.10.J.F.

III.10.J.1.a.xiv The Permittees will install and test all process and leak detection system monitors/instrumentation as specified in Permit Tables III.10.J.C and III.10.J.F, as approved/modified pursuant to Permit Condition III.10.J.5, in accordance with Operating Unit Group 10, Appendices 10.1, 10.2, and 10.14 of this Permit, as approved pursuant to Permit Conditions III.10.J.5.d.x and III.10.J.5.f.xvi.

III.10.J.1.a.xv Except during periods of HLW Vitrification System start up and shut down, no dangerous and/or mixed waste will be treated in the HLW Vitrification System unless the operating conditions specified under Permit Condition III.10.J.1.c are complied with.

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III.10.J.1.a.xvi The Permittees will not place dangerous and/or mixed waste, treatment reagents, or other materials in the HLW Vitrification System if these substances could cause the subsystem, subsystem equipment, or the containment system to rupture, leak, corrode, or otherwise fail [WAC 173-303-640(5)(a), in accordance with WAC 173-303-680(2)]. This condition is not applicable to corrosion of HLW Vitrification System sub-system and sub-system equipment that are expected to be replaced as part of normal operations (e.g., melters).

III.10.J.1.a.xvii The Permittees will operate the HLW Vitrification System to prevent spills and overflows using description of controls and practices as required under WAC 173-303-640(5)(b) described in Permit Condition III.10.C.5, and Operating Unit Group 10, Appendix 10.18 of this Permit, as approved pursuant to Permit Condition III.10.J.5.e [WAC 173-303-640(5)(b), in accordance with WAC 173-303-680(2) and (3), and WAC 173-303-806(4)(c)(ix)].

III.10.J.1.a.xviii For routinely non-accessible HLW Vitrification System sub-systems, as specified in Operating Unit Group 10, Chapter 4 of this Permit, as updated pursuant to Permit Condition III.10.J.5.e.vi, the Permittees will mark all routinely non-accessible HLW Vitrification System sub-systems access points with labels or signs to identify the waste contained in each HLW Vitrification System sub-system. The label, or sign, must be legible at a distance of at least fifty (50) feet, and must bear a legend which identifies the waste in a manner which adequately warns employees, emergency response personnel, and the public of the major risk(s) associated with the waste being stored or treated in the HLW Vitrification System sub-systems. For the purposes of this permit condition, "routinely non-accessible" means personnel are unable to enter these areas while waste is being managed in them [WAC 173-303-640(5)(d), in accordance with WAC 173-303-680(2)].

III.10.J.1.a.xix For all HLW Vitrification System sub-systems not addressed in Permit Condition III.10.J.1.a.xviii, the Permittees will mark all these HLW Vitrification System sub-systems holding dangerous and/or mixed waste with labels or signs to identify the waste contained in the HLW Vitrification System sub-systems. The labels, or signs, must be legible at a distance of at least fifty (50) feet, and must bear a legend which identifies the waste in a manner which adequately warns employees, emergency response personnel, and the public of the major risk(s) associated with the waste being stored or treated in the HLW Vitrification System sub-systems [WAC 173-303-640(5)(d), in accordance with WAC 173-303-680(2)].

III.10.J.1.a.xx The Permittees will ensure that the containment systems for the HLW Vitrification System sub-systems listed in Permit Tables III.10.J.A and III.10.J.B, as approved/modified pursuant to Permit Condition III.10.J.5, are free of cracks or gaps to prevent any migration of dangerous and/or mixed waste or accumulated liquid out of the system to the soil, groundwater, or surface water at any time during use of the HLW Vitrification System sub-systems. Any indication that a crack or gap may exist in the containment systems will be investigated and repaired in accordance with Operating Unit Group 10, Appendix 10.18 of this Permit, as approved pursuant to Permit Condition III.10.J.5.e.v [WAC 173-303–640(4)(b)(i), WAC 173-303-640(4)(e)(i)(C), and WAC 173-303-640(6), in accordance with WAC 173-303-680(2) and (3), WAC 173-303-806(4)(i)(i)(B), and WAC 173-303-320].

III.10.J.1.a.xxi The Permittees must immediately, and safely, remove from service any HLW Vitrification System or secondary containment system which, through an integrity assessment, is found to be "unfit for use" as defined in WAC 173-303-040, following

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Permit Conditions III.10.J.1.a.xxiii.A through D, and F. The affected HLW Vitrification System, or secondary containment system, must be either repaired or closed in accordance with Permit Condition III.10.J.1.a.xxiii.E [WAC 173-303-640(7)(e) and (f), and WAC 173-303-640(8), in accordance with WAC 173-303-680(3)].

III.10.J.1.a.xxii An impermeable coating, as specified in Operating Unit Group 10, Appendices 10.4, 10.5, 10.7, 10.9, 10.11, and 10.12 of this Permit, as approved pursuant to Permit Condition III.10.J.5.b.v, will be maintained for all concrete containment systems and concrete portions of containment systems for each HLW Vitrification System sub-systems listed in Permit Tables III.10.J.A and III.10.J.B as approved/modified pursuant to Permit Condition III.10.J.5 (concrete containment systems that do not have a liner, pursuant to WAC 173-303-640(4)(e)(i), in accordance with WAC 173-303-680(2), and have construction joints, will meet the requirements of WAC 173-303-640(4)(e)(ii)(C), in accordance with WAC 173-303-680(2). The coating will prevent migration of any dangerous and mixed waste into the concrete. All coatings will meet the following performance standards:

A. The coating must seal the containment surface such that no cracks, seams, or other avenues through which liquid could migrate, are present;

B. The coating must be of adequate thickness and strength to withstand the normal operation of equipment and personnel within the given area such that degradation or physical damage to the coating or lining can be identified and remedied before dangerous and mixed waste could migrate from the system; and

C. The coating must be compatible with the dangerous and mixed waste, treatment reagents, or other materials managed in the containment system [WAC 173-303-640(4)(e)(ii)(D), in accordance with WAC 173-303-680(2) and (3), and WAC 173-303-806(4)(i)(i)(A)].

III.10.J.1.a.xxiii The Permittees will inspect all containment systems for the HLW Vitrification System sub-systems listed in Permit Tables III.10.J.A and III.10.J.B, as approved/modified pursuant to Permit Condition III.10.J.5, in accordance with the Inspection Plan specified in Operating Unit Group 10, Chapter 6A of this Permit, as approved pursuant to Permit Conditions III.10.J.5.e.i and III.10.C.5.c, and take the following actions if a leak or spill of dangerous and/or mixed waste is detected in these containment systems [WAC 173-303-640(5)(c) and WAC 173-303-640(6), in accordance with WAC 173-303-680(2) and (3), WAC 173-303-320, and WAC 173-303-806(4)(i)(i)(B)]:

A. Immediately, and safely, stop the flow of dangerous and/or mixed waste into the HLW Vitrification System sub-systems or secondary containment system.

B. Determine the source of the dangerous and/or mixed waste.

C. Remove the dangerous and/or mixed waste from the containment area in accordance with WAC 173-303-680(2) and (3), as specified in WAC 173-303-640(7)(b). The dangerous and/or mixed waste removed from containment areas of the HLW Vitrification System sub-systems will be, as a minimum, managed as mixed waste.

D. If the cause of the release was a spill has not damaged the integrity of the HLW Vitrification System sub-system, the Permittees may return the HLW Vitrification System sub-system to service in accordance with WAC 173-303-680(2) and (3), as specified in WAC 173-303-640(7)(e)(ii). In such case,

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the Permittees will take action to ensure the incident that caused the dangerous and/or mixed waste to enter the containment system will not re-occur [WAC 173-303-320(3)].

E. If the source of the dangerous and/or mixed waste is determined to be a leak from the primary HLW Vitrification System into the secondary containment system, or the system is unfit for use as determined through an integrity assessment or other inspection, the Permittees will comply with the requirements of WAC 173-303-640(7) and take the following actions:

1. Close the HLW Vitrification System Sub-system following procedures in WAC 173-303-640(7)(e)(i), in accordance with WAC 173-303-680 and Operating Unit Group 10, Addendum H of this Permit, as approved pursuant to Permit Condition III.10.C.8, or

2. Repair and re-certify (in accordance with WAC 173-303-810(13)(a), as modified pursuant to Permit Condition III.10.J.1.a.iii) the HLW Vitrification System in accordance with Operating Unit Group 10, Appendix 10.18 of this Permit, as approved pursuant to Permit Condition III.10.J.5.e.v, before the HLW Vitrification System is placed back into service [WAC 173-303-640(7)(e)(iii) and WAC 173-303-640(7)(f), in accordance with WAC 173-303-680].

F. The Permittees will document, in the WTP Unit operating record, actions/procedures taken to comply with A. through E. above, as specified in WAC 173-303-640(6)(d), in accordance with WAC 173-303-680(2) and (3).

G. In accordance with WAC 173-303-680(2) and WAC 173-303-680 (3), the Permittees will notify and report releases to the environment to Ecology, as specified in WAC 173-303-640(7)(d).

III.10.J.1.a.xxiv If liquids (e.g., dangerous and/or mixed waste leaks and spills, precipitation, fire water, liquids from damaged or broken pipes) cannot be removed from the secondary containment system within twenty-four (24) hours, Ecology will be verbally notified within twenty-four (24) hours of discovery. The notification will provide the information in A, B, and C, listed below. The Permittees will provide Ecology with a written demonstration within seven (7) business days, identifying at a minimum [WAC 173-303-640(4)(c)(iv) and WAC 173-303-640(7)(b)(ii), in accordance with WAC 173-303-680(3) and WAC 173-303-806(4)(i)(i)(B)]:

A. Reasons for delayed removal;

B. Measures implemented to ensure continued protection of human health and the environment;

C. Current actions being taken to remove liquids from secondary containment.

III.10.J.1.a.xxv All air pollution control devices and capture systems in the HLW Vitrification System will be maintained and operated at all times in a manner so as to minimize the emissions of air contaminants and to minimize process upsets. Procedures for ensuring that the air pollution control devices and capture systems in the HLW Vitrification System are properly operated and maintained so as to minimize the emission of air contaminants and process upsets will be established.

III.10.J.1.a.xxvi In all future narrative permit submittals, the Permittees will include HLW Vitrification sub-system names with the sub-system designation.

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III.10.J.1.a.xxvii Modifications to approved design, plans, and specifications in Operating Unit Group 10 of this Permit for the HLW Vitrification System will be allowed only in accordance with Permit Conditions III.10.C.2.e and f, or III.10.C.2.g, III.10.C.9.d, e, and h.

III.10.J.1.a.xxviii For any portion of the HLW Vitrification System that has the potential for formation and accumulation of hydrogen gases, the Permittees will operate the portion to maintain hydrogen levels below the lower explosive limit [WAC 173-303-815(2)(b)(ii)].

III.10.J.1.a.xxix For each HLW Vitrification System sub-system holding dangerous waste which are acutely or chronically toxic by inhalation, the Permittees will operate the system to prevent escape of vapors, fumes or other emissions into the air [WAC 173-303-806(4)(i)(i)(B) and WAC 173-303-640(5)(e) in accordance with WAC 173-303-680].

III.10.J.1.b Performance Standards

III.10.J.1.b.i The HLW Vitrification System must achieve a DRE of 99.99% for the PODCs listed below [40 CFR §63.1203(c)(1) and 40-CFR 63.1203(c)(2), in accordance with WAC 173-303-680(2)].

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DRE in this Permit condition will be calculated in accordance with the formula given below:

DRE=[1-(Wout/Win)] x 100%

Where:

Win=mass feed rate of one PODC in a waste feed stream; and

Wout=mass emission rate of the same PODC present in exhaust emissions prior to release to the atmosphere.

III.10.J.1.b.ii Particulate matter emissions from the HLW Vitrification System will not exceed 34 mg/dscm (0.015 grains/dscf) [40 CFR §63.1203(b)(7), in accordance with WAC 173-303-680(2)]:

III.10.J.1.b.iii Hydrochloric acid and chlorine gas emissions from the HLW Vitrification System will not exceed 21 ppmv, combined [40 CFR §63.1203(b)(6), in accordance with WAC 173-303-680(2)]:

III.10.J.1.b.iv Dioxin and Furan TEQ emissions from the HLW Vitrification System will not exceed 0.2 nanograms (ng)/dscm [40 CFR §63.1203(b)(1), in accordance with WAC 173-303-680(2)]:

III.10.J.1.b.v Mercury emissions from the HLW Vitrification System will not exceed 45 µg/dscm, [40 CFR §63.1203(b)(2), in accordance with WAC 173-303-680(2)].

III.10.J.1.b.vi Lead and cadmium emissions from the HLW Vitrification System will not exceed 120 µg/dscm, combined [40 CFR §63.1203(b)(3), in accordance with WAC 173-303-680(2)].

III.10.J.1.b.vii Arsenic, beryllium, and chromium emissions from the HLW Vitrification System will not exceed 97 µg/dscm, combined [40 CFR §63.1203(b)(4), in accordance with WAC 173-303-680(2)].

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III.10.J.1.b.viii Carbon monoxide (CO) emission from the HLW Vitrification System will not exceed 100 parts per million (ppm) by volume, over an hourly rolling average (as measured and recorded by the CMS), dry [40 CFR §63.1203(b)(5)(i), in accordance with WAC 173-303-680(2)].

III.10.J.1.b.ix Hydrocarbon emission from the HLW Vitrification System will not exceed 10 parts per million (ppm) by volume, over an hourly rolling average (as measured and recorded by the CMS during demonstration testing required by this Permit), dry basis, and reported as propane [40 CFR §63.1203(b)(5)(ii), in accordance with WAC 173-303-680(2)]:

III.10.J.1.b.x If the emissions from the HLW Vitrification System exceed the emission rates listed in Permit Table III.10.J.E, as approved pursuant to Permit Condition III.10.C.11.b, the Permittees will notify Ecology, in accordance with Permit Condition III.10.J.3.d.vii [WAC 173-303-680(2) and (3), and WAC 173-303-815(2)(b)(ii)].

The emission limits specified in Permit Conditions III.10.J.1.b.i through III.10.J.1.b.ix above, will be met for the HLW Vitrification System by limiting feed rates as specified in Permit Tables III.10.J.D and III.10.J.F, as approved/modified pursuant to Permit Condition III.10.J.5, compliance with operating conditions specified in Permit Condition III.10.J.1.c (except as specified in Permit Condition III.10.J.1.b.xii), and compliance with Permit Condition III.10.J.1.b.xi.

III.10.J.1.b.xi Treatment effectiveness, feed-rates and operating rates for dangerous and mixed waste management units contained in the HLW Building, but not included in Permit Table III.10.J.A, as approved/modified pursuant to Permit Condition III.10.J.5, will be as specified in Permit Sections III.10.D, III.10.E, III.10.F and consistent with assumptions and basis which are reflected in Operating Unit Group 10, Appendix 6.3 of this Permit, as approved pursuant to Permit Condition III.10.C.11.b. For the purposes of this permit condition, Operating Unit Group 10, Appendix 6.3 will be superseded by Appendix 6.4 upon its approval pursuant to either Permit Conditions III.10.C.11.c or III.10.C.11.d [WAC 173-303-680(2) and (3), and WAC 173-303-815(2)(b)(ii)].

III.10.J.1.b.xii Except during periods of HLW Vitrification System startup and shutdown, compliance with the operating conditions specified in Permit Condition III.10.J.1.c, will be regarded as compliance with the required performance standards identified in Permit Conditions III.10.J.1.b.i through x. However, if it is determined that during the effective period of this Permit that compliance with the operating conditions in Permit Condition III.10.J.1.c is not sufficient to ensure compliance with the performance standards specified in Permit Conditions III.10.J.1.b.i through x, the Permit may be modified, revoked, or reissued pursuant to Permit Conditions III.10.C.2.e and III.10.C.2.f, or III.10.C.2.g.

III.10.J.1.c Operating Conditions [WAC-303-670(6), in accordance with WAC 173-303-680(2) and (3)].

The Permittees will operate the HLW Vitrification System in accordance with Operating Unit Group 10, Chapter 4 of this Permit, as updated pursuant to Permit Condition III.10.J.5.e.vi, and Operating Unit Group 10, Appendix 10.18 of this Permit, as approved pursuant to Permit Condition III.10.J.5.e, and Operating Unit Group 10, Appendix 10.15 of this Permit, as approved pursuant to Permit Condition III.10.J.5.f, except as modified pursuant to Permit Conditions III.10.J.1.b.xii, III.10.J.2, III.10.J.3, III.10.J.4, and in accordance with the following:

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III.10.J.1.c.i The Permittees will operate the HLW Vitrification System in order to maintain the systems and process parameters listed in Permit Tables III.10.J.C and III.10.J.F, as approved/modified pursuant to Permit Condition III.10.J.5, within the set-points specified in Permit Table III.10.J.F.

III.10.J.1.c.ii The Permittees will operate the AWFCO systems, specified in Permit Table III.10.J.F, as approved/modified pursuant to Permit Condition III.10.J.5, to automatically cut-off and/or lock-out the dangerous and mixed waste feed to the HLW Vitrification System when the monitored operating conditions deviate from the set-points specified in Permit Table III.10.J.F.

III.10.J.1.c.iii The Permittees will operate the AWFCO systems, specified in Permit Table III.10.J.F, as approved/modified pursuant to Permit Condition III.10.J.5, to automatically cut-off and/or lock-out the dangerous and mixed waste feed to the HLW Vitrification System when all instruments specified on Permit Table III.10.H.F for measuring the monitored parameters fails or exceeds its span value.

III.10.J.1.c.iv The Permittees will operate the AWFCO systems, specified in Permit Table III.10.J.F, as approved/modified pursuant to Permit Condition III.10.J.5, to automatically cut-off and/or lock out the dangerous and/or mixed waste feed to the HLW Vitrification System when any portion of the HLW Vitrification System is bypassed. The terms "bypassed" and "bypass event" as used in Permit Sections III.10.J and III.10.K will mean if any portion of the HLW Vitrification System is bypassed so that gases are not treated as during the Demonstration Test.

III.10.J.1.c.v In the event of a malfunction of the AWFCO systems listed in Permit Table III.10.J.F, as approved/modified pursuant to Permit Condition III.10.J.5, the Permittees will immediately, manually cut-off the dangerous and mixed waste feed to the HLW Vitrification System. The Permittees will not restart the dangerous and/or mixed waste feed until the problem causing the malfunction has been identified and corrected.

III.10.J.1.c.vi The Permittees will manually cut-off the dangerous and mixed waste feed to the HLW Vitrification System when the operating conditions deviate from the limits specified in Permit Condition III.10.J.1.c.i, unless the deviation automatically activates the waste feed cut-off sequence specified in Permit Conditions III.10.J.1.c.ii, III.10.J.1.c.iii, and/or III.10.J.1.c.iv.

III.10.J.1.c.vii If greater than thirty (30) dangerous and mixed waste feed cut-offs, combined, to the HLW Vitrification System occur due to deviations from Permit Table III.10.J.F, as approved/modified pursuant to Permit Condition III.10.J.5, within a sixty (60) day period, the Permittees will submit a written report to Ecology within five (5) calendar days of the thirty-first exceedance including the information specified below. These dangerous and mixed waste feed cut-offs to the HLW Vitrification System, whether automatically or manually activated, are counted if the specified set-points are deviated from while dangerous waste, mixed waste, and waste residues continue to be processed in the HLW Vitrification System. A cascade event is counted at a frequency of one (1) towards the first waste feed cut-off parameter, specified on Permit Table III.10.J.F, from which the set-point is deviated:

A. The parameter(s) that deviated from the set-point(s) in Permit Table III.10.J.F.
B. The magnitude, dates, and duration of the deviations.
C. Results of the investigation of the cause of the deviations.

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D. Corrective measures taken to minimize future occurrences of the deviations.

III.10.J.1.c.viii If any portion of the HLW Vitrification System is bypassed while treating dangerous and/or mixed waste, it will be regarded as non-compliance with the operating conditions specified in Permit Condition III.10.J.1.c and the performance standards specified in Permit Condition III.10.J.1.b. After such a bypass event, the Permittees will perform the following actions:

A. Investigate the cause of the bypass event.

B. Take appropriate corrective measures to minimize future bypasses.

C. Record the investigation findings and corrective measures in the operating record.

D. Submit a written report to Ecology within five (5) days of the bypass event documenting the result of the investigation and corrective measures.

III.10.J.1.c.ix The Permittees will control fugitive emissions from the HLW Vitrification System by maintaining the melter under negative pressure.

III.10.J.1.c.x Except during periods of HLW Vitrification System startup and shutdown, compliance with the operating conditions specified in Permit Condition III.10.J.1.c will be regarded as compliance with the required performance standards identified in Permit Condition III.10.J.1.b. However, evidence that compliance with these operating conditions is insufficient to ensure compliance with the performance standards, will justify modification, revocation, or re-issuance of this Permit, in accordance with Permit Conditions III.10.C.2.e and III.10.C.2.f, or III.10.C.2.g.

III.10.J.1.d Inspection Requirements [WAC 173-303-680(3)].

III.10.J.1.d.i The Permittees will inspect the HLW Vitrification System in accordance with the Inspection Plan in Operating Unit Group 10, Chapter 6A of this Permit, as modified in accordance with Permit Condition III.10.C.5.c.

III.10.J.1.d.ii The inspection data for HLW Vitrification System will be recorded, and the records will be placed in the WTP Unit operating record for the HLW Vitrification System, in accordance with Permit Condition III.10.C.4.

III.10.J.1.d.iii The Permittees will comply with the inspection requirements specified in Operating Unit Group 10, Appendix 10.15 of this Permit, as approved pursuant to Permit Condition III.10.J.5.f, and as modified by Permit Conditions III.10.J.1.b.xii, III.10.J.2, III.10.J.3., and III.10.J.4.

III.10.J.1.e Monitoring Requirements [WAC 173-303-670(5), WAC 173-303-670(6), WAC 173-303-670(7), and WAC 173-303-807(2), in accordance with WAC 173-303-680(3)]

III.10.J.1.e.i Upon receipt of a written request from Ecology, the Permittees will perform sampling and analysis of the dangerous and mixed waste and exhaust emissions to verify that the operating requirements established in the Permit achieve the performance standards delineated in this Permit.

III.10.J.1.e.ii The Permittees will comply with the monitoring requirements specified in Operating Unit Group 10, Appendices 10.2, 10.3, 10.7, 10.13, 10.15, and 10.18 of this Permit, as approved pursuant to Permit Conditions III.10.J.5.c, III.10.J.5.d, III.10.J.5.e, and III.10.J.5.f, as modified by Permit Conditions III.10.J.1.b.xii, III.10.J.2, III.10.J.3, and III.10.J.4.

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III.10.J.1.e.iii The Permittees will operate, calibrate, and maintain the carbon monoxide CEMS as specified in this Permit in accordance with Performance Specifications found in 40 CFR Part 60, Appendix B, in accordance with Appendix to Subpart EEE of 40 CFR Part 63, and Operating Unit Group 10 Appendix 10.15 of this Permit, as approved pursuant to Permit Condition III.10.J.5.f, and as modified by Permit Conditions III.10.J.1.b.xii, III.10.J.2, III.10.J.3, and III.10.J.4.

III.10.J.1.e.iv The Permittees will operate, calibrate, and maintain the instruments specified on Permit Tables III.10.J.C and F, as approved/modified pursuant to Permit Condition III.10.J.5, in accordance with Operating Unit Group 10, Appendix 10.15 of this Permit, as approved pursuant to Permit Condition III.10.J.5.f, and as modified by Permit Conditions III.10.J.1.b.xii, III.10.J.2, III.10.J.3, and III.10.J.4.

III.10.J.1.f Recordkeeping Requirements [WAC 173-303-380 and WAC 173-303-680(3)]

III.10.J.1.f.i The Permittees will record and maintain in the WTP Unit operating record for the HLW Vitrification System, all monitoring, calibration, maintenance, test data, and inspection data compiled under the conditions of this Permit, in accordance with Permit Conditions III.10.C.4 and III.10.C.5, as modified by Permit Conditions III.10.J.1.b.xii, III.10.J.2, III.10.J.3, and III.10.J.4.

III.10.J.1.f.ii The Permittees will record in the WTP Unit operating record the date, time, and duration of all automatic waste feed cut-offs and/or lockouts, including the triggering parameters, reason for the deviation, and recurrence of the incident. The Permittees will also record all incidents of AWFCO system function failures, including the corrective measures taken to correct the condition that caused the failure.

III.10.J.1.f.iii The Permittees will submit to Ecology a report semi-annually the first calendar year, and annually thereafter each calendar year within ninety (90) days following the end of the year. The report will include the following information:

A. Total dangerous and mixed waste feed processing time for the HLW Vitrification System.

B. Date/Time of all HLW Vitrification System startups and shutdown.

C. Date/Time/Duration/Cause/Corrective Action taken for all HLW Vitrification System shutdowns caused by malfunction of either process or control equipment.

D. Date/Time/Duration/Cause/Corrective Action taken for all instances of dangerous and/or mixed waste feed cut-off due to deviations from Permit Table III.10.J.F, as approved/modified pursuant to Permit Condition III.10.J.5.

III.10.J.1.f.iv The Permittees will submit an annual report to Ecology each calendar year within ninety (90) days following the end of the year of all quarterly CEMS Calibration Error and Annual CEMS Performance Specification Tests conducted in accordance with Permit Condition III.10.J.1.e.iii.

III.10.J.1.g Closure

The Permittees will close the HLW Vitrification System in accordance with Operating Unit Group 10, Addendum H of this Permit, as approved pursuant to Permit Condition III.10.C.8.

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III.10.J.2 Shakedown Period [WAC 173-303-670(5), WAC 173-303-670(6), WAC 173-303-670(7), and WAC 173-303-807(2), in accordance with WAC 173-303-680(2) and (3)].

III.10.J.2.a The shakedown period for the HLW Vitrification System will be conducted in accordance with Permit Condition III.10.J.1, Operating Unit Group 10, Appendix 10.15 of this Permit, as approved pursuant to Permit Condition III.10.J.5.f, and as modified in accordance with Permit Conditions III.10.J.1.b.xii, III.10.J.2, and III.10.J.3.

III.10.J.2.b Duration of the Shakedown Period

III.10.J.2.b.i The shakedown period for the HLW Vitrification System will begin with the initial introduction of dangerous waste in the HLW Vitrification System following construction and will end with the start of the demonstration test.

III.10.J.2.b.ii The shakedown period will not exceed the following limits, as defined by hours of operation, when the HLW Vitrification System is processing dangerous waste. The Permittees may petition Ecology for one (1) extension of each shakedown phase for seven hundred and twenty (720) additional operating hours in accordance with permit modification procedures specified in Permit Conditions III.10.C.2.e and III.10.C.2.f.

Shakedown Phase 1: 720 hours.

Shakedown Phase 2: 720 hours.

III.10.J.2.b.iii Shakedown Phase 2 will not be commenced until documentation has been submitted to Ecology verifying that the HLW Vitrification System has operated at a minimum of 75% of the shakedown Phase 1 feed-rate limit for two (2) separate eight (8) consecutive hour periods with no AWFCOs.

III.10.J.2.c Allowable Waste Feed during the Shakedown Period

III.10.J.2.c.i The Permittees may feed the dangerous waste specified for the HLW Vitrification System on the Part A Forms (Operating Unit Group 10, Chapter 1 of this Permit), except for those waste outside the waste acceptance criteria specified in the WAP, Operating Unit Group 10, Chapter 3 of this Permit, as approved pursuant to Permit Condition III.10.C.3, except Permit Conditions III.10.J.2.c.ii through v also apply.

III.10.J.2.c.ii The Permittees will not feed the following waste to the HLW Vitrification System during Shakedown Phase 1:

A. Acutely toxic dangerous waste listed in WAC 173-303-081(a)(2)(a)(i).
B. Mixed waste.

III.10.J.2.c.iii The Permittees will not feed the following waste to the HLW Vitrification System during Shakedown Phase 2:

A. Mixed waste.

III.10.J.2.c.iv The feed-rates to the HLW Vitrification System will not exceed the limits in Permit Tables III.10.J.D and III.10.J.F, as approved/modified pursuant to Permit Condition III.10.J.5.

III.10.J.2.c.v The Permittees will conduct sufficient analysis of the dangerous waste treated in the HLW Vitrification System to verify that the waste feed is within the physical and chemical composition limits specified in this Permit.

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III.10.J.3 Demonstration Test Period [WAC 173-303-670(5), WAC 173-303-670(6), WAC 173-303-670(7), and WAC 173-303-807(2), in accordance with WAC 173-303-680(2) and (3)]

III.10.J.3.a Demonstration Test Period

III.10.J.3.a.i The Permittees will operate, monitor, and maintain the HLW Vitrification System as specified in Permit Condition III.10.J.1, and Operating Unit Group 10, Appendix 10.15 of this Permit, as approved pursuant to Permit Condition III.10.J.5.f, except as modified in accordance with Permit Conditions III.10.J.1.b.xii and III.10.J.3.

III.10.J.3.a.ii Operating Unit Group 10, Appendix 10.15 of this Permit, as approved pursuant to Permit Condition III.10.J.5.f, will be re-submitted to Ecology for approval by the Permittees as a permit modification pursuant to Permit Conditions III.10.C.2.e and III.10.C.2.f at least one hundred and eighty (180) days prior to the start date of the demonstration test. The RDTP will include applicable EPA promulgated test methods and procedures in effect at the time of the re-submittal and projected commencement and completion dates for the Demonstration Test.

III.10.J.3.a.iii The Permittees will not commence the demonstration test period until documentation has been submitted to Ecology verifying that the HLW Vitrification System has operated at a minimum of 75% of the demonstration test period feed-rate limit for a minimum of an eight (8) consecutive hours period on two (2) consecutive days.

III.10.J.3.b Performance Standards

The Permittees will demonstrate compliance with the performance standards specified in Permit Condition III.10.J.1.b during the Demonstration Test Period.

III.10.J.3.c Allowable Waste Feed during the Demonstration Test Period

III.10.J.3.c.i The Permittees may feed the dangerous waste specified for the HLW Vitrification System in Part A Forms (Operating Unit Group 10, Chapter 1 of this Permit), except for those waste outside the waste acceptance criteria specified in the WAP, Operating Unit Group 10, Chapter 3 of this Permit, as approved pursuant to Permit Condition III.10.C.3, except Permit Conditions III.10.J.3.c.ii through iv also apply.

III.10.J.3.c.ii The Permittees will not feed mixed waste to the HLW Vitrification System.

III.10.J.3.c.iii RESERVED

III.10.J.3.c.iv ~~**III.10.J.3.c.iv.**~~ The dangerous waste feed-rates to the HLW Vitrification System will not exceed the limits in Permit Tables III.10.J.D and F, as approved/modified pursuant to Permit Condition III.10.J.5.

III.10.J.3.c.v ~~**III.10.J.3.c.v.**~~ The Permittees will conduct sufficient analysis of the dangerous waste treated in the HLW Vitrification System to verify that the dangerous waste is within the physical and chemical composition limits specified in this Permit.

III.10.J.3.d Demonstration Data Submissions and Certifications

III.10.J.3.d.i The Permittees will submit to Ecology a complete demonstration test report within one hundred and eighty (180) calendar days of completion of the Demonstration Test including all data collected during the Demonstration Test and updated Permit Tables III.10.K.D, III.10.K.E, and III.10.K.F.

III.10.J.3.d.ii The Permittees must submit the following information to Ecology prior to receiving Ecology's approval to commence feed of dangerous waste and mixed waste to the HLW Vitrification System:

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A. The Permittees will submit a summary of data collected as required during the Demonstration Test to Ecology upon completion of the Demonstration Test.

B. A certification that the Demonstration Test has been carried out in accordance with the approved Demonstration Test Plan and approved modifications within thirty (30) days of the completion of the Demonstration Test [WAC 173-303-807(8)].

C. Calculations and analytical data showing compliance with the performance standards specified in Permit Conditions III.10.J.1.b.i, III.10.J.1.b.iv, III.10.J.1.b.v, III.10.J.1.b.vi, and III.10.J.1.b.vii.

D. Laboratory data QA/QC summary for the information provided in III.10.J.3.d.ii.C.

III.10.J.3.d.iii After successful completion of the Demonstration Test and receipt of Ecology's approval, the Permittees will be authorized to commence feed of dangerous waste and mixed waste to the HLW Vitrification System for the post-demonstration test period indicated in Permit Tables III.10.J.D and F, as approved/modified pursuant to Permit Condition III.10.J.5, in compliance with the operating requirements specified in Permit Condition III.10.J.1.c and within the limitations specified in Permit Condition III.10.C.14.

III.10.J.3.d.iv RESERVED

III.10.J.3.d.v After successful completion of the Demonstration Test, Permittees submittal of the following to Ecology, and Permittees receipt of Ecology approval of the following in writing, the Permittees will be authorized to feed dangerous waste and mixed waste to the HLW Vitrification System pursuant to Permit Section III.10.K.

A. A complete Demonstration Test Report for the HLW Vitrification System and updated Permit Tables III.10.K.D, III.10.K.E, and III.10.K.F, as approved/modified pursuant to Permit Conditions III.10.J.5 and III.10.C.11.c or III.10.C.11.d, the test report will be certified in accordance with WAC 173-303-807(8), in accordance with WAC 173-303-680(2) and (3).

B. A Final Risk Assessment Report completed pursuant to Permit Conditions III.10.C.11.c or III.10.C.11.d.

III.10.J.3.d.vi If any calculations or testing results show that one or more of the performance standards listed in Permit Condition III.10.J.1.b, with the exception of Permit Condition III.10.J.1.b.x, for the HLW Vitrification System were not met during the Demonstration Test, the Permittees will perform the following actions:

A. Immediately stop dangerous and mixed waste feed to the HLW Vitrification System under the mode of operation that resulted in not meeting the performance standard(s).

B. Verbally notify Ecology within twenty-four (24) hours of discovery of not meeting the performance standard(s) as specified in Permit Condition I.E.21.

C. Investigate the cause of the failure and submit a report of the investigation findings to Ecology within fifteen (15) days of discovery of not meeting the performance standard(s).

D. Submit to Ecology within fifteen (15) days of discovery of not meeting the performance standard(s), documentation supporting a mode of operation where all performance standards listed in Permit Condition III.10.J.1.b, with

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the exception of Permit Condition III.10.J.1.b.x, for the HLW Vitrification System were met during the demonstration test, if any such mode was demonstrated.

E. Based on the information provided to Ecology by the Permittees, pursuant to Permit Conditions III.10.J.3.d.vi.A through D above, and any additional information, Ecology may provide, in writing, direction to the Permittees to stop dangerous and/or mixed waste feed to the LAW Vitrification System and/or amend the mode of operation the Permittees are allowed to continue operations prior to Ecology approval of a compliance schedule and/or RDTP, pursuant to Permit Conditions III.10.J.3.d.vi.F and G.

F. If the performance standard listed in Permit Condition III.10.J.1.b.i was not met during the Demonstration Test, the Permittees will submit within one hundred and twenty (120) days of discovery of not meeting the performance standard, a RDTP (if appropriate) and a compliance schedule for Ecology approval to address this deficiency. If a RDTP is submitted, it will be accompanied by a request for approval to retest as a permit modification pursuant to Permit Conditions III.10.C.2.e and III.10.C.2.f. The RDTP (if submitted) must include substantive changes to prevent failure from reoccurring.

G. If any of the performance standards listed in Permit Condition III.10.J.1.b, with the exception of Permit Conditions III.10.J.1.b.i or III.10.J.1.b.x, were not met during the Demonstration Test, the Permittees will submit to Ecology within one hundred and twenty (120) days of discovery of not meeting the performance standard(s), a RDTP requesting approval to retest as a permit modification pursuant to Permit Conditions III.10.C.2.e and III.10.C.2.f. The RDTP must include substantive changes to prevent failure from reoccurring.

III.10.J.3.d.vii If any calculations or testing results show that any emission rate for any constituent listed in Permit Table III.10.J.E, as approved pursuant to Permit Condition III.10.C.11.b, is exceeded for HLW Vitrification System during the Demonstration Test, the Permittees will perform the following actions:

A. Verbally notify Ecology within twenty-four (24) hours of the discovery of exceeding the emission rate(s) as specified in Permit Condition I.E.21.

B. Submit to Ecology additional risk information to indicate that the increased emissions impact is offset by decreased emission impact from one or more constituents expected to be emitted at the same time, and/or investigate the cause and impact of the exceedance of the emission rate(s) and submit a report of the investigation findings to Ecology within fifteen (15) days of the discovery of exceeding the emission rate(s).

C. Based on the notification and any additional information, Ecology may provide, in writing, direction to the Permittees to stop dangerous and/or mixed waste feed to the HLW Vitrification System and/or to submit a RDTP as a permit modification pursuant to Permit Conditions III.10.C.2.e and III.10.C.2.f, or III.10.C.2.g. The RDTP must include substantive changes to prevent failure from reoccurring.

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III.10.J.4 Post-Demonstration Test Period [WAC 173-303-670(5), WAC 173-303-670(6), and WAC 173-303-807(2), in accordance with WAC 173-303-680(2) and (3)].

III.10.J.4.a The Permittees will operate, monitor, and maintain the HLW Vitrification System as specified in Permit Condition III.10.J.1 and Operating Unit Group 10, Appendix 10.15 of this Permit, as approved pursuant to Permit Condition III.10.J.5, except as modified in accordance with Permit Conditions III.10.J.1.b.xii, III.10.J.3, and III.10.J.4.

III.10.J.4.b Allowable Waste Feed during the Post-Demonstration Test Period

III.10.J.4.b.i The Permittees may feed the dangerous and/or mixed waste specified for the HLW Vitrification System on the Part A Forms (Operating Unit Group 10, Chapter 1 of this Permit), except for those waste outside the waste acceptance criteria specified in the WAP, Operating Unit Group 10, Chapter 3 of this Permit, as approved pursuant to Permit Condition III.10.C.3, and except Permit Conditions III.10.J.4.b.ii and III.10.J.4.b.iii also apply.

III.10.J.4.b.ii The dangerous waste and mixed waste feed rates to the HLW Vitrification System will not exceed the limits in Permit Tables III.10.J.D and F, as approved/modified pursuant to Permit Condition III.10.J.5, or in Permit Condition III.10.J.3.

III.10.J.4.b.iii The Permittees will conduct sufficient analysis of the dangerous waste and mixed waste treated in HLW Vitrification System to verify that the waste feed is within the physical and chemical composition limits specified in this Permit.

III.10.J.5 Compliance Schedules

III.10.J.5.a All information identified for submittal to Ecology in a. through f. of this compliance schedule must be signed and certified in accordance with requirements in WAC 173-303-810(12), as modified in accordance with Permit Condition III.10.J.1.a.iii [WAC 173-303-806(4)].

III.10.J.5.b The Permittees will submit to Ecology, pursuant to Permit Condition III.10.C.9.f, prior to construction of each secondary containment and leak detection system for the HLW Vitrification System (per level) as identified in Permit Tables III.10.J.A and III.10.J.B, engineering information as specified below, for incorporation into Operating Unit Group 10, Appendices 10.2, 10.4, 10.5, 10.7, 10.8, 10.9, 10.11, and 10.12 of this Permit. At a minimum, engineering information specified below will show the following as described in WAC 173-303-640, in accordance with WAC 173-303-680 (the information specified below will include dimensioned engineering drawings and information on sumps and floor drains):

III.10.J.5.b.i IQRPE Reports (specific to foundation, secondary containment, and leak detection system) will include review of design drawings, calculations, and other information on which the certification report is based and will include, but not limited to, review of such information described below. Information (drawings, specifications, etc.) already included in Operating Unit Group 10, Appendix 10.0 of this Permit, may be included in the report by reference and should include drawing and document numbers. IQRPE Reports will be consistent with the information separately provided in ii through ix below [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)];

III.10.J.5.b.ii Design drawings (General Arrangement Drawings, plan) and specifications for the foundation, secondary containment including liner installation details, and leak detection methodology. These items should show the dimensions, volume calculations, and location of the secondary containment system, and should include

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items such as floor/pipe slopes to sumps, tanks, floor drains [WAC 173-303-640(4)(b) through (f) and WAC 173-303-640(3)(a), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)];

III.10.J.5.b.iii The Permittees will provide the design criteria (references to codes and standards, load definitions, and load combinations, materials of construction, and analysis/design methodology) and typical design details for the support of the secondary containment system. This information will demonstrate the foundation will be capable of providing support to the secondary containment system, resistance to pressure gradients above and below the system, and capable of preventing failure due to settlement, compression, or uplift [WAC 173-303-640(4)(c)(ii), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(B)];

III.10.J.5.b.iv A description of materials and equipment used to provide corrosion protection for external metal components in contact with soil, including factors affecting the potential for corrosion [WAC 173-303-640(3)(a)(iii)(B), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(A) through (B)];

III.10.J.5.b.v Secondary containment/foundation, and leak detection system, materials selection documentation (including, but not limited to, concrete coatings and water stops, and liner materials), as applicable [WAC 173-303-806(4)(i)(i)(A) through (B)];

III.10.J.5.b.vi Detailed description of how the secondary containment for the HLW Vitrification System will be installed in compliance with WAC 173-303-640(3)(c), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(A) through (B);

III.10.J.5.b.vii Submit Permit Tables III.10.J.B and III.10.K.B completed to provide for all secondary containment sumps and floor drains the information, as specified in each column heading consistent with information to be provided in i through vi, above;

III.10.J.5.b.viii Documentation that secondary containment and leak detection systems will not accumulate hydrogen gas levels above the lower explosive limit for incorporation into the Administrative Record [WAC 173-303-680, WAC 173-303-806(4)(i)(i)(A), and WAC 173-303-806(4)(i)(v)];

III.10.J.5.b.ix A detailed description of how HLW Vitrification System design provides access for conducting future HLW Vitrification System integrity assessments [WAC 173-303-640(3)(b) and WAC 173-303-806(4)(i)(i)(B)].

III.10.J.5.c The Permittees will submit to Ecology pursuant to Permit Condition III.10.C.9.f, prior to installation of each sub-system as identified in Permit Table III.10.J.A, engineering information as specified below, for incorporation into Operating Unit Group 10, Appendices 10.1 through 10.14 and 10.17 of this Permit. At a minimum, engineering information specified below will show the following, as required pursuant to WAC 173-303-640, in accordance with WAC 173-303-680 (the information specified below will include dimensioned engineering drawings):

III.10.J.5.c.i IQRPE Reports (specific to sub-system) will include review of design drawings, calculations, and other information on which the certification report is based and will include as applicable, but not limited to, review of such information described below. Information (drawings, specifications, etc.) already included in Operating Unit Group 10, Appendix 10.0 of this Permit, may be included in the report by reference and should include drawing and document numbers. The IQRPE Reports will be consistent with the information separately provided in ii. through xii. below and the

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IQRPE Report specified in Permit Condition III.10.J.5.b [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)];

III.10.J.5.c.ii Design drawings [General Arrangement Drawings in plan, Process Flow Diagrams, Piping and Instrumentation Diagrams, (including pressure control systems), Mechanical Drawings, and specifications, and other information specific to subsystems (to show location and physical attributes of each subsystem specific to miscellaneous units)] [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)];

III.10.J.5.c.iii Sub-system design criteria (references to codes and, standards, load definitions, and load combinations, materials of construction, and analysis/design methodology) and typical design details to support the sub-systems. Structural support calculations specific to off-specification, non-standard, and field-fabricated subsystems will be submitted for incorporation into the Administrative Record. Documentation will include, but not be limited to, supporting specifications (test data, treatment effectiveness report, etc.), supporting projected operational capability (e.g., WESP projected removal efficiency for individual metals, halogens, particulates, etc.), and compliance with performance standards specified in Permit Condition III.10.J.1.b [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(B)];

III.10.J.5.c.iv A description of materials and equipment used to provide corrosion protection for external metal components in contact with water, including factors affecting the potential for corrosion [WAC 173-303-640(3)(a)(iii)(B), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(A) through (B)];

III.10.J.5.c.v Sub-system materials selection documentation (e.g., physical and chemical tolerances) [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(A)];

III.10.J.5.c.vi Sub-system vendor information (including, but not limited to, required performance warranties, as available), consistent with information submitted under ii. above, will be submitted for incorporation into the Administrative Record WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2), WAC 173-303-806(4)(i)(i)(A) through (B), and WAC 173-303-806(4)(i)(v)];

III.10.J.5.c.vii System descriptions related to sub-system units will be submitted for incorporation into the Administrative Record [WAC 173-303-680, WAC 173-303-806(4)(i)(i)(A) through (B), and WAC 173-303-806(4)(i)(v)];

III.10.J.5.c.viii Mass and energy balance for normal projected operating conditions used in developing the Piping and Instrumentation Diagrams and Process Flow Diagrams, including assumptions and formulas used to complete the mass and energy balance, so that they can be independently verified for incorporation into the Administrative Record [WAC 173-303-680(2), WAC 173-303-806(4)(i)(i)(B), and WAC 173-303-806(4)(i)(v)];

III.10.J.5.c.ix Detailed description of all potential HLW Vitrification System bypass events including:

A. A report which includes an analysis of credible potential bypass events and recommendations for prevention/minimization of the potential, impact, and frequency of the bypass event to include at a minimum:

1. Operating procedures.

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2. Maintenance procedures.
3. Redundant equipment.
4. Redundant instrumentation.
5. Alternate equipment.
6. Alternate materials of construction.

III.10.J.5.c.x A detailed description of how the sub-systems will be installed in compliance with WAC 173-303-640(3)(b), (c), (d), and (e), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(B);

III.10.J.5.c.xi Sub-system design to prevent escape of vapors and emissions of acutely or chronically toxic (upon inhalation) EHW, for incorporation into the Administrative Record [WAC 173-303-640(5)(e), in accordance with WAC 173-303-680(2), and WAC 173-303-806(4)(i)(i)(B)];

III.10.J.5.c.xii Documentation that sub-systems are designed to prevent the accumulation of hydrogen gases levels above the lower explosive limit for incorporation into the Administrative Record [WAC 173-303-680, WAC 173-303-806(4)(i)(i)(A), and WAC 173-303-806(4)(i)(v)];

III.10.J.5.d The Permittees will submit to Ecology, pursuant to Permit Condition III.10.C.9.f, prior to installation of equipment for each sub-system as identified in Permit Tables III.10.J.A and III.10.J.B, not addressed in Permit Conditions III.10.J.5.b or III.10.J.5.c, engineering information as specified below, for incorporation into Operating Unit Group 10, Appendices 10.1 through 10.14 of this Permit. At a minimum, engineering information specified below will show the following as required pursuant to in WAC 173-303-640, in accordance with WAC 173-303-680 (the information specified below will include dimensioned engineering drawings):

III.10.J.5.d.i IQRPE Reports (specific to sub-system equipment) will include a review of design drawings, calculations, and other information as applicable on which the certification report is based. The reports will include, but not be limited to, review of such information described below. Information (drawings, specifications, etc.) already included in Operating Unit Group 10, Appendix 10.0 of this Permit, may be included in the report by reference and should include drawing and document numbers. The IQRPE Reports will be consistent with the information provided separately in ii. through xiii. below and the IQRPE Reports specified in Permit Conditions III.10.J.5.b and III.10.J.5.c [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(I)(I)(A) through (B)];

III.10.J.5.d.ii Design drawings [Process Flow Diagrams, Piping and Instrumentation Diagrams (including pressure control systems), and specifications, and other information specific to equipment (these drawings should include all equipment such as pipes, valves, fittings, pumps, instruments, etc.)] [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(A) through (B)];

III.10.J.5.d.iii Sub-system equipment design criteria (references to codes and standards, load definitions and load combinations, materials of construction, and analysis/design methodology) and typical design details for the support of the sub-system equipment. [WAC 173-303-640(3)(a) and WAC 173-303-640(3)(f), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(B)];

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III.10.J.5.d.iv A description of materials and equipment used to provide corrosion protection for external metal components in contact with soil and water, including factors affecting the potential for corrosion [WAC 173-303-640(3)(a)(iii)(B), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(A)];

III.10.J.5.d.v Materials selection documentation for equipment for each sub-system (e.g., physical and chemical tolerances) [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(A)];

III.10.J.5.d.vi Vendor information (including, but not limited to, required performance warranties, as available), consistent with information submitted under ii. above, for sub-system equipment will be submitted for incorporation into the Administrative Record [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2), WAC 173-303-806(4)(i)(i)(A) through (B), and WAC 173-303-806(4)(i)(iv)];

III.10.J.5.d.vii Sub-system, sub-system equipment, and leak detection system instrument control logic narrative description (e.g., descriptions of fail-safe conditions, etc.) [WAC 173-303-680(2), WAC 173-303-806(4)(i)(i)(B), and WAC 173-303-806(4)(i)(v)];

III.10.J.5.d.viii System description related to sub-system equipment, and system descriptions related to leak detection systems, for incorporation into the Administrative Record [WAC 173-303-680, WAC 173-303-806(4)(i)(i)(A) through (B), and WAC 173-303-806(4)(i)(v)];

III.10.J.5.d.ix A detailed description of how the sub-system equipment will be installed and tested [WAC 173-303-640(3)(c) through (e) and WAC 173-303-640(4)(b) and (c), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(B)];

III.10.J.5.d.x For process monitoring, control, and leak detection system instrumentation for the HLW Vitrification System as identified in Permit Tables III.10.J.C and III.10.J.F, a detailed description of how the process monitoring, control, and leak detection system instrumentation will be installed and tested [WAC 173-303-640(3)(c) through (e), WAC 173-303-640(4)(b) and (c), WAC 173-303-806(4)(c)(vi), and WAC 173-303-806(4)(i)(i)(B)];

III.10.J.5.d.xi Mass and energy balance for projected normal operating conditions used in developing the Piping and Instrumentation Diagrams and Process Flow Diagrams, including assumptions and formulas used to complete the mass and energy balance, so that they can be independently verified, for incorporation into the Administrative Record [WAC 173-303-680(2), WAC 173-303-806(4)(i)(i)(B), and WAC 173-303-806(4)(i)(v)];

III.10.J.5.d.xii Documentation that sub-systems equipment are designed to prevent the accumulation of hydrogen gas levels above the lower explosive limit into the Administrative Record [WAC 173-303-680, WAC 173-303-806(4)(i)(i)(A), and WAC 173-303-806(4)(i)(v)] [WAC 173-303-815(2)(b)(ii)];

III.10.J.5.d.xiii Leak Detection system documentation (e.g. vendor information etc.) consistent with information submitted under Permit Condition III.10.J.5.c.ii and Permit Conditions III.10.J.5.d.ii, vii, viii, and x above, will be submitted for incorporation into the Administrative Record.

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III.10.J.5.e Prior to initial receipt of dangerous and/or mixed waste in the WTP Unit, the Permittees will submit to Ecology, pursuant to Permit Condition III.10.C.9.f, the following as specified below for incorporation into Operating Unit Group 10, Appendix 10.18 of this Permit, except Permit Condition III.10.J.5.e.i, which will be incorporated into Operating Unit Group 10, Addendum E of this Permit. All information provided under this permit condition must be consistent with information provided pursuant to Permit Conditions III.10.J.5.b, c, d, e, and f, III.10.C.3.e.v, and III.10.C.11.b, as approved by Ecology:

III.10.J.5.e.i Integrity assessment program and schedule for the HLW Vitrification System will address the conducting of periodic integrity assessments on the HLW Vitrification System over the life of the system, as specified in Permit Condition III.10.J.5.b.ix and as specified in WAC 173-303-640(3)(b), in accordance with WAC 173-303-680, and descriptions of procedures for addressing problems detected during integrity assessments. The schedule must be based on past integrity assessments, age of the system, materials of construction, characteristics of the waste, and any other relevant factors [WAC 173-303-640(3)(b), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(B)];

III.10.J.5.e.ii Detailed plans and descriptions, demonstrating the leak detection system is operated so that it will detect the failure of either the primary or secondary containment structure or the presence of any release of dangerous and/or mixed waste or accumulated liquid in the secondary containment system within twenty-four (24) hours [WAC 173-303-640(4)(c)(iii)]. Detection of a leak of at least 0.1 gallons per hour within twenty-four (24) hours is defined as being able to detect a leak within twenty-four (24) hours. Any exceptions to this criteria must be approved by Ecology in accordance with WAC 173-303-680, WAC 173-303-640(4)(c)(iii), and WAC 173-303-806(4)(i)(i)(b);

III.10.J.5.e.iii Detailed operational plans and descriptions, demonstrating that spilled or leaked waste and accumulated precipitation liquids can be removed from the secondary containment system within twenty-four (24) hours [WAC 173-303-806(4)(i)(i)(B)];

III.10.J.5.e.iv Descriptions of operational procedures demonstrating appropriate controls and practices are in place to prevent spills and overflows from the HLW Vitrification System or containment systems in compliance with WAC 173-303-640(5)(b)(i) through (iii), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(B);

III.10.J.5.e.v Description of procedures for investigation and repair of the HLW Vitrification System [WAC 173-303–640(6) and WAC 173-303-640(7)(e) and (f), in accordance with WAC 173-303-680, WAC 173-303-320, WAC 173-303-806(4)(ia)(iv), and WAC 173-303-806(4)(a)(ii)(B)];

III.10.J.5.e.vi Updated Chapter 4, Narrative Description, Tables and Figures as identified in Permit Tables III.10.J.A and III.10.J.B, as modified pursuant to Permit Condition III.10.H.5.e.x and updated to identify routinely non-accessible LAW Vitrification sub-systems.

III.10.J.5.e.vii Description of procedures for management of ignitable and reactive, and incompatible dangerous and/or mixed waste as specified in accordance with WAC 173-303-640(9) and (10), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(B).

III.10.J.5.e.viii A description of the tracking system used to track dangerous and/or mixed waste generated throughout the HLW Vitrification System, pursuant to WAC 173-303-380.

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III.10.J.5.e.ix Permit Table III.10.J.C and III.10.K.C will be revised and/or completed for HLW Vitrification System process and leak detection system monitors and instruments (to include, but not be limited to: instruments and monitors measuring and/or controlling flow, pressure, temperature, density, pH, level, humidity, and emissions) to provide the information as specified in each column heading. Process and leak detection system monitors and instruments for critical systems, as specified in Operating Unit Group 10, Appendix 2.0 and as updated pursuant to Permit Condition III.10.C.9.b and for operating parameters as required to comply with Permit Condition III.10.C.3.e.iii, will be addressed. Process monitors and instruments for non-waste management operations (e.g., utilities, raw chemical storage, non-contact cooling waters, etc.) are excluded from this permit condition [WAC 173-303-680, WAC 173-303-806(4)(i)(i)(A) through (B), and WAC 173-303-806(4)(i)(v)];

III.10.J.5.e.x Permit Tables III.10.J.A and III.10.K.A amended as follows [WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(A) through (B)]:

A. Under column 1, update and complete list of dangerous and mixed waste HLW Vitrification System sub-systems, including plant items that comprise each system (listed by item number).

B. Under column 2, update and complete system designations.

C. Under column 3, replace the "Reserved" with Operating Unit Group 10, Appendix 10.0 sub-sections (e.g., 10.1, 10.2, etc.) designated in Permit Conditions III.10.J.5.b, c, and d specific to HLW Vitrification System sub-system, as listed in column 1.

D. Under column 4, update and complete list of narrative description, tables, and figures.

III.10.J.5.f One hundred and eighty (180) days prior to initial receipt of dangerous and/or mixed waste in the WTP Unit, the Permittees will submit for review and receive approval for incorporation into Operating Unit Group 10, Appendix 10.15 of this Permit, a Demonstration Test Plan for the HLW Vitrification System to demonstrate that the HLW Vitrification Systems meets the performance standards specified in Permit Condition III.10.J.1.b. In order to incorporate the Demonstration Test Plan for the HLW Vitrification System into Operating Unit Group 10, Appendix 10.15, Permit Condition III.10.C.2.g process will be followed. The Demonstration Test Plan will include, but not be limited to, the following information. The Demonstration Test Plan will also be consistent with the information provided pursuant to Permit Conditions III.10.J.5.b, c, d, and e, III.10.C.3.e.v and III.10.C.11.b, as approved by Ecology and consistent with the schedule described in Operating Unit Group 10, Appendix 1.0 of this Permit. The documentation required pursuant to Permit Condition III.10.J.5.f.xvi, in addition to being incorporated into Operating Unit Group 10, Appendix 10.15, will be incorporated by reference in Operating Unit Group 10, Addendum E of this Permit.

Notes: (1) The following should be consulted to prepare this Demonstration Test Plan: *Guidance on Setting Permit Conditions and Reporting Trial Burn Results Volume II of the Hazardous Waste Incineration Guidance Series*, and EPA/625/6-89/019 and *Risk Burn Guidance For Hazardous Waste Combustion Facilities*, EPA-R-01-001, July 2001, WAC 173-303-807(2), WAC 173-303-670(5), WAC-173-303-670(6), 40 CFR §63.1207(f)(2), 40 CFR §63.1209 and Appendix to 40 CFR Part 63 EEE.

(2) Cross-referencing to the information provided pursuant to permit Conditions III.H.5.b, c, d, e and III.10.C.3.e.v, as approved by Ecology, that are redundant to elements of the Demonstration Test Plan for the HLW Vitrification System is acceptable.

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III.10.J.5.f.i Analysis of each feed-stream to be fed during the demonstration test, including dangerous waste, glass formers and reductants, process streams (e.g., control air, process air, steam, sparge bubbler air, air in-leakage from melter cave, and gases from HLW Vitrification Vessel Ventilation System, process water, etc.) that includes:

A. Levels of ash, levels of metals, total chlorine (organic and inorganic), other halogens and radionuclide surrogates.

B. Description of the physical form of the feed-streams.

C. An identification and quantification of organics that are present in the feed-stream, including constituents proposed for DRE demonstration.

A comparison of the proposed demonstration test feed streams to the mixed waste feed envelopes to be processed in the melter must be provided that documents that the proposed demonstration test feed streams will serve as worst case surrogates for organic destruction, formation of products of incomplete oxidation, and metals, total chlorine (organic and inorganic), other halogens, particulate formation, and radionuclides;

III.10.J.5.f.ii Specification of trial PODCs for which destruction and removal efficiencies are proposed to be calculated during the demonstration test and for inclusion in Permit Conditions III.10.J.1.b.i and III.10.K.1.b.i. These trial PODCs will be specified based on destructibility, concentration or mass in the waste and the dangerous waste constituents or constituents in WAC 173-303-9905;

III.10.J.5.f.iii A description of the blending procedures, prior to introducing the feed-streams into the melter, including analysis of the materials prior to blending, and blending ratios;

III.10.J.5.f.iv A description of how the surrogate feeds are to be introduced for the demonstration. This description should clearly identify the differences and justify how any of differences would impact the surrogate feed introduction as representative of how mixed waste feeds will be introduced;

III.10.J.5.f.v A detailed engineering description of the HLW Vitrification System, including:

A. Manufacturer's name and model number for each sub-system.

B. Design capacity of each sub-system including documentation (engineering calculations, manufacturer/vendor specifications, operating data, etc.) supporting projected operational efficiencies (e.g., WESP projected removal efficiency for individual metals, halogens, particulates, etc.) and compliance with performance standards specified in Permit Condition III.10.J.1.b.

C. Detailed scaled engineering drawings, including Process Flow Diagrams, Piping and Instrumentation Diagrams, Vessel Drawings (plan, and elevation with cross sections) and General Arrangement Drawings.

D. Process Engineering Descriptions.

E. Mass and energy balances for each projected operating condition and each demonstration test condition, including assumptions and formulas used to complete mass and energy balances so that they can be independently verified for incorporation into the Administrative Record.

F. Engineering Specifications/data sheets (materials of construction, physical and chemical tolerances of equipment, equipment performance warranties, and fan curves).

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G. Detailed Description of Automatic Waste Feed Cut-off System addressing critical operating parameters for all performance standards specified in Permit Condition III.10.J.1.b.

H. Documentation to support compliance with performance standards specified in Permit Condition III.10.J.1.b, including engineering calculations, test data, and manufacturer/vendor's warranties, etc.

I. Detailed description of the design, operation, and maintenance practices for air pollution control system.

J. Detailed description of the design, operation, and maintenance practices of any stack gas monitoring and pollution control monitoring system.

III.10.J.5.f.vi Detailed description of sampling and monitoring procedures including sampling and monitoring locations in the system, the equipment to be used, sampling and monitoring frequency, and planned analytical procedures for sample analysis including, but not limited to:

A. A short summary narrative description of each stack sample method should be included within the main body of the demonstration test plan, which references an appendix to the plan that would include for each sampling train: (1) detailed sample method procedures, (2) sampling train configuration schematic, (3) sampling recovery flow sheet, (4) detailed analytical method procedures, and (5) sampling preparation and analysis flow sheet. The detailed procedures should clearly flag where the method has provided decision points (e.g., choices of equipment materials of construction, choices of clean-up procedures or whether additional clean-up procedures will be incorporated, whether pretest surveys or laboratory validation work will be performed, enhancements to train to accommodate high moisture content in stack gas, etc.) and what is being proposed along with the basis for the decision.

B. A short summary narrative description of the feed and residue sampling methods should be included within the main body of the demonstration test plan, which references an appendix that would include for each sample type: (1) detailed sample method procedures, (2) sampling recovery/compositing procedures, and (3) detailed analytical method procedures. The detailed procedures should clearly flag where the method has provided decision points (e.g., choices of equipment materials of construction, choices of clean-up procedures or whether additional clean-up procedures will be incorporated, whether pretest surveys or laboratory validation work will be performed, etc.) and what is being proposed along with the basis for the decision.

III.10.J.5.f.vii A detailed test schedule for each condition for which the demonstration test is planned, including projected date(s), duration, quantity of dangerous waste to be fed, and other relevant factors;

III.10.J.5.f.viii A detailed test protocol including, for each test condition, the ranges of feed-rate for each feed system, and all other relevant parameters that may affect the ability of the HLW Vitrification System to meet performance standards specified in Permit Condition III.10.J.1.b;

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III.10.J.5.f.ix A detailed description of planned operating conditions for each demonstration test condition, including operating conditions for shakedown, demonstration test, post-demonstration test and normal operations. This information will also include submittal of Permit Tables III.10.J.D, III.10.J.F, III.10.K.D, and III.10.K.F completed with the information as specified in each column heading for each HLW Vitrification System waste feed cut-off parameter and submittal of supporting documentation for Permit Tables III.10.J.D, III.10.J.F, III.10.K.D, and III.10.K.F set-point values.

III.10.J.5.f.x The test conditions proposed must demonstrate meeting the performance standards specified in Permit Condition III.10.J.1.b with the simultaneous operation of the melter at capacity and input from the HLW Vitrification Vessel Ventilation System at capacity to simulate maximum loading to the HLW Vitrification System off-gas treatment system and to establish the corresponding operating parameter ranges.

III.10.J.5.f.xi A detailed description of procedures for start-up and shutdown of waste feed and controlling emissions in the event of an equipment malfunction, including off-normal and emergency shutdown procedures;

III.10.J.5.f.xii A calculation of waste residence time;

III.10.J.5.f.xiii Any request to extrapolate metal feed-rate limits from Demonstration Test levels must include:

A. A description of the extrapolation methodology and rationale for how the approach ensures compliance with the performance standards, as specified in Permit Condition III.10.J.1.b.

B. Documentation of the historical range of normal metal feed-rates for each feed stream.

C. Documentation that the level of spiking recommended during the demonstration test will mask sampling and analysis imprecision and inaccuracy to the extent that extrapolation of feed-rates and emission rates from the Demonstration Test data will be as accurate and precise as if full spiking were used.

III.10.J.5.f.xiv Documentation of the expected levels of constituents in HLW Vitrification System input streams, including, but not limited to, waste feed, glass former and reactants, control air, process air, steam, sparge bubbler air, air in-leakage from melter cave, gases from HLW Vitrification Vessel Ventilation System, and process water.

III.10.J.5.f.xv Documentation justifying the duration of the conditioning required to ensure the HLW Vitrification System had achieved steady-state operations under Demonstration Test operating conditions.

III.10.J.5.f.xvi Documentation of HLW Vitrification System process and leak detection system instruments and monitors as listed on Permit Tables III.10.J.C, III.10.J.F, III.10.K.C, and III.10.K.F to include:

A. Procurement specifications.

B. Location used.

C. Range, precision, and accuracy.

D. Calibration/functionality test procedures (either method number ASTM) or provide a copy of manufacturer's recommended calibration procedures.

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E. Calibration/functionality test, inspection, and routine maintenance schedules and checklists, including justification for calibration, inspection and maintenance frequencies, criteria for identifying instruments found to be significantly out of calibration, and corrective action to be taken for instruments found to be significantly out of calibration (e.g., increasing frequency of calibration, instrument replacement, etc.).

F. Equipment instrument control logic narrative description (e.g., descriptions of failsafe conditions, etc.) [WAC 173-303-680(2), WAC 173-303-806(4)(i)(i)(B), and WAC 173-303-806(4)(i)(v)].

III.10.J.5.f.xvii Outline of demonstration test report.

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Table III.10.J.A – HLW Plant Miscellaneous Unit System Description

Sub-system Description	Sub-system Designation	Engineering Description (Drawing Nos., Specification Nos., etc.)	Narrative Description, Tables, and Figures
HLW Melter Process System HMP-MLTR-00001 (HLW Melter 1) HMP-MLTR-00002 (HLW Melter 2)	HMP	-M6-HMP-00001001 -M6-HMP-00001002 -M6-HMP-00003001 -M6-HMP-00004001 -M6-HMP-00006001 -M6-HMP-00006002 -M6-HMP-00007001 -M6-HMP-00008001 -M6-HMP-00013002 -M6-HMP-00013003 -M6-HMP-20001001 -M6-HMP-20001002 -M6-HMP-20003001 -M6-HMP-20004001 -M6-HMP-20006001 -M6-HMP-20008001 -M6-HMP-20013002 -M6-HMP-20013003 -M5-V17T-P0002 -M5-V17T-P20002 -M0D-HMP-00001 -M0D-HMP-00002 -MF-HMP-00001 -MF-HMP-00002 -MF-HMP-00003	Section 4F.2.2; Table 4F-2; and Figures 4A-1, 4A-4 and 4A-27 in Operating Unit Group 10, Chapter 4 of this Permit.

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Table III.10.J.A – HLW Plant Miscellaneous Unit System Description

Sub-system Description	Sub-system Designation	Engineering Description (Drawing Nos., Specification Nos., etc.)	Narrative Description, Tables, and Figures
		-N1D-HMP-P0001 -P1-P01T-00002 -3PS-AE00-T0001	
Melter Offgas Treatment Process System HOP-FCLR-00001 (Melter 1 Offgas Film Cooler) HOP-FCLR-00002 (Melter 2 Offgas Film Cooler) HOP-FCLR-00003 (Melter 1 Standby Offgas Insert) HOP-FCLR-00004 (Melter 2 Standby Offgas Insert)	HOP	**24590-HLW** -M5-V17T-P0002 -M5-V17T-P20002 -M6-HMP-00002001 -M6-HMP-00002002 -M6-HMP-20002001 -3YD-HOP-00001[a]	Section 4F.4.2; Table 4F-2; and Figures 4A-1, 4A-4 and 4A-27 in Operating Unit Group 10, Chapter 4 of this Permit.
Melter Offgas Treatment Process System (Cont.) HOP-SCB-00001 (Melter 1 Submerged Bed Scrubber, SBS) HOP-SCB-00002 (Melter 2 Submerged Bed Scrubber, SBS)	HOP	**24590-HLW** -M5-V17T-P0003 -M5-V17T-P20003 -M6-HOP-00001001 -M6-HOP-00001002 -M6-HOP-00001003 -M6-HOP-20001001 -M6-HOP-20001002 -M6-HOP-20001003	Section 4F.4.2; Table 4F-2; and Figures 4A-1 and 4A-4 in Operating Unit Group 10, Chapter 4 of this Permit.

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Table III.10.J.A – HLW Plant Miscellaneous Unit System Description

Sub-system Description	Sub-system Designation	Engineering Description (Drawing Nos., Specification Nos., etc.)	Narrative Description, Tables, and Figures
		-MKD-HOP-00016 -MK-HOP-P0001001 -MK-HOP-P0001002 -MK-HOP-P0001003 -MK-HOP-P0001004 -N1D-HOP-P0010 -P1-P01T-00002 -3YD-HOP-00001[a] **24590-WTP** -3PS-MV00-T0001 -3PS-MV00-T0002 -3PS-MV00-T0003	
Melter Offgas Treatment Process System (Cont.) HOP-WESP-00001 (Melter 1 Wet Electrostatic Precipitator, WESP) HOP-WESP-00002 (Melter 2 Wet Electrostatic Precipitator, WESP)	HOP	**24590-HLW** -M5-V17T-P0003 -M5-V17T-P20003 -M6-HOP-00002 -M6-HOP-20002 -N1D-HOP-P0002 -P1-P01T-00004 -P1-P01T-00005 -3YD-HOP-00001[a] **24590-WTP** -3PS-MKE0-T0001	Section 4F.4.2; Table 4F-2; and Figures 4A-1 and 4A-4 in Operating Unit Group 10, Chapter 4 of this Permit.

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Table III.10.J.A – HLW Plant Miscellaneous Unit System Description

Sub-system Description	Sub-system Designation	Engineering Description (Drawing Nos., Specification Nos., etc.)	Narrative Description, Tables, and Figures
Melter Offgas Treatment Process System (Cont.) HOP-HEPA-00001A (Melter 1 Primary Offgas HEPA Filter) HOP-HEPA-00001B (Melter 1 Primary Offgas HEPA Filter) HOP-HEPA-00002A (Melter 1 Secondary Offgas HEPA Filter) HOP-HEPA-00002B (Melter 1 Secondary Offgas HEPA Filter) HOP-HEPA-00007A (Melter 2 Primary Offgas HEPA Filter) HOP-HEPA-00007B (Melter 2 Primary Offgas HEPA Filter) HOP-HEPA-00008A (Melter 2 Secondary Offgas HEPA Filter) HOP-HEPA-00008B (Melter 2 Secondary Offgas HEPA Filter)	HOP	**24590-HLW** -M5-V17T-P0003 -M5-V17T-P20003 -M6-HOP-00010 -M6-HOP-20010 -MAD-HOP-00010 -MAD-HOP-00011 -MAD-HOP-00012 -MAD-HOP-00013 -MAD-HOP-00014 -MAD-HOP-00015 -MAD-HOP-00016 -MAD-HOP-00017 -P1-P01T-00002 -3YD-HOP-00001[a] **24590-WTP** -3PS-MKH0-T0002	Section 4F.4.2; Table 4F-2; and Figures 4A-1 and 4A-4 in Operating Unit Group 10, Chapter 4 of this Permit.

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Table III.10.J.A – HLW Plant Miscellaneous Unit System Description

Sub-system Description	Sub-system Designation	Engineering Description (Drawing Nos., Specification Nos., etc.)	Narrative Description, Tables, and Figures
Melter Offgas Treatment Process System (Cont.) HOP-ADBR-00001A (Melter 1 Activated Carbon Adsorber – located on Activated Carbon Adsorber Skid HOP-ADBR-00001) HOP-ADBR-00001B (Melter 1 Activated Carbon Adsorber – located on Activated Carbon Adsorber Skid HOP-ADBR-00001) HOP-ADBR-00002A (Melter 2 Activated Carbon Adsorber – located on Activated Carbon Adsorber Skid HOP-ADBR-00002) HOP-ADBR-00002B (Melter 2 Activated Carbon Adsorber – located on Activated Carbon Adsorber Skid HOP-ADBR-00002)	HOP	**24590-HLW** -M5-V17T-00004 -M5-V17T-20004 -M6-HOP-00003001 -M6-HOP-00003002 -M6-HOP-20003001 -M6-HOP-20003002 -MVD-HOP-00015 -MVD-HOP-00016 -N1D-HOP-00003 -P1-P01T-00002 **24590-WTP** -3PS-MWK0-T0001	Section 4F.4.2; Table 4F-2; and Figures 4A-1 and 4A-4 in Operating Unit Group 10, Chapter 4 of this Permit.

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Table III.10.J.A – HLW Plant Miscellaneous Unit System Description

Sub-system Description	Sub-system Designation	Engineering Description (Drawing Nos., Specification Nos., etc.)	Narrative Description, Tables, and Figures
Melter Offgas Treatment Process System (Cont.) HOP-HEME-00001A (Melter 1 High Efficiency Mist Eliminator, HEME) HOP-HEME-00001B (Melter 1 High Efficiency Mist Eliminator, HEME) HOP-HEME-00002A (Melter 2 High Efficiency Mist Eliminator, HEME) HOP-HEME-00002B (Melter 2 High Efficiency Mist Eliminator, HEME)	HOP	**24590-HLW** -M5-V17T-P0003 -M5-V17T-P20003 -M6-HOP-00009001 -M6-HOP-00009002 -M6-HOP-20009001 -M6-HOP-20009002 -MVD-HOP-00007 -MV-HOP-P0002001 -MV-HOP-P0002002 -MV-HOP-P0002003 -N1D-HOP-P0001 -P1-P01T-00002 -3YD-HOP-00001[a]	Section 4F.4.2; Table 4F-2; and Figures 4A-1 and 4A-4 in Operating Unit Group 10, Chapter 4 of this Permit.
Melter Offgas Treatment Process System (Cont.) HOP-SCO-00001 (Thermal Catalytic Oxidizer – located on Catalyst SkidHOP-SKID-00005) HOP-SCO-00004 (Thermal Catalytic Oxidizer – located on Catalyst Skid HOP-SKID-00007)	HOP	**24590-HLW** -M5-V17T-00004 -M5-V17T-20004 -M6-HOP-00008001 -M6-HOP-00008002 -M6-HOP-00008003 -M6-HOP-20008001 -M6-HOP-20008002 -M6-HOP-20008003	Section 4F.4.2; Table 4F-2; and Figures 4A-1 and 4A-4 in Operating Unit Group 10, Chapter 4 of this Permit.

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Table III.10.J.A – HLW Plant Miscellaneous Unit System Description

Sub-system Description	Sub-system Designation	Engineering Description (Drawing Nos., Specification Nos., etc.)	Narrative Description, Tables, and Figures
		-MKD-HOP-00019 -N1D-HOP-00004 -NID-HOP-00005 -P1-P01T-00002 -3PS-MBTV-T0002 **<u>24590-LAW</u>** -3PS-MBTV-T0001	
<u>Melter Offgas Treatment Process System (Cont.)</u> HOP-SCR-00001 (NOx Selective Catalytic Reducer – located on Catalyst Skid HOP-SKID-00005) HOP-SCR-00002 (NOx Selective Catalytic Reducer – located on Catalyst Skid HOP-SKID-00007)	HOP	**<u>24590-HLW</u>** -M5-V17T-00004 -M5-V17T-20004 -M6-HOP-00008001 -M6-HOP-00008002 -M6-HOP-00008003 -M6-HOP-20008001 -M6-HOP-20008002 -M6-HOP-20008003 -MKD-HOP-00019 -N1D-HOP-00004 -N1D-HOP-00005 -P1-P01T-00002 -3PS-MBTV-T0002 **<u>24590-LAW</u>** -3PS-MBTV-T0001	Section 4F.4.2; Table 4F-2; and Figures 4A-1 and 4A-4 in Operating Unit Group 10, Chapter 4 of this Permit.

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Table III.10.J.A – HLW Plant Miscellaneous Unit System Description

Sub-system Description	Sub-system Designation	Engineering Description (Drawing Nos., Specification Nos., etc.)	Narrative Description, Tables, and Figures
Melter Offgas Treatment Process System (Cont.) HOP-HX-00001 (Catalyst Skid Preheater – located on Catalyst Skid HOP-SKID-00005) HOP-HX-00003 (Catalyst Skid Preheater – located on Catalyst Skid HOP-SKID-00007)	HOP	**24590-HLW** -M5-V17T-00004 -M5-V17T-20004 -M6-HOP-00008001 -M6-HOP-00008002 -M6-HOP-00008003 -M6-HOP-20008001 -M6-HOP-20008002 -M6-HOP-20008003 -MKD-HOP-00019 -N1D-HOP-00008 -P1-P01T-P0002 -3PS-MBTV-T0002 **24590-LAW** -3PS-MBTV-T0001	Section 4F.4.2; Table 4F-2; and Figures 4A-1 and 4A-4 in Operating Unit Group 10, Chapter 4 of this Permit.
Melter Offgas Treatment Process System (Cont.) HOP-HTR-00001 (Catalyst Skid Electric Heater – located on Catalyst Skid HOP-SKID-00005) HOP-HTR-00007 (Catalyst Skid Electric Heaters – located on Catalyst Skid HOP-SKID-00007)	HOP	**24590-HLW** -M5-V17T-00004 -M5-V17T-20004 -M6-HOP-00008001 -M6-HOP-00008002 -M6-HOP-00008003 -M6-HOP-20008001 -M6-HOP-20008002 -M6-HOP-20008003	Section 4F.4.2; Table 4F-2; and Figures 4A-1 and 4A-4 in Operating Unit Group 10, Chapter 4 of this Permit.

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Table III.10.J.A – HLW Plant Miscellaneous Unit System Description

Sub-system Description	Sub-system Designation	Engineering Description (Drawing Nos., Specification Nos., etc.)	Narrative Description, Tables, and Figures
		-MKD-HOP-00019 -P1-P01T-00002 -3PS-MBTV-T0002 -N1D-HOP-00011 **24590-LAW** -3PS-MBTV-T0001	
Melter Offgas Treatment Process System (Cont.) HOP-ABS-00002 (Silver Mordenite Column) HOP-ABS-00003 (Silver Mordenite Column)	HOP	**24590-HLW** -M5-V17T-00004 -M5-V17T-20004 -M6-HOP-00008001 -M6-HOP-00008002 -M6-HOP-00008003 -M6-HOP-20008001 -M6-HOP-20008002 -M6-HOP-20008003 -MKD-HOP-00014 -MKD-HOP-00017 -NID-HOP-P0006 -P1-P01T-00001 -3PS-MBT0-TP001	Section 4F.4.2; Table 4F-2; and Figures 4A-1 and 4A-4 in Operating Unit Group 10, Chapter 4 of this Permit.

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Table III.10.J.A – HLW Plant Miscellaneous Unit System Description

Sub-system Description	Sub-system Designation	Engineering Description (Drawing Nos., Specification Nos., etc.)	Narrative Description, Tables, and Figures
Melter Offgas Treatment Process System (Cont.) HOP-HTR-00001B (HEPA Preheater) HOP-HTR-00002A (HEPA Preheater) HOP-HTR-00005A (HEPA Preheater) HOP-HTR-00005B (HEPA Preheater)	HOP	**24590-HLW** -M5-V17T-P0003 -M5-V17T-P20003 -M6-HOP-00010 -M6-HOP-20010 -MED-HOP-00013 -3PS-MEE0-T0001	Section 4F.4.2; Table 4F-2; and Figures 4A-1 and 4A-4 in Operating Unit Group 10, Chapter 4 of this Permit.
Melter Offgas Treatment Process System (Cont.) HOP-HX-00002 (Silver Mordenite Preheater) HOP-HX-00004 (Silver Mordenite Preheater)	HOP	**24590-HLW** -M5-V17T-00004 -M5-V17T-20004 -M6-HOP-00003001 -M6-HOP-00003002 -M6-HOP-20003001 -M6-HOP-20003002 -N1D-HOP-00007 -P1-P01T-00002	Section 4F.4.2; Table 4F-2; and Figures 4A-1 and 4A-4 in Operating Unit Group 10, Chapter 4 of this Permit.

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Table III.10.J.A – HLW Plant Miscellaneous Unit System Description

Sub-system Description	Sub-system Designation	Engineering Description (Drawing Nos., Specification Nos., etc.)	Narrative Description, Tables, and Figures
Melter Offgas Treatment Process System (Cont.) HOP-FAN-00001A (Booster Extraction Fan) HOP-FAN-00001B (Booster Extraction Fan) HOP-FAN-00001C (Booster Extraction Fan) HOP-FAN-00009A (Booster Extraction Fan) HOP-FAN-00009B (Booster Extraction Fan) HOP-FAN-00009C (Booster Extraction Fan)	HOP	**24590-HLW** -M5-V17T-00004 -M5-V17T-20004 -M6-HOP-00003001 -M6-HOP-00003002 -M6-HOP-20003001 -M6-HOP-20003002 -MAD-HOP-00018 -P1-P01T-00001 **24590-WTP** -3PS-MACS-T0004	Section 4F.4.2; Table 4F-2; and Figures 4A-1 and 4A-4 in Operating Unit Group 10, Chapter 4 of this Permit.
Melter Offgas Treatment Process System (Cont.) HOP-FAN-00008A (Stack Extraction Fan)	HOP	**24590-HLW** -M5-V17T-00004 -M5-V17T-20004 -M6-HOP-00008001 -M6-HOP-00008002 -M6-HOP-00008003 -M6-HOP-20008001	Section 4F.4.2; Table 4F-2; and Figures 4A-1 and 4A-4 in Operating Unit Group 10, Chapter 4 of this Permit.

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Table III.10.J.A – HLW Plant Miscellaneous Unit System Description

Sub-system Description	Sub-system Designation	Engineering Description (Drawing Nos., Specification Nos., etc.)	Narrative Description, Tables, and Figures
HOP-FAN-00008B (Stack Extraction Fan) HOP-FAN-00008C (Stack Extraction Fan) HOP-FAN-000010A (Stack Extraction Fan) HOP-FAN-000010B (Stack Extraction Fan) HOP-FAN-000010C (Stack Extraction Fan)		-M6-HOP-20008002 -M6-HOP-20008003 -MAD-HOP-00038 -P1-P01T-00005 **24590-WTP** -3PS-MACS-T0004	
Melter Offgas Treatment Process System (Cont.) HLW Stack	HOP	**24590-HLW** -M5-V17T-00004 -M5-V17T-20004 -M6-HOP-00008001 -M6-HOP-00008002 -M6-HOP-00008003 -M6-HOP-20008001 -M6-HOP-20008002 -M6-HOP-20008003	Section 4F.4.2; and Figures 4A-1 and 4A-4 in Operating Unit Group 10, Chapter 4 of this Permit.
Pulse Jet Ventilation System	PJV	**24590-HLW** -M6-PJV-00001001 -M6-PJV-00002001	

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Table III.10.J.A – HLW Plant Miscellaneous Unit System Description

Sub-system Description	Sub-system Designation	Engineering Description (Drawing Nos., Specification Nos., etc.)	Narrative Description, Tables, and Figures
PJV-HTR-00002 (Pulse Jet Ventilation HEPA Electric Preheater) PJV-HEPA-00004B (PJV System HEPA Filter (Standby Primary)) PJV-HEPA-00005B (PJV System HEPA Filter (Standby Secondary)) PJV-HEPA-00004A (PJV System HEPA Filter (Primary)) PJV-HEPA-00005A (PJV System HEPA Filter (Secondary)) PJV-FAN-00002A (Pulse Jet Vent Extraction Fan) PJV-FAN-00002B (Pulse Jet Vent Extraction Fan)			
Process Vessel Vent Extraction System PVV system contains ancillary equipment only.	PVV	**24590-HLW** -M6-PVV-00001 -M6-PVV-20001	

[a] System Descriptions are maintained in the Administrative Record, and are listed here for information only.

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Table III.10.J.B – HLW Vitrification Systems Secondary Containment Systems Including Sumps and Floor Drains

Sump/Floor Drain I.D. # & Room Location	Maximum Sump Capacity (gallons)	Sump Dimensions[a] (feet) & Materials of Construction	Maximum Allowable Liquid Height (inches)	Secondary Containment Volume (gallons)	Engineering Description (Drawing Nos., Specification Nos., etc.)
RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

[a] Dimensions listed are based on permitted design. Actual dimensions may vary within plus or minus (TBD).

Table III.10.J.C – HLW Vitrification System Process and Leak Detection System Instruments and Parameters

P&ID	Monitoring or Control Parameter	Type of Instrument or Control Device	Instrument or Control Device Tag No.	Instrument Range	Expected Range	Fail States	Instrument Accuracy	Instrument Calibration Method No. and Range
24590-HLW-M6-HMP-00004001	Melter 1 plenum temperature, 62”	TBD	(TE-0920A + TT-0920A + TI-0920A)* Or (TE-0920C + TT-0921A + TI-0921F)*	TBD	TBD	TBD	TBD	TBD
24590-HLW-M6-HMP-00004001	Melter 1 plenum temperature, 59”	TBD	(TE-0920B + TT-920A + TI-0920B)* Or (TE-920D + TT-0921A+ TI-0921E)*	TBD	TBD	TBD	TBD	TBD

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Table III.10.J.C – HLW Vitrification System Process and Leak Detection System Instruments and Parameters

P&ID	Monitoring or Control Parameter	Type of Instrument or Control Device	Instrument or Control Device Tag No.	Instrument Range	Expected Range	Fail States	Instrument Accuracy	Instrument Calibration Method No. and Range
24590-HLW-M6-HMP-20004001	Melter 2 plenum temperature, 62”	TBD	(TE-2920A + TT-2920A + TI-2920A)* Or (TE-2920C + TT-2921A + TI-2920C)*	TBD	TBD	TBD	TBD	TBD
24590-HLW-M6-HMP-20004001	Melter 2 plenum temperature, 59”	TBD	(TE-2920B + TT-2920A + TI-2920B)* Or (TE-2920D + TT-2921A + TI-2920D)*	TBD	TBD	TBD	TBD	TBD
24590-HLW-M6-HMP-0001300224590-HLW-M6-HMP-00013003	Melter 1 glass pool density	TBD	DT-0132 DI-0132	TBD	TBD	TBD	TBD	TBD
24590-HLW-M6-HMP-0001300224590-HLW-M6-HMP-00013003	Melter 1 glass pool level	TBD	LT-0131 LI-0131	TBD	TBD	TBD	TBD	TBD
24590-HLW-M6-HMP-2001300224590-HLW-M6-HMP-20013003	Melter 2 glass pool density	TBD	DT-2132 DI-2132	TBD	TBD	TBD	TBD	TBD
24590-HLW-M6-HMP-2001300224590-HLW-M6-HMP-20013003	Melter 2 glass pool level	TBD	LT-2131 LI-2131	TBD	TBD	TBD	TBD	TBD

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Table III.10.J.C – HLW Vitrification System Process and Leak Detection System Instruments and Parameters

P&ID	Monitoring or Control Parameter	Type of Instrument or Control Device	Instrument or Control Device Tag No.	Instrument Range	Expected Range	Fail States	Instrument Accuracy	Instrument Calibration Method No. and Range
24590-HLW-M6-HMP-0001300224590-HLW-M6-HMP-00013003	Melter 1 plenum pressure	TBD	(PDT-0139A + PDI-0139A)* Or (PDT-0139B + PDI-0139B)*	TBD	TBD	TBD	TBD	TBD
24590-HLW-M6-HMP-2001300224590-HLW-M6-HMP-20013003	Melter 2 plenum pressure	TBD	(PDT-2139A + PDI-2139A)* Or (PDT-2139B + PDI-2139B)*	TBD	TBD	TBD	TBD	TBD
24590-HLW-M6-HMP-0000800124590-HLW-M6-HMP-00008002	Melter 1 West canister level	TBD	LT-0816 (LI-0816A Or LI-0816B)**	TBD	TBD	TBD	TBD	TBD
24590-HLW-M6-HMP-00007001	Melter 1 West Discharge Air Lift	TBD	YC-0761 YV-0761	TBD	TBD	TBD	TBD	TBD
24590-HLW-M6-HMP-0000800124590-HLW-M6-HMP-00008002	Melter 1 East canister level	TBD	LT-0820 (LI-0820A Or LI-0820B)**	TBD	TBD	TBD	TBD	TBD
24590-HLW-M6-HMP-0000600124590-HLW-M6-HMP-00006002	Melter 1 East Discharge Air Lift	TBD	YC-0664 YV-0664	TBD	TBD	TBD	TBD	TBD

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Table III.10.J.C – HLW Vitrification System Process and Leak Detection System Instruments and Parameters

P&ID	Monitoring or Control Parameter	Type of Instrument or Control Device	Instrument or Control Device Tag No.	Instrument Range	Expected Range	Fail States	Instrument Accuracy	Instrument Calibration Method No. and Range
24590-HLW-M6-HMP-2000800124590-HLW-M6-HMP-20008002	Melter 2 West canister level	TBD	LT-2816 (LI-2816A Or LI-2816B)**	TBD	TBD	TBD	TBD	TBD
24590-HLW-M6-HMP-20007001	Melter 2 West Discharge Air Lift	TBD	YC-2761 YV-2761	TBD	TBD	TBD	TBD	TBD
24590-HLW-M6-HMP-2000800124590-HLW-M6-HMP-20008002	Melter 2 East canister level	TBD	LT-2820 (LI-2820A Or LI-2820B)**	TBD	TBD	TBD	TBD	TBD
24590-HLW-M6-HMP-20006001	Melter 2 East Discharge Air Lift	TBD	YC-2664 YV-2664	TBD	TBD	TBD	TBD	TBD
RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

*These instrument sets are duplicates. Only one instrument set is required to remain functioning during waste feed operations.

**These instruments are duplicates. Only one instrument is required to remain functioning during waste feed operations.

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Table III.10.J.D – Maximum Feed-Rates to HLW Vitrification System (RESERVED)

Description of Waste	Shakedown 1	Shakedown 2, Demonstration Test and Post Demonstration Test
Dangerous and Mixed Waste Feed Rate	RESERVED	RESERVED
Ash Feed Rate	RESERVED	RESERVED
Total Chlorine/Chloride Feed Rate	RESERVED	RESERVED
Total Metal Feedrates	RESERVED	RESERVED

Table III.10.J.E – HLW Vitrification System Estimated Emission Rates (RESERVED)

Chemicals	CAS Number	Emission Rates (grams/second)
RESERVED	RESERVED	RESERVED

Table III.10.J.F – HLW Vitrification System Waste Feed Cut-off Parameters* (RESERVED)

Subsystem Designation	Instrument Tag Number	Parameter Description	Setpoints During Shakedown 1 and Post Demonstration Test	Setpoints During Shakedown 2 and Demonstration Test
RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

*A CMS will be used as defined in Permit Section III.10.C.1.

[1]Maximum Feed-rate will be set based on not exceeding any of the constituent (e.g., metals, ash, and chlorine/chloride) feed limits specified on Permit Table III.10.J.D of this Permit

III.10.K HLW VITRIFICATION SYSTEM – LONG TERM MISCELLANEOUS THERMAL TREATMENT UNIT

For purposes of Permit Section III.10.K, where reference is made to WAC 173-303-640, the following substitutions apply: substitute the terms “HLW Vitrification System” for “tank system(s),” “sub-system(s)” for “tank(s),” “sub-system equipment” for “ancillary equipment,” and “sub-system(s) or sub-system equipment of a HLW Vitrification System” for “component(s),” in accordance with WAC 173-303-680.

III.10.K.1 Requirements for HLW Vitrification System Beginning Normal Operation

Prior to commencing normal operations provided in Permit Section III.10.K, all requirements in Permit Section III.10.J will have been met by the Permittees and approved by Ecology, including the following: The HLW Vitrification System Demonstration Test results and the revised Final Risk Assessment provided for in Permit Conditions III.10.C.11.c or d and Permit Section III.10.J, will have been evaluated and

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approved by Ecology, Permit Tables III.10.K.D and F, as approved/modified pursuant to Permit Condition III.10.J.5, will have been completed, submitted and approved pursuant to Permit Condition III.10.J.3.d.v and Permit Table III.10.K.E, as approved/modified pursuant to Permit Condition III.10.J.5, will have been completed, submitted and approved pursuant to Permit Conditions III.10.C.11.c or d.

III.10.K.1.a Construction and Maintenance [WAC 173-303-640, in accordance with WAC 173-303-680(2) and (3), and WAC 173-303-340]

III.10.K.1.a.i The Permittees will maintain the design and construction of the HLW Vitrification System as specified in Permit Condition III.10.K.1, Operating Unit Group 10, Chapter 4 of this Permit, and Operating Unit Group 10, Appendices 10.1 through 10.17 of this Permit, as approved pursuant to Permit Conditions III.10.J.5.a through d and III.10.J.5.f.

III.10.K.1.a.ii The Permittees will maintain the design and construction of all containment systems for the HLW Vitrification System as specified in Operating Unit Group 10, Chapter 4 of this Permit, and Operating Unit Group 10, Appendices 10.2 and 10.4 through 10.14 of this Permit, as approved pursuant to Permit Conditions III.10.J.5.a through d.

III.10.K.1.a.iii Modifications to approved design, plans, and specifications in Operating Unit Group 10, of this Permit, for the HLW Vitrification System will be allowed only in accordance with Permit Conditions III.10.C.2.e and f, or III.10.C.2.g, III.10.C.9.d, e, and h.

III.10.K.1.a.iv The Permittees will ensure all certifications required by specialists (e.g., independent qualified registered professional engineer; registered, professional engineer; independent corrosion expert; independent qualified installation inspector; installation inspector; etc.) use the following statement or equivalent pursuant to Permit Condition III.10.C.10:

> "I, (Insert Name) have (choose one or more of the following: overseen, supervised, reviewed, and/or certified) a portion of the design or installation of a new HLW Vitrification system or component located at (address), and owned/operated by (name(s)). My duties were: (e.g., installation inspector, testing for tightness, etc.), for the following HLW Vitrification system components (e.g., the venting piping, etc.), as required by the Dangerous Waste Regulations, namely, WAC 173-303-640(3) (applicable paragraphs [i.e., (a) through (g)]), in accordance with WAC 173-303-680.
>
> "I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

III.10.K.1.a.v The Permittees will ensure periodic integrity assessments are conducted on the HLW Vitrification System listed in Permit Table III.10.I.A, as approved/modified pursuant to Permit Condition III.10.J.5, over the term of this Permit, in accordance with WAC 173-303-680(2) and (3), as specified in WAC 173-303-640(3)(b) following the description of the integrity assessment program and schedule in Operating Unit Group 10, Addendum E of this Permit, as approved pursuant to Permit Conditions III.10.J.5.e.i and III.10.C.5.c. Results of the integrity assessments will be included in the WTP Unit operating record until ten (10) years after post-closure, or corrective action is complete and certified, whichever is later.

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III.10.K.1.a.vi The Permittees will address problems detected during the HLW Vitrification System integrity assessments specified in Permit Condition III.10.K.1.a.v following the description of the integrity assessment program in Operating Unit Group 10, Addendum E of this Permit, as approved pursuant to Permit Conditions III.10.J.5.e.i and III.10.C.5.c.

III.10.K.1.a.vii All process monitors/instruments as specified in Permit Table III.10.K.F, as approved/modified pursuant to Permit Condition III.10.J.5 and III.10.J.3.d.v, will be equipped with operational alarms to warn of deviation, or imminent deviation from the limits specified in Permit Table III.10.K.F.

III.10.K.1.a.viii The Permittees will install and test all process and leak detection system monitors/instruments, as specified in Permit Tables III.10.K.C and III.10.K.F, as approved/modified pursuant to Permit Conditions III.10.J.5 and III.10.J.3.d.v, in accordance with Operating Unit Group 10, Appendices 10.1, 10.2, and 10.14 of this Permit, as approved pursuant to Permit Conditions III.10.J.5.d.x and III.10.J.5.f.xvi.

III.10.K.1.a.ix No dangerous and/or mixed waste will be treated in the HLW Vitrification System unless the operating conditions, specified under Permit Condition III.10.K.1.c are complied with.

III.10.K.1.a.x The Permittees will not place dangerous and/or mixed waste, treatment reagents, or other materials in the HLW Vitrification System if these substances could cause the sub-system, sub-system equipment, or the containment system to rupture, leak, corrode, or otherwise fail [WAC 173-303-640(5)(a), in accordance with WAC 173-303-680(2)]. This condition is not applicable to corrosion of HLW Vitrification System sub-system or sub-system equipment that are expected to be replaced as part of normal operations (e.g., melter).

III.10.K.1.a.xi The Permittees will operate the HLW Vitrification System to prevent spills and overflows using the description of controls and practices as required under WAC 173-303-640(5)(b), described in Permit Condition III.10.C.5, and Operating Unit Group 10, Appendix 10.18 of this Permit, as approved pursuant to Permit Condition III.10.J.5.e [WAC 173-303-640(5)(b), in accordance with WAC 173-303-680(2) and (3), WAC-173-303-806(4)(c)(ix)].

III.10.K.1.a.xii For routinely non-accessible HLW Vitrification System sub-systems, as specified in Operating Unit Group 10, Chapter 4 of this Permit, as updated pursuant to Permit Condition III.10.J.5.e.vi, the Permittees will mark all routinely non-accessible HLW Vitrification System sub-systems access points with labels or signs to identify the waste contained in each HLW Vitrification System sub-system. The label, or sign, must be legible at a distance of at least fifty (50) feet, and must bear a legend which identifies the waste in a manner which adequately warns employees, emergency response personnel, and the public of the major risk(s) associated with the waste being stored or treated in the HLW Vitrification System sub-systems. For the purposes of this permit condition, "routinely non-accessible" means personnel are unable to enter these areas while waste is being managed in them [WAC 173-303-640(5)(d), in accordance with WAC 173-303-680(2)].

III.10.K.1.a.xiii For all the HLW Vitrification System sub-systems not addressed in Permit Condition III.10.K.1.a.xii, the Permittees will mark all these HLW Vitrification System sub-systems holding dangerous and/or mixed waste with labels or signs to identify the waste contained in the HLW Vitrification System sub-systems. The labels, or signs, must be legible at a distance of at least fifty (50) feet, and must bear a legend which

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identifies the waste in a manner which adequately warns employees, emergency response personnel, and the public of the major risk(s) associated with the waste being stored or treated in the HLW Vitrification System sub-systems [WAC 173-303-640(5)(d), in accordance with WAC 173-303-680(2)].

III.10.K.1.a.xiv The Permittees will ensure that the secondary containment systems for the HLW Vitrification System sub-systems listed in Permit Tables III.10.K.A and III.10.K.B, as approved/modified pursuant to Permit Condition III.10.J.5, are free of cracks or gaps to prevent any migration of dangerous and/or mixed waste or accumulated liquid out of the system to the soil, groundwater, or surface water at any time during the use of the HLW Vitrification System sub-systems. Any indication that a crack or gap may exist in the containment systems will be investigated and repaired in accordance with Operating Unit Group 10, Appendix 10.18 of this Permit, as approved pursuant to Permit Condition III.10.J.5.e.v [WAC 173-303–640(4)(b)(i), WAC 173-303-640(4)(e)(i)(C), and WAC 173-303-640(6), in accordance with WAC 173-303-680(2) and (3), WAC 173-303-806(4)(i)(i)(B), and WAC 173-303-320].

III.10.K.1.a.xv The Permittees must immediately and safely remove from service any HLW Vitrification System or secondary containment system which through an integrity assessment is found to be "unfit for use" as defined in WAC 173-303-040, following Permit Condition III.10.K.1.a.xvii.A through D, and F. The affected HLW Vitrification System or secondary containment system must be either repaired or closed in accordance with Permit Condition III.10.K.1.a.xvii.E [WAC 173-303-640(7)(e) and (f) and WAC 173-303-640(8), in accordance with WAC 173-303-680(3)].

III.10.K.1.a.xvi An impermeable coating, as specified in Operating Unit Group 10, Appendices 10.4, 10.5, 10.7, 10.9, 10.11, and 10.12 of this Permit, as approved pursuant to Permit Condition III.10.J.5.b.v, will be maintained for all concrete containment systems and concrete portions of containment systems for the HLW Vitrification System sub-systems listed in Permit Tables III.10.K.A and III.10.K.B, as approved/modified pursuant to Permit Condition III.10.J.5 (concrete containment systems that do not have a liner, pursuant to WAC 173-303-640(4)(e)(i), in accordance with WAC 173-303-680(2), and have construction joints, will meet the requirements of WAC 173-303-640(4)(e)(ii)(C), in accordance with WAC 173-303-680(2). The coating will prevent migration of any dangerous and/or mixed waste into the concrete. All coatings will meet the following performance standards:

A. The coating must seal the containment surface such that no cracks, seams, or other avenues through which liquid could migrate are present;

B. The coating must be of adequate thickness and strength to withstand the normal operation of equipment and personnel within the given area such that degradation or physical damage to the coating or lining can be identified and remedied before dangerous and/or mixed waste could migrate from the system; and

C. The coating must be compatible with the dangerous and/or mixed waste, treatment reagents, or other materials managed in the containment system [WAC 173-303-640(4)(e)(ii)(D), in accordance with WAC 173-303-680(2) and (3), and WAC 173-303-806(4)(i)(i)(A)].

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III.10.K.1.a.xvii The Permittees will inspect all secondary containment systems for the HLW Vitrification System sub-systems listed in Permit Tables III.10.K.A and III.10.K.B, as approved/modified pursuant to Permit Condition III.10.J.5, in accordance with the Inspection Plan specified in Operating Unit Group 10, Chapter 6A of this Permit, as approved pursuant to Permit Conditions III.10.J.5.e.i and III.10.C.5.c, and take the following actions if a leak or spill of dangerous and/or mixed waste is detected in these containment systems [WAC 173-303-640(5)(c), WAC 173-303-640(6) in accordance with WAC 173-303-680(2) and (3), WAC 173-303-320, and WAC 173-303-806(4)(i)(i)(B)]:

A. Immediately, and safely, stop the flow of dangerous and/or mixed waste into the HLW Vitrification System sub-systems or secondary containment system.

B. Determine the source of the dangerous and/or mixed waste.

C. Remove the dangerous and/or mixed waste from the containment area in accordance with WAC 173-303-680(2) and (3), as specified in WAC 173-303-640(7)(b). The dangerous and/or mixed waste removed from containment areas of the HLW Vitrification System will be, at a minimum, managed as mixed waste.

D. If the cause of the release was a spill that has not damaged the integrity of the HLW Vitrification System sub-system, the Permittees may return the HLW Vitrification System sub-system to service in accordance with WAC 173-303-680(2) and (3), as specified in WAC 173-303-640(7)(e)(ii). In such case, the Permittees will take action to ensure the incident that caused the dangerous and/or mixed waste to enter the containment system will not reoccur.

E. If the source of the dangerous and/or mixed waste is determined to be a leak in from the primary HLW Vitrification System into the secondary containment system, or the system is unfit for use as determined through an integrity assessment or other inspection, the Permittees will comply with the requirements of WAC 173-303-640(7) and take the following actions:

1. Close the HLW Vitrification System sub-system following procedures in WAC 173-303-640(7)(e)(i), in accordance with WAC 173-303-680, and Operating Unit Group 10, Addendum H of this Permit, as approved pursuant to Permit Condition III.10.C.8.

2. Repair and re-certify (in accordance with WAC 173-303-810(13)(a), as modified pursuant to Permit Condition III.10.K.1.a.iii) the HLW Vitrification System, in accordance with Operating Unit Group 10, Appendix 10.18 of this Permit, as approved pursuant to Permit Condition III.10.J.5.e.v, before the HLW Vitrification System is placed back into service [WAC 173-303-640(7)(e)(iii) and WAC 173-303-640(7)(f), in accordance with WAC 173-303-680].

F. The Permittees will document in the operating record actions/procedures taken to comply with A through E above, as specified in WAC 173-303-640(6)(d), in accordance with WAC 173-303-680(2) and (3).

G. In accordance with WAC 173-303-680(2) and (3), the Permittees will notify and report releases to the environment to Ecology as specified in WAC 173-303-640(7)(d).

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III.10.K.1.a.xviii If liquids (e.g., dangerous and/or mixed waste, leaks and spills, precipitation, fire water, liquids from damaged or broken pipes) cannot be removed from the secondary containment system within twenty-four (24) hours; Ecology will be verbally notified within twenty-four (24) hours of discovery. The notification will provide the information in A, B, and C, listed below. The Permittees will provide Ecology with a written demonstration within seven (7) business days, identifying at a minimum [WAC 173-303-640(4)(c)(iv) and WAC 173-303-640(7)(b)(ii), in accordance with WAC 173-303-680(3) and WAC 173-303-806(4)(i)(i)(B)]:

A. Reasons for delayed removal.

B. Measures implemented to ensure continued protection of human health and the environment.

C. Current actions being taken to remove liquids from secondary containment.

III.10.K.1.a.xix All air pollution control devices and capture systems in the HLW Vitrification System will be maintained and operated at all times in a manner so as to minimize the emissions of air contaminants and to minimize process upsets. Procedures for ensuring that the air pollution control devices and capture systems in the HLW Vitrification System are properly operated and maintained so as to minimize the emission of air contaminants and process upsets will be established.

III.10.K.1.a.xx In all future narrative permit submittals, the Permittees will include HLW Vitrification sub-system names with the sub-system designation.

III.10.K.1.a.xxi For any portion of the HLW Vitrification System which has the potential for formation and accumulation of hydrogen gases, the Permittees will operate the portion to maintain hydrogen levels below the lower explosive limit [WAC 173-303-815(2)(b)(ii)].

III.10.K.1.a.xxii For each HLW Vitrification System sub-system holding dangerous waste which are acutely or chronically toxic by inhalation, the Permittees will operate the system to prevent escape of vapors, fumes, or other emissions into the air [WAC 173-303-806(4)(i)(i)(B) and WAC 173-303-640(5)(e), in accordance with WAC 173-303-680].

III.10.K.1.b Performance Standards

III.10.K.1.b.i The HLW Vitrification System must achieve a DRE of 99.99% for the PODCs listed below [40 CFR §63.1203(c)(1) and 40CFR §63.1203(c)(2), in accordance with WAC 173-303-680(2)]:

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DRE in this Permit Condition will be calculated in accordance with the formula given below:

$DRE=[1-(W_{out}/W_{in})] \times 100\%$

Where:

W_{in}=mass feed-rate of one PODC in a waste feed stream; and

W_{out}=mass emission rate of the same PODC present in exhaust emissions prior to release to the atmosphere.

III.10.K.1.b.ii Particulate matter emissions from the HLW Vitrification System will not exceed 34 mg/dscm (0.015 grains/dscf) [40 CFR §63.1203(b)(7), in accordance with WAC 173-303-680(2)];

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III.10.K.1.b.iii Hydrochloric acid and chlorine gas emissions from the HLW Vitrification System will not exceed 21 ppmv, combined [40 CFR §63.1203(b)(6), in accordance with WAC 173-303-680(2)];

III.10.K.1.b.iv Dioxin and Furan TEQ emissions from the HLW Vitrification System will not exceed 0.2 nanograms (ng)/dscm [40 CFR §63.1203(b)(1), in accordance with WAC 173-303-680(2)];

III.10.K.1.b.v Mercury emissions from the HLW Vitrification System will not exceed 45 µg/dscm [40 CFR §63.1203(b)(2), in accordance with WAC 173-303-680(2)];

III.10.K.1.b.vi Lead and cadmium emissions from the HLW Vitrification System will not exceed 120 µg/dscm, combined [40 CFR §63.1203(b)(3), in accordance with WAC 173-303-680(2)];

III.10.K.1.b.vii Arsenic, beryllium, and chromium emissions from the HLW Vitrification System will not exceed 97 µg/dscm, combined [40 CFR §63.1203(b)(4), in accordance with WAC 173-303-680(2)];

III.10.K.1.b.viii Carbon monoxide (CO) emission from the HLW Vitrification System will not exceed 100 parts per million (ppm) by volume, over an hourly rolling average (as measured and recorded by the CMS), dry basis [40 CFR §63.1203(b)(5)(i), in accordance with WAC 173-303-680(2) and (3)];

III.10.K.1.b.ix RESERVED

III.10.K.1.b.x If the emissions from the HLW Vitrification System exceed the emission rates listed in Permit Table III.10.K.E, as approved pursuant to Permit Condition III.10.C.11.c or d, the Permittees will perform the following actions [WAC 173-303-680(2) and (3), and WAC 173-303-815(2)(b)(ii)]:

A. Verbally notify Ecology within twenty-four (24) hours of the discovery of exceeding the emission rate(s) as specified in Permit Condition I.E.21.

B. Submit to Ecology additional risk information to indicate that the increased emissions impact is off-set by decreased emission impact from one or more constituents expected to be emitted at the same time, and/or investigate the cause and impact of the exceedance of the emission rate(s) and submit a report of the investigation findings to Ecology within fifteen (15) days of the discovery of exceeding the emission rate(s).

C. Based on the notification and any additional information, Ecology may provide, in writing, direction to the Permittees to stop dangerous and/or mixed waste feed to the HLW Vitrification System and/or to submit a RDTP as a permit modification pursuant to Permit Conditions III.10.C.2.e and f, or III.10.C.2.g. The RDTP must include substantive changes to prevent failure from reoccurring.

The emission limits specified in Permit Conditions III.10.K.1.b.i through III.10.K.1.b.ix above, will be met for the HLW Vitrification System by limiting feed rates as specified in Permit Tables III.10.K.D and III.10.K.F, as approved/modified pursuant to Permit Condition III.10.J.5 and III.10.J.3.d.v, compliance with operating conditions specified in Permit Condition III.10.K.1.c (except as specified in Permit Condition III.10.K.1.b.xii), and compliance with Permit Condition III.10.K.1.b.xi.

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III.10.K.1.b.xi Treatment effectiveness, feed-rates, and operating rates for dangerous and/or mixed waste management units contained in the HLW Building, but not included in Permit Table III.10.K.A, as approved/modified pursuant to Permit Condition III.10.J.5, will be as specified in Permit Sections III.10.D, III.10.E, III.10.F and consistent with the assumptions and basis which are reflected in Operating Unit Group 10, Appendix 6.3 of this Permit, as approved pursuant to Permit Condition III.10.C.11.b. For the purposes of this permit condition, Operating Unit Group 10, Appendix 6.3 will be superseded by Appendix 6.4 upon its approval pursuant to either Permit Conditions III.10.C.11.c or d [WAC 173-303-680(2) and (3), and WAC 173-303-815(2)(b)(ii)].

III.10.K.1.b.xii Compliance with the operating conditions specified in Permit Condition III.10.K.1.c, will be regarded as compliance with the required performance standards identified in Permit Conditions III.10.K.1.b.i through x. However, if it is determined that during the effective period of this Permit that compliance with the operating conditions in Permit Condition III.10.K.1.c is not sufficient to ensure compliance with the performance standards specified in Permit Conditions III.10.K.1.b.i through x, the Permit may be modified, revoked, or reissued pursuant to Permit Conditions III.10.C.2.e and f, or III.10.C.2.g.

III.10.K.1.c Operating Conditions [WAC 173-303-670(6), in accordance with WAC 173-303-680(2) and (3)]

The Permittees will operate the HLW Vitrification System in accordance with Operating Unit Group 10, Chapter 4 of this Permit, as updated pursuant to Permit Condition III.10.J.5.e.vi, Operating Unit Group 10, Appendix 10.18 of this Permit, as approved pursuant to Permit Conditions III.10.J.5.e and f, and Operating Unit Group 10, Appendix 10.15 of this Permit, as approved pursuant to Permit Condition III.10.J.5.f, except as modified pursuant to Permit Conditions III.10.J.3, III.10.K.1.b.x, III.10.K.1.b.xii, III.10.K.1.h, and in accordance with and the following:

III.10.K.1.c.i The Permittees will operate the HLW Vitrification System in order to maintain the systems and process parameters listed in Permit Tables III.10.K.C and III.10.K.F, as approved/modified pursuant to Permit Conditions III.10.J.5 and III.J.3.d.v, within the set-points specified in Permit Table III.10.K.F.

III.10.K.1.c.ii The Permittees will operate the AWFCO systems, specified in Permit Table III.10.K.F, as approved/modified pursuant to Permit Conditions III.10.J.5 and III.J.3.d.v, to automatically cut-off and/or lock-out the dangerous and/or mixed waste feed to HLW Vitrification System when the monitored operating conditions deviate from the set-points specified in Permit Table III.10.K.F.

III.10.K.1.c.iii The Permittees will operate the AWFCO systems, specified in Permit Table III.10.K.F, as approved/modified pursuant to Permit Conditions III.10.J.5 and III.J.3.d.v, to automatically cut-off and/or lock-out the dangerous and/or mixed waste feed to HLW Vitrification System when all instruments specified on Permit Table III.10.I.F for measuring the monitored parameters fails or exceeds its span value.

III.10.K.1.c.iv The Permittees will operate the AWFCO systems, specified in Permit Table III.10.K.F, as approved/modified pursuant to Permit Conditions III.10.J.5 and III.J.3.d.v, to automatically cut-off and/or lock out the dangerous and/or mixed waste feed to the HLW Vitrification System when any portion of the HLW Vitrification System is bypassed. The terms “bypassed” and “bypass event” as used in Permit Sections III.10.J and K will mean if any portion of the HLW Vitrification System is bypassed so that gases are not treated as during the Demonstration Test.

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III.10.K.1.c.v In the event of a malfunction of the AWFCO systems listed in Permit Table III.10.K.F, as approved/modified pursuant to Permit Conditions III.10.J.5 and III.J.3.d.v, the Permittees will immediately, manually, cut-off the dangerous and/or mixed waste feed to the HLW Vitrification System. The Permittees will not restart the dangerous and/or mixed waste feed until the problem causing the malfunction has been identified and corrected.

III.10.K.1.c.vi The Permittees will manually cut-off the dangerous and/or mixed waste feed to the HLW Vitrification System when the operating conditions deviate from the limits specified in Permit Condition III.10.K.1.c.i, unless the deviation automatically activates the waste feed cut-off sequence specified in Permit Conditions III.10.K.1.c.ii, iii, and/or iv.

III.10.K.1.c.vii If greater than thirty (30) dangerous and/or mixed waste feed cut-off, combined, to the HLW Vitrification System occur due to deviations from Permit Table III.10.K.F, as approved/modified pursuant to Permit Conditions III.10.J.5 and III.J.3.d.v, within a sixty (60) day period, the Permittees will submit a written report to Ecology within five (5) calendar days of the thirty-first (31) exceedance including the information specified below. These dangerous and/or mixed waste feed cut-offs to the HLW Vitrification System, whether automatically or manually activated, are counted if the specified set-points are deviated from while dangerous and/or mixed waste and waste residues continue to be processed in the HLW Vitrification System. A cascade event is counted at a frequency of one (1) towards the first waste feed cut-off parameter, specified on Permit Table III.10.K.F, from which the set-point is deviated:

A. The parameter(s) that deviated from the set-point(s) in Permit Table III.10.K.F;
B. The magnitude, dates, and duration of the deviations;
C. Results of the investigation of the cause of the deviations; and
D. Corrective measures taken to minimize future occurrences of the deviations.

III.10.K.1.c.viii If greater than thirty (30) dangerous and/or mixed waste feed cut-offs, combined, to the HLW Vitrification System occur due to deviations from Permit Table III.10.K.F, as approved/modified pursuant to Permit Conditions III.10.J.5 and III.J.3.d.v, within a thirty (30) day period, the Permittees will submit the written report required to be submitted pursuant to Permit Condition III.10.K.1.c.vii to Ecology, on the first business day following the thirty-first exceedance. These dangerous and/or mixed waste feed cut-offs to the HLW Vitrification System, whether automatically or manually activated, are counted if the specified set-points are deviated from while dangerous and/or mixed waste and waste residues continue to be processed in the HLW Vitrification System. A cascade event is counted at a frequency of one (1) towards the first waste feed cut-off parameter, specified on Permit Table III.10.K.F, from which the set-point is deviated:

In accordance with WAC 173-303-680(2) and (3), the Permittees may not resume dangerous and/or mixed waste feed to the HLW Vitrification System until this written report has been submitted; and

A. Ecology has authorized the Permittees, in writing, to resume dangerous and/or mixed waste feed, or
B. Ecology has not, within seven (7) days, notified the Permittees in writing of the following:

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1. The Permittees written report does not document that the corrective measures taken will minimize future exceedances.
2. The Permittees must take further corrective measures and document that these further corrective measures will minimize future exceedances.

III.10.K.1.c.ix If any portion of the HLW Vitrification System is bypassed while treating dangerous and/or mixed waste, it will be regarded as non-compliance with the operating conditions specified in Permit Condition III.10.K.1.c and the performance standards specified in Permit Condition III.10.K.1.b. After such a bypass event, the Permittees will perform the following actions:

A. Investigate the cause of the bypass event.
B. Take appropriate corrective measures to minimize future bypasses.
C. Record the investigation findings and corrective measures in the operating record.
D. Submit a written report to Ecology within five (5) days of the bypass event documenting the result of the investigation and corrective measures.

III.10.K.1.c.x The Permittees will control fugitive emissions from the HLW Vitrification System by maintaining the melter under negative pressure.

III.10.K.1.c.xi Compliance with the operating conditions specified in Permit Condition III.10.K.1.c. will be regarded as compliance with the required performance standards identified in Permit Condition III.10.K.1.b. However, evidence that compliance with these operating conditions is insufficient to ensure compliance with the performance standards, will justify modification, revocation, or re-issuance of this Permit, in accordance with Permit Conditions III.10.C.2.e and f, or III.10.C.2.g.

III.10.K.1.d Inspection Requirements [WAC 173-303-680(3)]

III.10.K.1.d.i The Permittees will inspect the HLW Vitrification System in accordance with the Inspection Plan in Operating Unit Group 10, Chapter 6A of this Permit, as modified in accordance with Permit Condition III.10.C.5.c.

III.10.K.1.d.ii The inspection data for HLW Vitrification System will be recorded, and the records will be placed in the WTP Unit operating record for HLW Vitrification System, in accordance with Permit Condition III.10.C.4.

III.10.K.1.d.iii The Permittees will comply with the inspection requirements specified in Operating Unit Group 10, Appendix 10.15 of this Permit, as approved pursuant to Permit Condition III.10.J.5.f, and as modified by Permit Conditions III.10.J.3, III.10.K.1.b.x, III.10.K.1.b.xii, and III.10.K.1.h.

III.10.K.1.e Monitoring Requirements [WAC 173-303-670(5), WAC 173-303-670(6), WAC 173-303-670(7), and WAC 173-303-807(2), in accordance with WAC 173-303-680(3)]

III.10.K.1.e.i Upon receipt of a written request from Ecology, the Permittees will perform sampling and analysis of the dangerous and/or mixed waste and exhaust emissions to verify that the operating requirements established in the permit achieve the performance standards delineated in this Permit.

III.10.K.1.e.ii The Permittees will comply with the monitoring requirements specified in the Operating Unit Group 10, Appendices 10.2, 10.3, 10.7, 10.13, 10.15, and 10.18 of this Permit, as approved pursuant to Permit Condition III.10.J.5, and as modified by Permit Conditions III.10.J.3, III.10.K.1.h, and III.10.K.1.b.x and xii.

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III.10.K.1.e.iii The Permittees will operate, calibrate, and maintain the carbon monoxide CEMS as specified in this Permit in accordance with Performance Specifications found in 40 CFR Part 60, Appendix B, in accordance with Appendix to Subpart EEE of 40 CFR Part 63, and Operating Unit Group 10 Appendix 10.15 of this Permit, as approved pursuant to Permit Condition III.10.J.5.f, and as modified by Permit ConditionsIII.10.J.3, III.10.K.1.h, and III.10.K.1.b.x and xii.

III.10.K.1.e.iv The Permittees will operate, calibrate, and maintain the instruments specified on Permit Tables III.10.K.C and F, as approved/modified pursuant to Permit Conditions III.10.J.5 and III.J.3.d.v, in accordance with Operating Unit Group 10, Appendix 10.15 of this Permit, as approved pursuant to Permit Condition III.10.J.5.f, and as modified by Permit Conditions III.10.J.3, III.10.K.1.h, and III.10.K.1.b.x and xii.

III.10.K.1.e.v The Permittees shall calibrate, inspect, and maintain or replace the following cooling water flow and temperature instruments: (Melter 1: FT/FI-0306, FT/FI-0316, FT/FI-0321, FT/FI-0326, FT/FI-0336, TE/TT/TI-0352; Melter 2: FT/FI-2306, FT/FI-2316, FT/FI-2321, FT/FI-2326, FT/FI-2336, TE/TT/TI-2352) in accordance with manufacturer's recommendations.

III.10.K.1.f Recordkeeping Requirements [WAC 173-303-380 and WAC 173-303-680(3)]

III.10.K.1.f.i The Permittees will record and maintain in the WTP Unit operating record for the HLW Vitrification System, all monitoring, calibration, maintenance, test data, and inspection data compiled under the conditions of this Permit, in accordance with Permit Conditions III.10.C.4 and 5 as modified by Permit Conditions III.10.J.3, III.10.K.1.h, and III.10.K.1.b.x and xii.

III.10.K.1.f.ii The Permittees will record in the WTP Unit operating record the date, time, and duration of all automatic waste feed cut-offs and/or lockouts, including the triggering parameters, reason for the deviation, and recurrence of the incident. The Permittees will also record all incidents of AWFCO system function failures, including the corrective measures taken to correct the condition that caused the failure.

III.10.K.1.f.iii The Permittees will submit to Ecology an annual report each calendar year within ninety (90) days following the end of the year. The report will include the following information:

A. Total dangerous and/or mixed waste feed processing time for the HLW Vitrification System.

B. Date/Time of all HLW Vitrification System startups and shutdowns.

C. Date/Time/Duration/Cause/Corrective Action taken for all HLW Vitrification System shutdowns caused by malfunction of either process or control equipment.

D. Date/Time/Duration/Cause/Corrective Action taken for all instances of dangerous and/or mixed waste feed cut-off due to deviations from Permit Table III.10.K.F, as approved/modified pursuant to Permit Conditions III.10.J.5 and III.10J.3.d.v.

III.10.K.1.f.iv The Permittees will submit an annual report to Ecology each calendar year within ninety (90) days following the end of the year of all quarterly CEMS Calibration Error and Annual CEMS Performance Specification Tests conducted in accordance with Permit Condition III.10.K.1.e.iii.

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III.10.K.1.f.v The Permittees shall maintain operating and calibration/maintenance records for Ecology's inspection for the following cooling water flow and temperature instruments (Melter 1: FT/FI-0306, FT/FI-0316, FT/FI-0321, FT/FI-0326, FT/FI-0336, TE/TT/TI-0352; Melter 2: FT/FI-2306, FT/FI-2316, FT/FI-2321, FT/FI-2326, FT/FI-2336, TE/TT/TI-2352).

III.10.K.1.f.vi The Permittees shall maintain refractory thermocouple temperature data for Ecology inspection.

III.10.K.1.g Closure

The Permittees will close the HLW Vitrification System in accordance with Operating Unit Group 10, Addendum H of this Permit, as approved pursuant to Permit Condition III.10.C.8.

III.10.K.1.h Periodic Emission Re-testing Requirements [WAC 173-303-670(5), WAC 173-303-670(7), and WAC 173-303-807(2), in accordance with WAC 173-303-680(2) and (3)].

III.10.K.1.h.i Dioxin and Furan Emission Testing

A. Within eighteen (18) months of commencing operation pursuant to Permit Section III.10.K, the Permittees will submit to Ecology for approval, a DFETP for the performance of emission testing of the HLW Vitrification System gases for dioxin and furans during "Normal Operating Conditions" as a permit modification in accordance with Permit Conditions III.10.C.2.e and f. The DFETP will include all elements applicable to dioxin and furan emission testing included in the "Previously Approved Demonstration Test Plan," applicable EPA promulgated test methods and procedures in effect at the time of the submittal, and projected commencement and completion dates for dioxin and furan emission test. "Normal Operating Conditions" will be defined for the purposes of this permit condition as follows:

1. Carbon monoxide emissions, dangerous and/or mixed waste feed-rate, and automatic waste feed cut-off parameters specified on Permit Table III.10.K.F (as approved/modified pursuant to Permit Conditions III.10.J.5 and III.10.J.3.d.v), that were established to maintain compliance with Permit Condition III.10.K.1.b.iv, as specified in Operating Unit Group 10, Appendix 10.15 of this Permit (as approved pursuant to Permit Condition III.10.J.3.d and in accordance with III.10.K.1.b.xii and III.10.K.1.c.xi), are held within the range of the average value over the previous twelve (12) months and the set-point value specified on Permit Table III.10.K.F. The average value is defined as the sum of the rolling average values recorded over the previous twelve (12) months divided by the number of rolling averages recorded during that time. The average value will not include calibration data, malfunction data, and data obtained when not processing dangerous and/or mixed waste.
2. Feed-rate of metals, ash, and chlorine/chloride are held within the range of the average value over the previous twelve (12) months and the set-point value specified on Permit Table III.10.K.D (as approved/modified pursuant to Permit Conditions III.10.J.5 and III.10.J.3.d.v). Feed-rate of organics as measured by TOC are held within the range of the average value over the previous twelve (12) months. The average value is defined as the sum of the rolling average values recorded over the

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previous twelve (12) months divided by the number of rolling averages recorded during that time. The average value will not include data obtained when not processing dangerous and/or mixed waste.

For purposes of this permit Condition, the "Previously Approved Demonstration Test Plan" is defined to include the Demonstration Test Plan approved pursuant to Permit Condition III.10.J.5.f.

B. Within sixty (60) days of Ecology's approval of the DFETP, or within thirty-one (31) months of commencing operation pursuant to Permit Section III.10.K, whichever is later, the Permittees will implement the DFETP approved, pursuant to Permit Condition III.10.K.1.h.i.A.

C. The Permittees will resubmit the DFETP, approved pursuant to Permit Condition III.10.K.1.h.i.A, revised to include applicable EPA promulgated test methods and procedures in effect at the time of the submittal, and projected commencement and completion dates for dioxin and furan emission test as a permit modification in accordance with Permit Conditions III.10.C.2.e and f at twenty-four (24) months from the implementation date of the testing required pursuant to Permit Condition III.10.K.1.h.i.A and at reoccurring eighteen (18) month intervals from the implementation date of the previously approved DFETP. The Permittees will implement these newly approved revised DFETPs every thirty-one (31) months from the previous approved DFETP implementation date or within sixty (60) days of the newly Ecology approved revised DFETP, whichever is later, for the duration of this Permit.

D. The Permittees will submit a summary of operating data collected pursuant to the DFETPs in accordance with Permit Conditions III.10.K.1.h.i.A and C to Ecology upon completion of the tests. The Permittees will submit to Ecology the complete test report within ninety (90) calendar days of completion of the testing. The test reports will be certified as specified in WAC 173-303-807(8), in accordance with WAC 173-303-680(2) and (3).

E. If any calculations or testing results collected pursuant to the DFETPs in accordance with Permit Conditions III.10.K.1.h.i.A and C show that one or more of the performance standards listed in Permit Condition III.10.K.1.b, with the exception of Permit Condition III.10.K.1.b.x, for the HLW Vitrification System were not met during the emission test, the Permittees will perform the following actions:

1. Immediately stop dangerous and/or mixed waste feed to the HLW Vitrification System under the mode of operation that resulted in not meeting the performance standard(s).
2. Verbally notify Ecology within twenty-four (24) hours of discovery of not meeting the performance standard(s) as specified in Permit Condition I.E.21.
3. Investigate the cause of the failure and submit a report of the investigation findings to Ecology within fifteen (15) days of discovery of not meeting the performance standard(s).
4. Submit to Ecology within fifteen (15) days of discovery of not meeting the performance standard(s) documentation supporting a mode of operation where all performance standards listed in Permit Condition III.K.1.b, with the exception of Permit Condition III.10.K.1.b.x, for the

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HLW Vitrification System were met during the demonstration test, if any such mode was demonstrated.

5. Based on the information provided to Ecology by the Permittees, pursuant to Permit Conditions III.10.K.1.h.i.E.1 through 4 above, and any additional information, Ecology may provide, in writing, direction to the Permittees to stop dangerous and/or mixed waste feed to the HLW Vitrification System and/or amend the mode of operation the Permittees are allowed to continue operations prior to Ecology approval of the RDTP pursuant to Permit Condition III.10.K.1.h.i.E.6.
6. Submit to Ecology within one hundred and twenty (120) days of discovery of not meeting the performance standard(s) a RDTP requesting approval to retest as a permit modification pursuant to Permit Conditions III.10.C.2.e and f. The RDTP must include substantive changes to prevent failure from reoccurring reflecting performance under operating conditions representative of the extreme range of normal conditions, and include revisions to Permit Tables III.10.K.D and F.

F. If any calculations or testing results collected pursuant to the DFETPs in accordance with Permit Conditions III.10.K.1.h.i.A and C show that any emission rate for any constituent listed in Permit Table III.10.K.E, as approved/modified pursuant to Permit Conditions III.10.C.11.c or d, is exceeded for HLW Vitrification System during the emission test, the Permittees will perform the following actions:

1. Verbally notify Ecology within twenty-four (24) hours of the discovery of exceeding the emission rate(s) as specified in Permit Condition I.E.21;
2. Submit to Ecology additional risk information to indicate that the increased emissions impact is off-set by decreased emission impact from one or more constituents expected to be emitted at the same time, and/or investigate the cause and impact of the exceedance and submit a report of the investigation findings to Ecology within fifteen (15) days of this discovery of exceeding the emission rate(s); and
3. Based on the notification and any additional information, Ecology may provide, in writing, direction to the Permittees to stop dangerous and/or mixed waste feed to the HLW Vitrification System and/or to submit a RDTP as a permit modification pursuant to Permit Conditions III.10.C.2.e and f, or III.10.C.2.g. The RDTP must include substantive changes to prevent failure from reoccurring reflecting performance under operating conditions representative of the extreme range of normal conditions, and include revisions to Permit Tables III.10.K.D and F.

III.10.K.1.h.ii Non-organic Emission Testing

A. Within forty-eight (48) months of commencing operation pursuant to Permit Section III.10.K, the Permittees will resubmit to Ecology for approval the "Previously Approved Demonstration Test Plan" revised as a permit modification in accordance with Permit Conditions III.10.C.2.e and f. The RDTP will include applicable EPA promulgated test methods and procedures in effect at the time of the submittal, projected commencement and completion dates for emission testing to demonstrate performance standards specified in Permit Conditions III.10.K.1.b.ii, iii, v, vi, and vii, and non-organic emissions as specified in Permit Table III.10.K.E, as

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approved/modified pursuant to Permit Conditions III.10.J.3.d and III.10.C.11.c or d, under "Normal Operating Conditions." "Normal Operating Conditions" will be defined for the purposes of this permit condition as follows:

1. Carbon monoxide emissions, dangerous and/or mixed waste feed-rate, and automatic waste feed cut-off parameters specified in Permit Table III.10.K.F, as approved/modified pursuant to Permit Conditions III.10.J.3.d and III.10.C.11.c or d, that were established to maintain compliance with Permit Conditions III.10.K.1.b.ii, iii, v, vi, and vii, and non-organic emissions, as specified in Permit Table III.10.K.E, as specified in Operating Unit Group 10, Appendix 10.15 of this Permit (as approved pursuant to Permit Conditions III.10.J.3.d and III.10.C.11.c or d), are held within the range of the average value over the previous twelve (12) months and the set-point value specified on Permit Table III.10.K.F. The average value is defined as the sum of the rolling average values recorded over the previous twelve (12) months divided by the number of rolling averages recorded during that time. The average value will not include calibration data, malfunction data, and data obtained when not processing dangerous and/or mixed waste; and
2. Feed-rate of metals, ash, and chlorine/chloride are held within the range of the average value over the previous twelve (12) months and the set-point value specified on Permit Table III.10.K.D, as approved/modified pursuant to Permit Conditions III.10.J.3.d and III.10.C.11.c or d. The average value is defined as the sum of all rolling average values recorded over the previous twelve (12) months divided by the number of rolling averages recorded during that time. The average value will not include data obtained when not processing dangerous and/or mixed waste.

For purposes of this permit Condition, the "Previously Approved Demonstration Test Plan" is defined to include the Demonstration Test Plan approved pursuant to Permit Condition III.10.J.5.f.

B. Within sixty (60) days of Ecology's approval of the RDTP, or within sixty (60) months of commencing operation pursuant to Permit Section III.10.K, whichever is later, the Permittees will implement the RDTP approved pursuant to Permit Condition III.10.K.1.h.ii.A.

C. The Permittees will resubmit the RDTP, approved pursuant to Permit Condition III.10.K.1.h.ii.A, revised to include applicable EPA promulgated test methods and procedures in effect at the time of the submittal, and projected commencement and completion dates for emission test as a permit modification in accordance with Permit Conditions III.10.C.2.e and f at forty-eight (48) months from the implementation date of the testing required pursuant to Permit Condition III.10.K.1.h.ii.A and at reoccurring forty-eight (48) month intervals from the implementation date of the previously approved RDTP. The Permittees will implement these newly approved revised RDTP, every sixty (60) months from the previous approved RDTP implementation date or within sixty (60) days of the newly Ecology approved revised RDTP, whichever is later, for the duration of this Permit.

D. The Permittees will submit a summary of operating data collected pursuant to the RDTPs in accordance with Permit Conditions III.10.K.1.h.ii.A and C to

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Ecology upon completion of the tests. The Permittees will submit to Ecology the complete test report within ninety (90) calendar days of completion of the testing. The test reports will be certified pursuant to WAC 173-303-807(8), in accordance with WAC 173-303-680(2) and (3).

E. If any calculations or testing results collected pursuant to the DFETPs in accordance with Permit Conditions III.10.K.1.h.ii.A and C show that any emission rate for any constituent listed in Permit Table III.10.K.E, as approved/modified pursuant to Permit Conditions III.10.J.3.d and III.10.C.11.c or d, is exceeded for HLW Vitrification System during the emission test, the Permittees will perform the following actions:

1. Verbally notify Ecology within twenty-four (24) hours of the discovery of exceeding the emission rate(s) as specified in Permit Condition I.E.21.
2. Submit to Ecology additional risk information to indicate that the increased emissions impact is off-set by decreased emission impact from one or more constituents expected to be emitted at the same time, and/or investigate the cause and impact of the exceedance and submit a report of the investigation findings to Ecology within fifteen (15) days of this discovery of exceeding the emission rate(s).
3. Based on the notification and any additional information, Ecology may provide, in writing, direction to the Permittees to stop dangerous and/or mixed waste feed to the HLW Vitrification System and/or to submit a RDTP as a permit modification pursuant to Permit Conditions III.10.C.2.e and f, or III.10.C.2.g. The RDTP must include substantive changes to prevent failure from reoccurring reflecting performance under operating conditions representative of the extreme range of normal conditions, and include revisions to Permit Tables III.10.K.D and III.10.K.F.

F. If any calculations or testing results collected pursuant to the DFETPs in accordance with Permit Conditions III.10.K.1.h.ii.A and C show that one or more of the performance standards listed in Permit Condition III.10.K.1.b, with the exception of Permit Condition III.10.K.1.b.x, for the HLW Vitrification System were not met during the emission test, the Permittees will perform the following actions:

1. Immediately stop dangerous and/or mixed waste feed to the HLW Vitrification System under the mode of operation that resulted in not meeting the performance standard(s).
2. Verbally notify Ecology within twenty-four (24) hours of discovery of not meeting the performance standard(s), as specified in Permit Condition I.E.21.
3. Investigate the cause of the failure and submit a report of the investigation findings to Ecology within fifteen (15) days of discovery of not meeting the performance standard(s).
4. Submit to Ecology within fifteen (15) days of discovery of not meeting the performance standard(s) documentation supporting a mode of operation where all performance standards listed in Permit Condition III.K.1.b, with the exception of Permit Condition III.10.K.1.b.x, for the HLW Vitrification System were met during the demonstration test, if any such mode was demonstrated.

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5. Based on the information provided to Ecology by the Permittees pursuant to Permit Conditions III.10.K.1.h.ii.F.1 through 4 above, and any additional information, Ecology may provide, in writing, direction to the Permittees to stop dangerous and/or mixed waste feed to the HLW Vitrification System and/or amend the mode of operation the Permittees are allowed to continue operations prior to Ecology approval of the RDTP pursuant to Permit Condition III.10.K.1.h.ii.F.6.
6. Submit to Ecology within one hundred and twenty (120) days of discovery of not meeting the performance standard(s) a RDTP requesting approval to retest as a permit modification pursuant to Permit Conditions III.10.C.2.e and f. The RDTP must include substantive changes to prevent failure from reoccurring reflecting performance under operating conditions representative of the extreme range of normal conditions, and include revisions to Permit Tables III.10.K.D and F.

III.10.K.1.h.iii Other Emission Testing

A. Within seventy-eight (78) months of commencing operation pursuant to Permit Section III.10.K, the Permittees will resubmit to Ecology for approval the "Previously Approved Demonstration Test Plan" revised as a permit modification in accordance with Permit Conditions III.10.C.2.e and f. The RDTP will include applicable EPA promulgated test methods and procedures in effect at the time of the submittal, projected commencement and completion dates for emission testing to demonstrate performance standards as specified in Permit Conditions III.10.K.1.b.viii and ix, and emissions as specified on Permit Table III.10.K.E, as approved/modified pursuant to Permit Conditions III.10.J.3.d and III.10.C.11.c or d, not addressed under Permit Conditions III.10.K.1.h.i or ii under "Normal Operating Conditions." "Normal Operating Conditions" will be defined for the purposes of this Permit Condition as follows:
1. Carbon monoxide emissions, dangerous and/or mixed waste feed-rate, and automatic waste feed cut-off parameters specified on Permit Table III.10.K.F, as approved/modified pursuant to Permit Condition III.10.J.3.d and III.10.C.11.c or d, that were established to maintain compliance with Permit Conditions III.10.K.1.b.viii and ix, and emissions as specified on Permit Table III.10.K.E, not addressed under Permit Conditions III.10.K.1.h.i or ii as specified in Operating Unit Group 10, Appendix 10.15 of this Permit, as approved pursuant to Permit Condition III.10.J.3.d, and in accordance with Permit Conditions III.10.K.1.b.xii and III.10.K.1.c.xi are held within the range of the average value over the previous twelve (12) months and the set-point value specified on Permit Table III.10.K.F. The average value is defined as the sum of all rolling average values recorded over the previous twelve (12) months divided by the number of rolling averages recorded during that time. The average value will not include calibration data, malfunction data, and data obtained when not processing dangerous and/or mixed waste; and
2. Feed-rate of metals, ash, and chlorine/chloride are held within the range of the average value over the previous twelve (12) months and the set-point value specified on Permit Table III.10.K.D, as approved/modified pursuant to Permit Conditions III.10.J.3.d and III.10.C.11.c or d. Feed-

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rate of organics as measured by TOC are held within the range of the average value over the previous twelve (12) months. The average value is defined as the sum of the rolling average values recorded over the previous twelve (12) months divided by the number of rolling averages recorded during that time. The average value will not include data obtained when not processing dangerous and/or mixed waste.

For purposes of this permit Condition, the "Previously Approved Demonstration Test Plan" is defined to include the Demonstration Test Plan approved pursuant to Permit Condition III.10.J.5.f.

B. Within sixty (60) days of Ecology's approval of the RDTP, or within ninety-one (91) months of commencing operation pursuant to Permit Section III.10.K, whichever is later, the Permittees will implement the RDTP approved pursuant to Permit Condition III.10.K.1.h.iii.A.

C. The Permittees will submit a summary of operating data collected pursuant to the RDTPs in accordance with Permit Condition III.10.K.1.h.iii.A to Ecology upon completion of the tests. The Permittees will submit to Ecology the complete test report within ninety (90) calendar days of completion of the testing. The test reports will be certified as specified in WAC 173-303-807(8), in accordance with Permit Condition WAC 173-303-680(2) and (3).

D. If any calculations or testing results show that one or more of the performance standards listed in Permit Condition III.10.K.1.b, with the exception of Permit Condition III.10.K.1.b.x, for the HLW Vitrification System were not met during the emission test, the Permittees will perform the following actions:

1. Immediately stop dangerous and/or mixed waste feed to the HLW Vitrification System under the mode of operation that resulted in not meeting the performance standard(s).
2. Verbally notify Ecology within twenty-four (24) hours of discovery of not meeting the performance standard(s), as specified Permit Condition I.E.21.
3. Investigate the cause of the failure and submit a report of the investigation findings to Ecology within fifteen (15) days of discovery of not meeting the performance standard(s).
4. Submit to Ecology within fifteen (15) days of discovery of not meeting the performance standard(s) documentation supporting a mode of operation where all performance standards listed in Permit Condition III.10.K.1.b, with the exception of Permit Condition III.10.K.1.b.x, for the HLW Vitrification System were met during the demonstration test, if any such mode was demonstrated.
5. Based on the information provided to Ecology by the Permittees pursuant to Permit Conditions III.10.K.1.h.iii.D.1 through 4 above, and any additional information, Ecology may provide, in writing, direction to the Permittees to stop dangerous and/or mixed waste feed to the HLW Vitrification System and/or amend the mode of operation the Permittees are allowed to continue operations prior to Ecology approval of the RDTP, pursuant to Permit Condition III.10.K.1.h.iii.D.6.
6. Submit to Ecology within one hundred and twenty (120) days of discovery of not meeting the performance standard(s) a RDTP requesting

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approval to retest as a permit modification pursuant to Permit Conditions II.10.C.2.e and f. The RDTP must include substantive changes to prevent failure from reoccurring reflecting performance under operating conditions representative of the extreme range of normal conditions, and include revisions to Permit Tables III.10.K.D and F.

E. If any calculations or testing results show that any emission rate for any constituent listed in Permit Table III.10.K.E, as approved/modified pursuant to Permit Condition III.10.C.11.c or d, is exceeded for HLW Vitrification System during the emission test, the Permittees will perform the following actions:

1. Verbally notify Ecology within twenty-four (24) hours of the discovery of exceeding the emission rate(s) as specified in Permit Condition I.E.21;
2. Submit to Ecology additional risk information to indicate that the increased emissions impact is off-set by decreased emission impact from one or more constituents expected to be emitted at the same time, and/or investigate the cause and impact of the exceedance of the emission rate(s) and submit a report of the investigation findings to Ecology within fifteen (15) days of the discovery of the exceedance of the emission rate(s); and
3. Based on the notification and any additional information, Ecology may provide, in writing, direction to the Permittees to stop dangerous and/or mixed waste feed to the HLW Vitrification System and/or to submit a RDTP as a permit modification pursuant to Permit Conditions III.10.C.2.e and f, or III.10.C.2.g. The RDTP must include substantive changes to prevent failure from reoccurring reflecting performance under operating conditions representative of the extreme range of normal conditions, and include revisions to Permit Tables III.10.K.D and F.

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Table III.10.K.A – HLW Vitrification System Description

Sub-system Description	Sub-System Designation	Engineering Description (Drawing Nos., etc.)	Narrative Description, Tables, and Figures
RESERVED	RESERVED	RESERVED	RESERVED

[a] Permit Table III.10.K.A will be completed in accordance with Permit Condition III.10.J.5.e.x, prior to initiating Permit Condition III.10.K.1. See Permit Table III.10.J.A for the current HLW Vitrification System Description.

Table III.10.K.B – HLW Vitrification System Secondary Containment Systems Including Sumps and Floor Drains

Sump/Floor Drain I.D. # & Room Location	Maximum Sump Capacity (gallons)	Sump Dimensions[b] (feet) & Materials of Construction	Engineering Description (Drawing Nos., Specification Nos., etc.)
RESERVED	RESERVED	RESERVED	RESERVED

[a] Permit Table III.10.K.B will be completed in accordance with Permit Condition III.10.J.5.b.vii, prior to initiating Permit Condition III.10.K.1. See Permit Table III.10.J.B for the current HLW Vitrification System Secondary Containment Systems Including Sumps and Floor Drains.

[b] Dimensions listed are based on permitted design. Actual dimensions may vary within plus or minus (TBD).

Table III.10.K.C – HLW Vitrification System Process and Leak Detection System Instruments and Parameters

Sub-system Locator and Name (including P&ID)	Control Parameter	Type of Measuring or Leak Detection Instrument	Location of Measuring Instrument (Tag No.)	Instrument Range	Failure State	Expected Range	Instrument Accuracy	Instrument Calibration Method No. and Range
RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

[a] Permit Table III.10.K.C will be completed in accordance with Permit Condition III.10.J.5.e.ix, prior to initiating Permit Condition III.10.K.1. See Permit Table III.10.J.C for the current HLW Vitrification System Process and Leak Detection System Instruments and Parameters.

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Table III.10.K.D – Maximum Feed-rates to HLW Vitrification System (RESERVED)

Description of Waste	Normal Operation
Dangerous and/or mixed waste Feed Rate	RESERVED
Ash Feed Rate	RESERVED
Total Chlorine/Chloride Feed Rate	RESERVED
Total Metal Feed Rates	RESERVED

Table III.10.K.E – HLW Vitrification System Estimated Emission Rates (RESERVED)

Chemicals	CAS Number	Emission Rates (grams/second)
RESERVED	RESERVED	RESERVED

TABLE III.10.K.F – HLW Vitrification System Waste Feed Cut-off Parameters* [1] (RESERVED)

Sub-system Designation	Instrument Tag Number	Parameter Description	Set-points During Normal Operation
RESERVED	RESERVED	RESERVED	RESERVED

*A CMS will be used as defined in Permit Section III.10.C.1.

[1]Maximum Feed-rate will be set based on not exceeding any of the constituent (e.g., metals, ash, and chlorine/chloride) feed limits specified on Table III.10.K.D of this Permit

III.10.L ANALYTICAL LABORATORY SPECIFIC OPERATING CONDITIONS

Unit Description

The Analytical Laboratory is one of the six major facilities within the WTP Operating Unit Group. The LAB will operate to ensure efficient WTP operations by performing analysis of samples to meet permitting, process control, authorization basis, and waste form qualification requirements.

The LAB consists of analytical laboratory rooms, hotcells, and a waste management area for storage of secondary waste generated for analytical activities. The LAB also contains a RLD Tank System (tanks and ancillary equipment) which will be used to store and manage liquid waste generated in the LAB. Under the DFLAW configuration, the contents of the laboratory area sink drain collection vessel are transferred to the EMF Direct Feed Effluent Transfer (DEP) System for evaporation and treatment prior to being returned to the LAW vitrification process, or sent to be treated at the Liquid Effluent Retention Facility/Effluent Treatment Facility (LERF/ETF). Construction of the LAB was completed in 2014 and operations are expected to begin 2023.

This Chapter provides unit-specific Permit conditions applicable to the dangerous waste management units for the WTP LAB.

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III.10.L.1 Compliance With Unit-Specific Permit Conditions

III.10.L.1.a The Permittees will comply with all permit conditions and corresponding Chapters for the WTP Operating Unit Group with respect to dangerous waste management and dangerous waste management units in Operating Unit Group 10, in addition to applicable requirements in Part I and II.

III.10.L.2 General Waste Management

III.10.L.2.a The Permittees are authorized to accept, according to the requirements of Permit Condition III.10.C.2 and Chapter 3, Waste Analysis Plan, dangerous/mixed waste for management in Operating Unit Group 10 dangerous waste management units.

III.10.L.2.b The Permittees will manage wastes at the facility in accordance with the requirements of this Permit, including the performance standard requirements in WAC 173-303-283, incorporated by reference.

III.10.L.2.c The Permittees will maintain the physical structure of the Analytical Laboratory as documented in the applicable sections of Permit Chapter 4H, Analytical Laboratory. [WAC 173-303-640(2), WAC 173-303-640(3), WAC 173-303-640(4)]

III.10.L.3 Waste Analysis

III.10.L.3.a The Permittees will comply with requirements in Permit Condition III.10.C.3 and Chapter 3/3A, Waste Analysis Plan, for all dangerous and/or mixed waste managed at the WTP Operating Unit Group. [WAC 173-303-300(5)]

III.10.L.3.b The Permittees will comply with the requirements of WAC 173-303-395(1), (2), and (6).

III.10.L.3.c The Permittees will have an accurate and complete waste profile as described in Chapter 3/3A, Waste Analysis Plan, Section 3A.3.1.1, for every waste stream accepted by the Analytical Laboratory. [WAC 173-303-380(1)(a)(b)]

III.10.L.3.d Inaccurate or incomplete waste analysis information is not a defense for noncompliance by the Permittees with the waste management requirements and conditions in this Permit, or the LDR specified in the requirements of WAC 173-303-140, incorporated by reference.

III.10.L.4 Recordkeeping and Reporting

III.10.L.4.a The Permittees will keep and maintain records in the Hanford Facility Operating Record, Analytical Laboratory, as required by WAC 173-303-380, as specified in the corresponding chapters and Permit Condition II.I.

III.10.L.4.b The Permittees will place a copy of each waste profile required by Permit Condition III.10.C.3.d, in the Hanford Facility Operating Record, Analytical Laboratory file required by Permit Condition II.I. [WAC 173-303-380(1)(a)]

III.10.L.4.c Records and results of waste analysis required by Permit Condition III.10.C.4 and Chapter 3, Waste Analysis Plan, will be maintained in the Hanford Facility Operating Record, WTP analytical laboratory as required by Permit Condition II.I. [WAC 173-303-380(1)(a)]

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III.10.L.4.d The Permittees will place updates to engineering drawings listed in Appendix 11 into the Hanford Facility Operating Record for the Analytical Laboratory.

III.10.L.4.e The Permittees will keep summary reports and details of all incidents that require implementation of the Contingency Plan in the Hanford Facility Operating Record, Analytical Laboratory, according to the requirements of Permit Condition II.A.1. [WAC 173-303-380(1)(d)]

III.10.L.5 Security

III.10.L.5.a The Permittees will maintain in accordance with Permit Condition III.10.C.13 that onsite, unrestricted, twenty-four (24) hour access to key WTP Unit operating data and emissions monitoring data will be provided to Ecology. This onsite, unrestricted access will include providing and maintaining for Ecology only use a computer terminal and printer with access to key WTP Unit operating data bases and emissions monitoring data bases. This terminal will be equipped with all necessary software and hardware to monitor, retrieve, and trend this data. Additional remote access will be provided on Ecology request if security concerns can be addressed.

III.10.L.5.b The Permittees will implement and maintain the practices described in Chapter 6, Procedures to Prevent Hazards, as required by Permit Condition II.M at the WTP Operating Unit Group. [WAC 173-303-310]

III.10.L.6 Preparedness and Prevention

III.10.L.6.a The Permittees will comply with the Preparedness and Prevention requirements, procedures and practices described in Chapter 6, Procedures to Prevent Hazards, in addition to WAC 173-303-340.

III.10.L.6.b The Permittees will operate and maintain the runoff controls, interlock systems and other systems described in Chapter 6, Procedures to Prevent Hazards, in accordance with the requirements of WAC 173-303-640(5), incorporated by reference.

III.10.L.7 Contingency Plan

III.10.L.7.a The Permittees will comply with Chapter 7, Contingency Plan in addition to the requirements of Permit Condition II.A when applicable. [WAC 173-303-350]

III.10.L.7.b The Permittees will implement the emergency procedures specified in Chapter 7, Contingency Plan in the event of a fire, explosion, or release that could threaten human health or the environment, in accordance with the requirements of WAC 173-303-340 and WAC-173-303-360, incorporated by reference.

III.10.L.8 Inspections

III.10.L.8.a The Permittees will implement the practices specific to the WTP Operating Unit Group as described in Chapter 6A, Inspection Plan, and include the inspection requirements of Chapter 6A in the inspection schedule required by Permit Condition II.O. [WAC 173-303-320]

III.10.L.8.b The Permittees will keep a copy of the elements of the inspection log or summary required by WAC 173-303-380(1)(e); -380(3) and -320.

III.10.L.8.c The Permittees will remedy any problem revealed by inspections on a schedule which prevents hazards to the public health and environment per the requirements of WAC 173-303-320(3), incorporated by reference.

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III.10.L.8.d Where an inspection reveals a problem that creates a hazard that is imminent or has already occurred, the Permittees will take remedial action immediately per the requirements of WAC 173-303-320(3), incorporated by reference.

III.10.L.9 Training

III.10.L.9.a The Permittees will include the training requirements described in Chapter 8, "Personnel Training," in the training program required by Permit Condition II.C. [WAC 173-303-330]

III.10.L.10 Other General Requirements – Reserved

III.10.L.11 Closure

III.10.L.11.a The Permittees will close the WTP Analytical Laboratory Dangerous Waste Management Unit in Operating Unit Group 10 in accordance with Chapter 11, "Closure Plan." [WAC 173-303-610]

III.10.L.11.b The Permittees will provide prior written notice to Ecology of the date they expect to begin closure of any dangerous waste management unit subject to the requirements of this Permit in accordance with Permit Condition II.J.3. The notice of closure may apply to closure of any dangerous waste management units in the WTP Operating Unit Group, or final closure of the remaining Operating Unit Group 10. [WAC 173-303-610(3)(c)]

III.10.L.12 Post-Closure – Reserved

III.10.L.13 Critical Systems

III.10.L.13.a The RLD is a critical system within the LAB. The RLD in the LAB will comply with III.10.C.9, Critical Systems.

III.10.L.14 Reserved

III.10.L.15 Containers

III.10.L.15.a Container Storage and Treatment Unit Standards

III.10.L.15.b The Permittees will ensure that all containers remain in good condition. If a container holding mixed and dangerous waste is not in good condition (e.g., severe rusting or corrosion, or apparent structural defects), or if it begins to leak, the Permittees must transfer the waste from the container to a container that is in good condition or place the leaking container in an appropriate over-pack container. [WAC 173-303-630(2)]

III.10.L.15.c Container Management Standards

III.10.L.15.d The Permittees will maintain and manage wastes in accordance with the requirements, procedures, and practices described in Chapter 4H, "Analytical Laboratory," in addition to WAC 173-303-630.

III.10.L.15.e The contents of any leaking container will be transferred as soon as possible considering safety of the work force to a compatible container which is in good condition or to an over pack container. Any waste residue remaining in the damaged container will be managed as a dangerous waste unless the container is empty pursuant to WAC 173-303-160(2).

III.10.L.15.f The Permittees will label containers in accordance with the requirements of Chapter 4H, "Analytical Laboratory." [WAC 173-303-630(3)]

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III.10.L.15.g The Permittees will ensure wastes will not be ignitable, reactive or incompatible with containers and with other wastes stored or treated in containers within the Container Storage Area for the Analytical Laboratory, and if such wastes are managed in any container storage area, the containers of incompatible waste or chemicals will not be stored in close proximity to each other; according to the requirements of Chapter 4H, "Analytical Laboratory." [WAC 173-303-630(4), WAC 173-303-630(9)]

~~**III.10.L.15.g**~~**III.10.L.15.h** RESERVED

~~**III.10.L.15.h**~~**III.10.L.15.i** ~~**III.10.L.15.i**~~ The Permittees will remove any accumulated liquids from container storage areas in according with the requirements of Chapter 4H, "Analytical Laboratory," to ensure containers are not in contact with free liquids and to prevent overflow of the container storage area secondary containment.

~~**III.10.L.15.i**~~**III.10.L.15.j** ~~**III.10.L.15.j**~~ The Permittees will comply with the requirements for air emissions from containers in Chapter 4H, "Analytical Laboratory." [WAC 173-303-692]

III.10.L.16 Tank Systems

III.10.L.16.a Tank System Management Requirements

III.10.L.16.a.i The Permittees will comply with the schedule for conducting integrity assessments for the WTP analytical laboratory tank systems as described in Chapter 4H, "Analytical Laboratory," and the requirements in WAC 173-303-640(3)(b).

III.10.L.16.a.ii If the findings of an integrity assessment indicate that a WTP analytical laboratory tank has structural deficiencies or lacks integrity such that it may collapse, rupture, or fail, the Permittees will at a minimum do the following:

III.10.L.16.a.ii.A Evaluate and review the waste acceptance criteria in Chapter 3, "Waste Analysis Plan;"

III.10.L.16.a.ii.B Evaluate and review the applicable tank design and/or operating requirements in Chapter 4H, "Analytical Laboratory;"

III.10.L.16.a.ii.C Evaluate and review any other permit requirements, which may reasonably influence the integrity of the tank in question;

III.10.L.16.a.ii.D Based on this evaluation and review, the Permittees will request the required permit modifications in accordance with WAC 173-303-830. [WAC 173-303-640(3)(b), WAC 173-303-815(2)(b)]

III.10.L.16.a.iii The Permittees will submit a permit change notification to the Part A (Chapter 1) for the Analytical Laboratory in accordance with Permit Condition I.C if the capacity decreases or increases for the Analytical Laboratory tank systems.

III.10.L.16.b Tank System Operating Requirements

III.10.L.16.b.i The Permittees will not place dangerous wastes or treatment reagents in the tank system if they could cause the tank, ancillary equipment, or the containment system to rupture, leak, corrode or fail. [WAC 173-303-640(5)(a)]

III.10.L.16.b.ii The Permittees will operate the Analytical Laboratory Tank System to prevent spills and overflows using the controls and practices as required under WAC 173-303-640(5)(b) described in Permit Condition III.10.C.5, and Operating Unit Group 10, Appendix 13.18 of this Permit. [WAC 173-303-640(5)(b), WAC 173-303-806(4)(c)(ix)]

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III.10.L.16.b.iii The Permittees will comply with the requirements of WAC 173-303-640(7), in response to spills or leaks from the Tank System. [WAC 173-303-640(5)(c)]

III.10.L.16.b.iv For all Analytical Laboratory Unit Systems the Permittees will mark all the unit systems holding dangerous and/or mixed waste with labels or signs to identify the waste contained in the unit. The labels or sign must be legible at a distance of at least fifty (50) feet, and must bear a legend which identifies the waste in a manner which adequately warns employees, emergency response personnel, and the public of the major risk(s) associated with the waste being stored or treated in the unit system(s). [WAC 173-303-640(5)(d), in accordance with WAC 173-303-680(2)].

III.10.L.16.b.v For each Analytical Laboratory Unit System holding dangerous waste which are acutely or chronically toxic by inhalation, the Permittees will operate the system to prevent escape of vapors, fumes, or other emissions into the air. [WAC 173-303-806(4)(i)(i)(B) and WAC 173-303-640(5)(e), in accordance with WAC 173-303-680]

III.10.L.16.b.vi The Permittees will ensure that incompatible wastes/material are not placed in the same tank system, unless WAC 173-303-395(1)(b) is complied with. [WAC 173-303-640(10)(a)]

III.10.L.16.b.vii The Permittees will not place dangerous waste in a tank system that has not been previously decontaminated and that previously held an incompatible waste/material, unless WAC 173-303-395(1)(b) is complied with. [WAC 173-303-640(10)(b)]

III.10.L.16.b.viii If there is indication that a tank system is leaking or unfit for use, the Permittees will comply with WAC 173-303-640(7).

III.10.L.16.b.ix The Permittees will not transfer waste into the analytical laboratory tank systems in excess of the maximum capacity of the tanks as listed in Table III.10.E.D.

III.10.L.16.b.x The Permittees will comply with the requirements of Chapter 4H, "Analytical Laboratory," in response to spills or leaks from tank systems at the Analytical Laboratory [WAC 173-303-640(5)(c), WAC 173-303-640(7)].

III.10.L.16.b.xi The Permittees will comply with the requirements of WAC 173-303-640(9) incorporated by reference. [WAC 173-303-640(9)]

III.10.L.16.b.xii The Permittees will comply with the requirements of WAC 173-303-640(10), incorporated by reference.

III.10.M EMF MISCELLANEOUS UNIT SYSTEMS

Unless otherwise noted in Permit Table III.10.M.A, for purposes of Permit Section III.10.M., where reference is made to WAC 173-303-640, the following substitutions apply: substitute the terms "EMF Miscellaneous Unit System(s)" for "tank system(s)," "miscellaneous unit(s)" for "tank(s)," "equipment" for "ancillary equipment," and "miscellaneous unit(s) or equipment of a EMF Miscellaneous Unit System" for "component(s)" in accordance with WAC 173-303-680. Miscellaneous unit systems, exempt from the WAC-173-303-640 requirements in Permit Section III.10.M are noted as exempt in Table III.10.M.A.

III.10.M.1 Waste and Storage Limits

III.10.M.1.a The Permittees may process, in the EMF Miscellaneous Unit Systems listed in Permit Table III.10.M.A, as approved/modified pursuant to Permit Condition III.10.M.9, all dangerous and mixed waste listed in the Part A Forms, Operating Unit Group 10, Chapter 1 of this Permit, and in accordance with in the WAP, Operating Unit Group 10, Chapter 3/Chapter 3A of this Permit, as approved pursuant to Permit Condition

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III.10.C.3. Total EMF Miscellaneous Unit dangerous and mixed waste storage at the Facility will not exceed the limits specified in Permit Table III.10.M.A.

III.10.M.1.b The Permittees may process dangerous and mixed waste only in approved EMF Miscellaneous Unit Systems listed in Permit Table III.10.M.A in accordance with Permit Section III.10.M and in accordance with Operating Unit Group 10, Chapters 1.0 and 4.0 of this Permit, and Operating Unit Group 10, Appendices 13.1 through 13.14 of this Permit, as approved pursuant to Permit Conditions III.10.M.9.b through e. The Permittees will limit the total volume of wastes to quantities specified for the individual miscellaneous units listed in Permit Table III.10.M.A.

III.10.M.1.c RESERVED

III.10.M.1.d The Permittees will ensure all certifications required by specialists (e.g., independent qualified registered professional engineer; independent corrosion expert; independent qualified installation inspector; etc.) use the following statement or equivalent pursuant to Permit Condition III.10.C.10:

"I, (Insert Name) have (choose one or more of the following: overseen, supervised, reviewed, and/or certified) a portion of the design or installation of a new miscellaneous unit system or component located at (address), and owned/operated by (name(s)). My duties were: (e.g., installation inspector, testing for tightness, etc.), for the following miscellaneous unit system components (e.g., the venting piping, etc.), as required by the Dangerous Waste Regulations, namely, WAC 173-303-640(3) (applicable paragraphs (i.e., (a) through (g)) in accordance with WAC 173-303-680).

"I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

III.10.M.1.e In all future narrative permit submittals, the Permittees will include Miscellaneous Unit System names with the unit designation (e.g., Evaporator Separator Vessel; DEP-EVAP-00001).

III.10.M.2 Miscellaneous Unit Systems Design and Construction [WAC 173-303-640, in accordance with WAC 173-303-680(2) and WAC 173-303-340].

III.10.M.2.a The Permittees will construct the EMF Miscellaneous Unit Systems identified in Permit Table III.10.M.A, as specified in Operating Unit Group 10, Appendices 13.1 through 13.14 of this Permit, as approved pursuant to Permit Conditions III.10.M.9.b, III.10.M.9.c, and III.10.M.9.d.

III.10.M.2.b The Permittees will construct secondary containment systems for the EMF Miscellaneous Unit Systems identified in Permit Tables III.10.M.A, as specified in Operating Unit Group 10, Appendices 13.2, 13.4 through 13.14 of this Permit, as approved pursuant to Permit Conditions III.10.M.9.b, III.10.M.9.c, and III.10.M.9.d.

III.10.M.2.c Modifications to approved design, plans, and specifications in Operating Unit Group 10 of this Permit for the EMF Miscellaneous Unit Systems will be allowed only in accordance with Permit Conditions III.10.C.2.e and f, or III.10.C.2.g, III.10.C.9.d, e, and h.

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III.10.M.3 Miscellaneous Unit System Installation and Certification [WAC 173-303-640, in accordance with WAC 173-303-680(2) and (3), and WAC 173-303-340].

III.10.M.3.a The Permittees must ensure that proper handling procedures are adhered to in order to prevent damage to EMF Miscellaneous Unit Systems during installation. Prior to covering, enclosing, or placing a new EMF Miscellaneous Unit System(s) or component(s) in use, an independent qualified installation inspector or an independent qualified registered professional engineer, either of whom is trained and experienced in the proper installation of similar systems or components, must inspect the system for the presence of any of the following items:

III.10.M.3.a.i Weld breaks;

III.10.M.3.a.ii Punctures;

III.10.M.3.a.iii Scrapes of protective coatings;

III.10.M.3.a.iv Cracks;

III.10.M.3.a.v Corrosion;

III.10.M.3.a.vi Other structural damage or inadequate construction/installation;

III.10.M.3.a.vii All discrepancies must be remedied before the EMF Miscellaneous Unit Systems are covered, enclosed, or placed in use [WAC 173-303-640(3)(c) in accordance with WAC 173-303-680(2) and (3)].

III.10.M.3.b For EMF Miscellaneous Unit Systems or components that are placed underground and that are back-filled, the Permittees must provide a backfill material that is a non-corrosive porous, homogeneous substance. The backfill must be installed so that it is placed completely around the miscellaneous unit and compacted to ensure that the miscellaneous unit and piping are fully and uniformly supported [WAC 173-303 640(3)(d), in accordance with WAC 173-303-680(2) and (3)].

III.10.M.3.c The Permittees must test for tightness all new EMF miscellaneous units and equipment, prior to being covered, enclosed, or placed into use. If the EMF Miscellaneous Unit Systems are found not to be tight, all repairs necessary to remedy the leak(s) in the system must be performed prior to the EMF Miscellaneous Units Systems being covered, enclosed, or placed in use [WAC 173-303-640(3)(e), in accordance with WAC 173-303-680(2) and (3)].

III.10.M.3.d The Permittees must ensure EMF Miscellaneous Unit Systems equipment is supported and protected against physical damage and excessive stress due to settlement, vibration, expansion, or contraction [WAC 173-303-640(3)(f), in accordance with WAC 173-303-680(2) and (3)].

III.10.M.3.e The Permittees must provide the type and degree of corrosion protection recommended by an independent corrosion expert, based on the information provided in Operating Unit Group 10, Appendices 13.9 and 13.11 as approved pursuant to Permit Conditions III.10.M.9.b.i., III.10.M.9.b.iv, III.10.M.9.b.v, III.10.M.9.c.i, III.10.M.9.c.iv, III.10.M.9.c.v, and III.10.M.9.d.i, III.10.M.9.d.iv, III.10.M.9.d.v, or other corrosion protection if Ecology believes other corrosion protection is necessary to ensure the integrity of the EMF Miscellaneous Unit Systems during use of the EMF Miscellaneous Unit Systems. The installation of a corrosion protection system that is field fabricated must be supervised by an independent corrosion expert to ensure proper installation [WAC 173-303-640(3)(g), in accordance with WAC 173-303-680(2) and (3)].

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III.10.M.3.f Prior to initial receipt of dangerous and/or mixed waste in the WTP Unit, the Permittees will obtain, and keep on file in the WTP Unit operating record, written statements by those persons required to certify the design of the EMF Miscellaneous Unit Systems and supervise the installation of the EMF Miscellaneous Unit Systems, as specified in WAC 173-303-640(3)(b), (c), (d), (e), (f), and (g), in accordance with WAC 173-303-680, attesting that each EMF Miscellaneous Unit System and corresponding containment system listed in Permit Table III.10.M.A, as approved/modified pursuant to Permit Condition III.10.M.9, were properly designed and installed, and that repairs, in accordance with WAC 173-303-640(3)(c) and (e), were performed [WAC 173-303-640(3)(a), WAC 173-303-640(3)(h), in accordance with WAC 173-303-680(3)].

III.10.M.3.g The independent EMF Miscellaneous Unit System installation inspection and subsequent written statements will be certified in accordance with WAC 173-303-810(13)(a) as modified pursuant to Permit Condition III.10.M.1.d, comply with all requirements of WAC 173-303-640(3)(h), in accordance with WAC 173-303-680, and will consider, but not be limited to, the following miscellaneous unit system installation documentation:

III.10.M.3.g.i Field installation report with date of installation;

III.10.M.3.g.ii Approved welding procedures;

III.10.M.3.g.iii Welder qualifications and certification;

III.10.M.3.g.iv Hydro-test reports, as applicable, in accordance with the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section VIII, Division 1, API Standard 620, or Standard 650 as applicable;

III.10.M.3.g.v Tester credentials;

III.10.M.3.g.vi Field inspector credentials;

III.10.M.3.g.vii Field inspector reports;

III.10.M.3.g.viii Field waiver reports; and

III.10.M.3.g.ix Non-compliance reports and corrective action (including field waiver reports) and repair reports.

III.10.M.4 Integrity Assessments [WAC 173-303-340 and WAC 173-303-640, in accordance with WAC173-303-680(2) and (3)].

III.10.M.4.a The Permittees will ensure periodic integrity assessments are conducted on the EMF Miscellaneous Unit Systems listed in Permit Table III.10.M.A, as approved/modified pursuant to Permit Condition III.10.M.9, over the term of this Permit in accordance with WAC 173-303-680(2) and (3) as specified in WAC 173-303-640(3)(b), following the description of the integrity assessment program and schedule in Operating Unit Group 10, Chapter 6 of this Permit, as approved pursuant to Permit Conditions III.10.M.9.e.i and III.10.M.4.c. Results of the integrity assessments will be included in the WTP Unit operating record until ten (10) years after post-closure, or corrective action is complete and certified, whichever is later.

III.10.M.4.b The Permittees will address problems detected during EMF Miscellaneous Unit Systems integrity assessments specified in Permit Condition III.10.M.4.a following the integrity assessment program in Operating Unit Group 10, Chapter 6 of this Permit, as approved pursuant to Permit Conditions III.10.M.9.e.i and III.10.M.4.c.

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III.10.M.4.c The Permittees must immediately and safely remove from service any EMF Miscellaneous Unit System or secondary containment system which through an integrity assessment is found to be "unfit for use" as defined in WAC 173-303-040, following Permit Condition III.10.M.5.i.i through iv, and vi. The affected EMF Miscellaneous Unit or secondary containment system must be either repaired or closed in accordance with Permit Condition III.10.M.5.i.v [WAC 173-303-640(7)(e) and (f) and WAC 173-303-640(8), in accordance with WAC 173-303-680(3)].

III.10.M.5 Miscellaneous Unit Management Practices

III.10.M.5.a No dangerous and/or mixed waste will be managed in the EMF Miscellaneous Unit Systems unless the operating conditions, specified under Permit Condition III.10.M.5, are complied with.

III.10.M.5.b The Permittees will install and test all process and leak detection system monitoring/instrumentation, as specified in Permit Table III.10.M.A, as approved/modified pursuant to Permit Condition III.10.M.9, in accordance with Operating Unit Group 10, Appendices 13.1, 13.2, and 13.14 of this Permit, as approved pursuant to Permit Condition III.10.M.9.d.x.

III.10.M.5.c The Permittees will not place dangerous and/or mixed waste, treatment reagents, or other materials in the EMF Miscellaneous Unit Systems if these substances could cause the systems to rupture, leak, corrode, or otherwise fail [WAC 173-303-640(5)(a), in accordance with WAC 173-303-680(2)].

III.10.M.5.d The Permittees will operate the EMF Miscellaneous Unit Systems to prevent spills and overflows using the description of controls and practices, as required under WAC 173-303-640(5)(b), described in Permit Condition III.10.M.5, and Operating Unit Group 10, Appendix 13.13 of this Permit, as approved pursuant to Permit Condition III.10.M.9.e.iv [WAC 173-303-640(5)(b), in accordance with WAC 173-303-680(2) and (3) and WAC 173-303-806 (4)(c)(ix)].

III.10.M.5.e For routinely non-accessible EMF Miscellaneous Unit Systems, as specified in Operating Unit Group 10, Chapter 4 of this Permit, as updated pursuant to Permit Condition III.10.M.9.e.vi, the Permittees will mark all routinely non-accessible EMF Miscellaneous Unit System access points with labels or signs to identify the waste contained in the units. The label, or sign, must be legible at a distance of at least fifty (50) feet and must bear a legend which identifies the waste in a manner which adequately warns employees, emergency response personnel, and the public of the major risk(s) associated with the waste being stored or treated in the miscellaneous unit system(s). For the purposes of this Permit condition, "routinely non-accessible" means personnel are unable to enter these areas while waste is being managed in them [WAC 173-303-640(5)(d), in accordance with WAC 173-303-680(2)].

III.10.M.5.f For all EMF Miscellaneous Unit Systems not addressed in Permit Condition III.10.M.5.e, the Permittees will mark all these miscellaneous unit systems holding dangerous and/or mixed waste with labels or signs to identify the waste contained in the unit. The labels, or sign, must be legible at a distance of at least fifty (50) feet, and must bear a legend which identifies the waste in a manner which adequately warns employees, emergency response personnel, and the public of the major risk(s) associated with the waste being stored or treated in the miscellaneous unit system(s) [WAC 173-303-640(5)(d), in accordance with WAC 173-303-680(2)].

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III.10.M.5.g The Permittees will ensure that the secondary containment systems for EMF Miscellaneous Unit Systems listed in Permit Table III.10.M.A, as approved/modified pursuant to Permit Condition III.10.M.9, are free of cracks or gaps to prevent any migration of dangerous and/or mixed waste or accumulated liquid out of the system to the soil, ground water, or surface water at any time waste is in the EMF Miscellaneous Units System. Any indication that a crack or gap may exist in the containment systems will be investigated and repaired in accordance with Operating Unit Group 10, Appendix 13.18 of this Permit, as approved pursuant to Permit Condition III.10.M.9.e.v. [WAC 173-303-640(4)(b)(i), WAC 173-303–640(4)(e)(i)(C), and WAC 173-303-640(6) in accordance with WAC 173-303-680(2) and (3), WAC 173-303-806(4)(i)(i)(B), and WAC 173-303-320].

III.10.M.5.h An impermeable coating, as specified in Operating Unit Group 10, Appendices 13.4, 13.5, 13.7, 13.9, 13.11, and 13.12 of this Permit, as approved pursuant to Permit Condition III.10.M.9.b.v of this Permit, will be maintained for all concrete containment systems and concrete portions of containment systems for each EMF Miscellaneous Unit System listed in Permit Table III.10.M.A, as approved/modified pursuant to Permit Condition III.10.M.9 [concrete containment systems that do not have a liner pursuant to WAC-173-303-640(4)(e)(i), in accordance with WAC 173-303-680(2), and have construction joints, will meet the requirements of WAC 173-303-640(4)(e)(ii)(C), in accordance with WAC 173-303-680(2)]. The coating will prevent migration of any dangerous and mixed waste into the concrete. All coatings will meet the following performance standards:

III.10.M.5.h.i The coating must seal the containment surface such that no cracks, seams, or other avenues through which liquid could migrate are present;

III.10.M.5.h.ii The coating must be of adequate thickness and strength to withstand the normal operation of equipment and personnel within the given area such that degradation or physical damage to the coating or lining can be identified and remedied before dangerous and mixed waste could migrate from the system; and

III.10.M.5.h.iii The coating must be compatible with the dangerous and mixed waste, treatment reagents, or other materials managed in the containment system [WAC 173-303-640(4)(e)(ii)(D), in accordance with WAC 173-303-680(2) and (3) and WAC 173-303-806(4)(i)(i)(A)].

III.10.M.5.i The Permittees will inspect all secondary containment systems for the EMF Miscellaneous Unit Systems listed in Permit Table III.10.M.A, as approved/modified pursuant to Permit Condition III.10.M.9, in accordance with the Inspection Plan specified in Operating Unit Group 10, Chapter 6/Chapter 6A of this Permit, as approved pursuant to Permit Conditions III.10.M.9.e.ii, and take the following actions if a leak or spill of dangerous and/or mixed waste is detected in these containment systems [WAC 173-303-640(5)(c) and WAC 173-303-640(6), in accordance with WAC 173-303-680(2) and (3), WAC 173-303-320, and WAC 173-303-806(4)(i)(i)(B)]:

III.10.M.5.i.i Immediately and safely stop the flow of dangerous and/or mixed waste into the miscellaneous unit system or secondary containment system;

III.10.M.5.i.ii Determine the source of the dangerous and/or mixed waste;

III.10.M.5.i.iii Remove the waste from the containment area in accordance with WAC 173-303-680(2) and (3), as specified in WAC 173-303-640(7)(b). The dangerous and/or mixed waste removed from containment areas of miscellaneous unit systems will be, as a minimum, managed as dangerous and/or mixed waste;

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III.10.M.5.i.iv If the cause of the release was a spill that has not damaged the integrity of the miscellaneous unit system, the Permittees may return the miscellaneous unit system to service in accordance with WAC 173-303-680(2) and (3), as specified in WAC 173-303-640(7)(e)(ii). In such a case, the Permittees will take action to ensure the incident that caused liquid to enter the containment system will not reoccur [WAC 173-303-320(3)];

III.10.M.5.i.v If the source of the dangerous and/or mixed waste is determined to be a leak from the primary EMF Miscellaneous Unit System into the secondary containment system, or the system is unfit for use as determined through an integrity assessment or other inspection, the Permittees must comply with the requirements of WAC 173-303-640(7), and take the following actions:

A. Close the EMF Miscellaneous Unit System following procedures in WAC 173-303-640(7)(e)(i) and in accordance with WAC 173-303-680, and Operating Unit Group 10, Chapter 11 of this Permit, as approved pursuant to Permit Condition III.10.C.8; or

B. Repair and re-certify (in accordance with WAC 173-303-810(13)(a), as modified pursuant to Permit Condition III.10.M.1.d) the EMF Miscellaneous Unit System in accordance with Operating Unit Group 10, Appendix 13.11 of this Permit, as approved pursuant to Permit Condition III.10.M.9.e.v before the EMF Miscellaneous Unit System is placed back into service [WAC 173-303-640(7)(e)(iii) and WAC 173-303-640(7)(f), in accordance with WAC 173-303-680].

III.10.M.5.i.vi The Permittees will document, in the operating record, actions/procedures taken to comply with III.10.M.5.i through v above, as specified in WAC 173-303-640(6)(d) and in accordance with WAC 173-303-680(2) and (3).

III.10.M.5.i.vii In accordance with WAC 173-303-680(2) and (3), the Permittees will notify and report releases to the environment to Ecology as specified in WAC 173-303-640(7)(d).

III.10.M.5.j If liquids (e.g., Dangerous and/or mixed waste leaks and spills, precipitation, fire water, liquids from damaged or broken pipes) cannot be removed from the secondary containment system within twenty-four (24) hours, Ecology will be verbally notified within twenty-four (24) hours of discovery. The notification will provide the information in A., B., and C. listed below. The Permittees will provide Ecology with a written demonstration, within seven (7) business days, identifying at a minimum [WAC 173-303-640(4)(c)(iv) and WAC 173-303-640(7)(b)(ii), in accordance with WAC 173-303-680(3) and WAC 173-303-806(4)(i)(i)(B)]:

A. Reasons for delayed removal.

B. Measures implemented to ensure continued protection of human health and the environment.

C. Current actions being taken to remove liquids from secondary containment.

III.10.M.5.k The Permittees will operate the EMF Miscellaneous Unit Systems in accordance with Operating Unit Group 10, Chapter 4 as updated pursuant to Permit Condition III.10.M.9.e.vi and Appendix 13.18 of this Permit, as approved pursuant to Permit Condition III.10.M.9.e, and the following:

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III.10.M.5.k.i The Permittees will operate the EMF Miscellaneous Unit Systems in order to maintain the systems and process parameters listed in Permit Table III.10.M.A as approved/modified pursuant to Permit Condition III.10.M.9, within the operating trips and operating ranges specified in Permit Table III.10.M.A, and consistent with assumptions and basis which are reflected in Operating Unit Group 10, Appendix 6.3, as approved pursuant to Permit Condition III.10.M.9.b. [WAC 173-303-815(2)(b)(ii) and WAC 173-303-680(2) and (3)]. For the purposes of this Permit Condition, Operating Unit Group 10, Appendix 6.3 will be superseded by Appendix 6.4 upon its approval pursuant to either Permit Conditions III.10.M.9.c or III.10.M.9.d.

III.10.M.5.k.ii The Permittees will calibrate/function test the instruments listed in Permit Table III.10.M.A, in accordance with Operating Unit Group 10, Appendix 13.18, as approved pursuant to Permit Condition III.10.M.9.e.xii.

III.10.M.5.l For any portion of the EMF Miscellaneous Unit Systems which have the potential for formation and accumulation of hydrogen gases, the Permittees will operate the portion to maintain hydrogen levels below the lower explosive limit [WAC 173-303-815(2)(b)(ii)].

III.10.M.5.m For each miscellaneous unit holding dangerous waste which are acutely or chronically toxic by inhalation, the Permittees will operate the system to prevent escape of vapors, fumes, or other emissions into the air [WAC 173-303-806(4)(i)(i)(B) and WAC 173-303-640(5)(e), in accordance with WAC 173-303-680].

III.10.M.6 Inspections [WAC 173-303-680(3)]

III.10.M.6.a The Permittees will inspect the EMF Miscellaneous Unit Systems in accordance with the Inspection Plan in Operating Unit Group 10, Chapter 6/Chapter 6A of this Permit, as modified in accordance with Permit Condition III.10.C.5.c.

III.10.M.6.b The inspection data for EMF Miscellaneous Unit Systems will be recorded, and the records will be placed in the WTP Unit operating record for the EMF Miscellaneous Unit Systems, in accordance with Permit Condition III.10.C.4.

III.10.M.7 Recordkeeping

The Permittees will record and maintain in the WTP Unit operating record for the EMF Miscellaneous Unit Systems, all monitoring, calibration, maintenance, test data, and inspection data compiled under the conditions of this Permit, in accordance with Permit Conditions III.10.C.4 and III.10.C.5.

III.10.M.8 Closure

The Permittees will close the EMF Miscellaneous Unit Systems in accordance with Operating Unit Group 10, Chapter 11, as approved pursuant to Permit Condition III.10.C.8.

III.10.M.9 Compliance Schedule

III.10.M.9.a All information identified for submittal to Ecology in a. through e. of this compliance schedule must be signed and certified in accordance with requirements in WAC 173-303-810(12), as modified in accordance with Permit Condition III.10.M.1.d. [WAC 173-303-806(4)].

III.10.M.9.b The Permittees will submit to Ecology, pursuant to Permit Condition III.10.C.9.f, prior to construction of each secondary containment and leak detection system for the EMF Miscellaneous Unit Systems (per level) as identified in Permit Tables III.10.M.A, engineering information as specified below, for incorporation into Operating Unit Group 10, Appendices 13.2, 13.4, 13.5, 13.7, 13.8, 13.9, 13.11, and 13.12 of this Permit.

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At a minimum, engineering information specified below will show the following as described in WAC 173-303-640, in accordance with WAC 173-303-680 (the information specified below will include dimensioned engineering drawings and information on sumps and floor drains):

III.10.M.9.b.i IQRPE Reports (specific to foundation, secondary containment, and leak detection system) will include review of design drawings, calculations, and other information on which the certification report is based and will include as applicable, but not limited to, review of such information described below. Information (drawings, specifications, etc.) already included in Operating Unit Group 10, Appendix 13.0 of this Permit may be included in the report by reference and should include drawing and document numbers. IQRPE Reports will be consistent with the information separately provided in III.10.M.9.b ii through ix below [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)];

III.10.M.9.b.ii Design drawings (General Arrangement Drawings, in plan) and specifications for the foundation, secondary containment, including, liner installation details, and leak detection methodology [Note: leak detection systems for areas where daily, direct, or remote visual inspection is not feasible, will be continuous in accordance with WAC 173-303-640(4)(e)(iii)(C)]. These items should show the dimensions, volume calculations, and location of the secondary containment system, and should include items such as floor/pipe slopes to sumps, tanks, floor drains [WAC 173-303-640(4)(b) through (f) and WAC 173-303-640(3)(a), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)];

III.10.M.9.b.iii The Permittees will provide the design criteria (references to codes and standards, load definitions, and load combinations, materials of construction, and analysis/design methodology) and typical design details for the support of the secondary containment system. This information will demonstrate the foundation will be capable of providing support to the secondary containment system, resistance to pressure gradients above and below the system, and capable of preventing failure due to settlement, compression, or uplift [WAC 173-303-640(4)(c)(ii), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(B)];

III.10.M.9.b.iv A description of materials and equipment used to provide corrosion protection for external metal components in contact with soil, including factors affecting the potential for corrosion [WAC 173-303-640(3)(a)(iii)(B), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(A) through (B)];

III.10.M.9.b.v Secondary containment/foundation and leak detection systems materials selection documentation (including, but not limited to, concrete coatings and water stops, and liner materials), as applicable [WAC 173-303-806(4)(i)(i)(A) through (B)];

III.10.M.9.b.vi Detailed description of how the secondary containment for each miscellaneous unit system will be installed in compliance with WAC 173-303-640(3)(c), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(A) through (B);

III.10.M.9.b.vii Submit Permit Table III.10.E.S completed to provide for all secondary containment sumps and floor drains, the information as specified in each column heading, consistent with information to be provided in III.10.M.9.b i through vi above;

III.10.M.9.b.viii Documentation that secondary containment and leak detection systems will not accumulate hydrogen gas levels above the lower explosive limit for incorporation into the Administrative Record [WAC 173-303-680, WAC 173-303-806(4)(i)(i)(A), and WAC 173-303-806(4)(i)(v)];

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III.10.M.9.b.ix A detailed description of how miscellaneous unit design provides access for conducting future miscellaneous unit integrity assessments [WAC 173-303-640(3)(b) and WAC 173-303-806(4)(i)(i)(B)].

III.10.M.9.c The Permittees will submit to Ecology, pursuant to Permit Condition III.10.M.9, prior to installation of each EMF Miscellaneous Unit System as identified in Permit Table III.10.M.A, engineering information as specified below, for incorporation into Operating Unit Group 10, Appendix 13.1 through 13.18 of this Permit. At a minimum, engineering information specified below will show the following as required pursuant to WAC 173-303-640 and in accordance with WAC 173-303-680 (the information specified below will include dimensioned engineering drawings):

III.10.M.9.c.i IQRPE Reports (specific to miscellaneous unit) will include review of design drawings, calculations, and other information on which the certification report is based and will include as applicable, but not limited to, review of such information described below. Information (drawings, specifications, etc.) already included in Operating Unit Group 10, Appendix 8.0 of this Permit may be included in the report by reference and should include drawing and document numbers. The IQRPE Reports will be consistent with the information separately provided in III.10.M.9.c.ii through xi below and the IQRPE Report specified in Permit Condition III.10.M.9.b.i [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)];

III.10.M.9.c.ii Design drawings (General Arrangement Drawings in plan, Process Flow Diagrams, Piping and Instrumentation Diagrams [including pressure control systems], and Mechanical Drawings) and specifications, and other information specific to miscellaneous units (to show location and physical attributes of each miscellaneous unit), [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)];

III.10.M.9.c.iii Miscellaneous unit design criteria (references to codes and standards, load definitions, and load combinations, materials of construction, and analysis/design methodology) and typical design details for the support of the miscellaneous unit(s). Structural support calculations specific to off-specification, non-standard, and field fabricated miscellaneous units will be submitted for incorporation into the Administrative Record [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(B)];

III.10.M.9.c.iv A description of materials and equipment used to provide corrosion protection for external metal components in contact with water, including factors affecting the potential for corrosion [WAC 173-303-640(3)(a)(iii)(B), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(A) through (B)];

III.10.M.9.c.v Miscellaneous unit materials selection documentation (e.g., physical and chemical tolerances) [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(A)];

III.10.M.9.c.vi Miscellaneous unit vendor information (including, but not limited to, required performance warranties, as available), consistent with information submitted under ii above, will be submitted for incorporation into the Administrative Record [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2), WAC 173-303-806(4)(i)(i)(A) through (B), and WAC 173-303-806(4)(i)(v)];

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III.10.M.9.c.vii System Description related to miscellaneous units will be submitted for incorporation into the Administrative Record [WAC 173-303-680, WAC 173-303 806(4)(i)(i)(A) through (B), and WAC 173-303-806(4)(i)(v)].

III.10.M.9.c.viii Mass and energy balance for normal projected operating conditions used in developing the Piping and Instrumentation Diagrams and the Process Flow Diagrams, including assumptions and formulas used to complete the mass and energy balance, so that they can be independently verified for incorporation into the Administrative Record [WAC 173-303-680(2), WAC 173-303-806(4)(i)(i)(B), and WAC 173-303-806(4)(i)(v)];

III.10.M.9.c.ix A detailed description of how the miscellaneous unit will be installed in compliance with WAC 173-303-640(3)(c), (d), and (e), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(B);

III.10.M.9.c.x Documentation that miscellaneous units are designed to prevent the accumulation of hydrogen gas levels above the lower explosive limit for incorporation into the Administrative Record [WAC 173-303-680, WAC 173-303-806(4)(i)(i)(A), and WAC 173-303-806(4)(i)(v)];

III.10.M.9.c.xi Documentation that miscellaneous units are designed to prevent escape of vapors and emissions of acutely or chronically toxic (upon inhalation) EHW, for incorporation into the Administrative Record [WAC 173-303-640(5)(e), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(B)];

III.10.M.9.d The Permittees will submit to Ecology, pursuant to Permit Condition III.10.C.9.f, prior to installation of equipment as identified in Permit Table III.10.M.A, not addressed in Permit Condition III.10.M.9.c, engineering information as specified below for incorporation into Operating Unit Group 10, Appendices 13.1 through 13.14 of this Permit. At a minimum, engineering information specified below will show the following as required pursuant to WAC 173-303-640, in accordance with WAC 173-303-680 (the information specified below will include dimensioned engineering drawings):

III.10.M.9.d.i IQRPE Reports (specific to equipment) will include a review of design drawings, calculations, and other information as applicable, on which the certification report is based. The reports will include, but not be limited to, review of such information described below. Information (drawings, specifications, etc.) already included in Operating Unit Group 10, Appendix 13.0 of this Permit may be included in the report by reference and should include drawing and document numbers. The IQRPE Reports will be consistent with the information provided separately in ii. through xiii. below and the IQRPE Reports specified in Permit Conditions III.10.M.9.b and III.10.M.9.c [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(A) through (B)];

III.10.M.9.d.ii Design drawings (Process Flow Diagrams, Piping and Instrumentation Diagrams [including pressure control systems]) specifications and other information specific to equipment (these drawings should include all equipment such as pipe, valves, fittings, pumps, instruments, etc.) [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(A) through (B)];

III.10.M.9.d.iii The Permittees will provide the design criteria (references to codes and standards, load definitions, and load combinations, materials of construction, and analysis/design methodology) and typical design details for the support of the equipment [WAC 173-303-640(3)(a) and WAC 173-303-640(3)(f), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(B)];

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III.10.M.9.d.iv A description of materials and equipment used to provide corrosion protection for external metal components in contact with soil and water, including factors affecting the potential for corrosion [WAC 173-303-640(3)(a)(iii)(B), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(A)];

III.10.M.9.d.v Materials selection documentation for equipment (e.g., physical and chemical tolerances) [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2) and WAC 173-303-806(4)(i)(i)(A)];

III.10.M.9.d.vi Vendor information (including, but not limited to, required performance warranties, as available), consistent with information submitted under ii above, for equipment will be submitted for incorporation into the Administrative Record [WAC 173-303-640(3)(a), in accordance with WAC 173-303-680(2), WAC 173-303-806(4)(i)(i)(A) through (B), and WAC 173-303-806(4)(i)(iv)];

III.10.M.9.d.vii Miscellaneous unit, equipment, and leak detection system instrument control logic narrative description (e.g., descriptions of fail-safe conditions, etc.) [WAC 173-303-680(2), WAC 173-303-806(4)(i)(i)(B), and WAC 173-303-806(4)(i)(v)].

III.10.M.9.d.viii System Descriptions related to equipment and system descriptions related to leak detection systems, for incorporation into the Administrative Record [WAC 173-303-680, WAC 173-303-806(4)(i)(i)(A) through (B), and WAC 173-303-806(4)(i)(v)];

III.10.M.9.d.ix A detailed description of how the equipment will be installed and tested [WAC 173-303-640(3)(c) through (e) and WAC 173-303-640(4)(b) and (c), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(B)];

III.10.M.9.d.x For process monitoring, control, and leak detection system instrumentation for the WTP Unit Miscellaneous Unit Systems as identified in Permit Table III.10.M.A, a detailed description of how the process monitoring, control, and leak detection system instrumentation will be installed and tested [WAC 173-303-640(3)(c) through (e), WAC 173-303-640(4)(b) and (c), WAC 173-303-806(4)(c)(vi), and WAC 173-303-806(4)(i)(i)(B)];

III.10.M.9.d.xi Mass and energy balance for projected normal operating conditions, used in developing the Piping and Instrumentation Diagrams and Process Flow Diagrams, including assumptions and formulas used to complete the mass and energy balance, so that they can be independently verified, for incorporation into the Administrative Record [WAC 173-303-680(2), WAC 173-303-806(4)(i)(i)(B), and WAC 173-303-806(4)(i)(v)];

III.10.M.9.d.xii Documentation that miscellaneous units are designed to prevent the accumulation of hydrogen gas levels above the lower explosive limit for incorporation into the Administrative Record [WAC 173-303-680, WAC 173-303-806(4)(i)(i)(A), and WAC 173-303-806(4)(i)(v)].

III.10.M.9.d.xiii Leak detection system documentation (e.g. vendor information, etc.) consistent with information submitted under Permit Condition III.10.M.9.c.ii and Permit Conditions III.10.M.9.d.ii, vii, viii, and x above, will be submitted for incorporation into the Administrative Record.

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III.10.M.9.e Prior to initial receipt of dangerous and/or mixed waste in the WTP Unit, the Permittees will submit to Ecology, pursuant to Permit Condition III.10.C.9.f, the following as specified below for incorporation into Operating Unit Group 10, Appendix 13.18, except Permit Condition III.10.M.9.e.i, which will be incorporated into Operating Unit Group 10, Chapter 6, of this Permit. All information provided under this permit condition must be consistent with information provided pursuant to Permit Conditions III.10.M.9.b, c, d, and e, III.10.M.3.e, and III.10.C.11.b, as approved by Ecology.

III.10.M.9.e.i Integrity assessment program and schedule for the EMF Miscellaneous Unit Systems will address the conducting of periodic integrity assessments on the EMF Miscellaneous Unit Systems over the life of the systems, as specified in Permit Condition III.10.M.9.b.ix and WAC 173-303-640(3)(b), in accordance with WAC 173-303-680, and descriptions of procedures for addressing problems detected during integrity assessments. The schedule must be based on past integrity assessments, age of the system, materials of construction, characteristics of the waste, and any other relevant factors [WAC 173-303-640(3)(b), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(B)];

III.10.M.9.e.ii Detailed plans and descriptions, demonstrating the leak detection system is operated so that it will detect the failure of either the primary or secondary containment structure or the presence of any release of dangerous and/or mixed waste or accumulated liquid in the secondary containment system within twenty-four (24) hours WAC 173-303-640(4)(c)(iii). Detection of a leak of at least 0.1 gallons per hour within twenty-four (24) hours is defined as being able to detect a leak within twenty-four (24) hours. Any exceptions to this criteria must be approved by Ecology in accordance with WAC 173-303-680, WAC 173-303-640(4)(c)(iii), and WAC 173-303-806(4)(i)(i)(B)];

A. Dangerous waste pipe penetrations that require a penetration seal in accordance with the IBC and DOE-STD-1066, DOE Standard for Fire Protection Design Criteria, or meet ventilation sealing requirements identified in Permit Table III.10.M.B, are not required to meet the 0.1 gallons per hour within twenty-four (24) hours leak detection rate for those sections of piping that are in contact with approved silicone or equivalent low-permeability seal material or boot.

B. Piping on either side of the penetration seal must meet the requirements of III.10.M.9.e.ii.

C. Revisions (including additions or deletions) to Permit Table III.10.M.B will be submitted to Ecology for review and approval pursuant to Conditions III.10.C.2.e and III.10.C.2.f. Addition of penetration seal locations to Permit Table III.10.M.B will be approved by Ecology prior to installation of the penetration seal.

III.10.M.9.e.iii Detailed operational plans and descriptions, demonstrating that spilled or leaked waste and accumulated liquids can be removed from the secondary containment system within twenty-four (24) hours [WAC 173-303-806(4)(i)(i)(B)];

III.10.M.9.e.iv Descriptions of operational procedures demonstrating appropriate controls and practices are in place to prevent spills and overflows from the EMF Miscellaneous Unit Systems, or containment systems, in compliance with WAC 173-303-640(5)(b)(i) through in accordance with WAC 173-303-680 [WAC 173-303-806(4)(i)(i)(B)];

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III.10.M.9.e.v Description of procedures for investigation and repair of the EMF Miscellaneous Unit Systems [WAC 173-303–640(6) and WAC 173-303-640(7)(e) and (f), in accordance with WAC 173-303-680, WAC 173-303-320, WAC 173-303-806(4)(a)(v), and WAC 173-303-806(4)(i)(i)(B)];

III.10.M.9.e.vi Updated Chapter 4, Narrative Descriptions, Tables and Figures as identified in Permit Table III.10.M.A, as modified pursuant to Permit Condition III.10.M.9.e.ix, and updated to identify routinely non-accessible EMF Miscellaneous Unit Systems [WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(A) through (B)];

III.10.M.9.e.vii Descriptions of procedures for management of ignitable and reactive, and incompatible dangerous and/or mixed waste, in accordance with WAC 173-303-640(9) and (10), in accordance with WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(B).

III.10.M.9.e.viii A description of the tracking system used to track dangerous and/or mixed waste generated throughout the EMF Miscellaneous Unit Systems, pursuant to WAC 173-303-380.

III.10.M.9.e.ix Permit Table III.10.M.A, amended as follows [WAC 173-303-680 and WAC 173-303-806(4)(i)(i)(A) through (B)]:

A. Under column 1, update and complete list of dangerous and mixed waste EMF Miscellaneous Unit Systems, including plant items which comprise each system (listed by item number).

B. Under column 2, update and complete system designations.

C. Under column 3, replace the "Reserved" with the Operating Unit Group 10, Appendix 13.0 subsections specific to miscellaneous unit systems as listed in column 1.

D. Under column 4, update and complete list of narrative description tables and figures.

E. Under column 5, update and complete maximum operating volume for each miscellaneous unit, as applicable.

F. Permit Table III.10.M.A, amended as follows:

1. Under column 1, update and complete list of plant items that comprise the EMF Vessel Vent System (listed by item number).
2. Under column 2, update and complete designations.
3. Under column 3, replace the "Reserved" with the Operating Unit Group 10, Appendix 13.0, subsections (e.g., 13.1, 13.2, etc.) specific to systems as listed in column 1.
4. Under column 4, update and complete list of narrative description tables and figures.

III.10.M.9.e.x Permit Table III.10.M.A will be completed for EMF Miscellaneous Unit System process and leak detection system monitors and instruments (to include, but not be limited to: instruments and monitors measuring and/or controlling flow, pressure, temperature, density, pH, level, humidity, and emissions) to provide the information as specified in each column heading. Process and leak detection system monitors and instruments for critical systems as specified in Operating Unit Group 10, Appendix 2.0 and as updated pursuant to Permit Condition III.10.C.9.b and for operating parameters as required to comply with Permit Condition III.10.C.3.e.iii will be addressed. Process monitors and instruments for non-waste management operations

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(e.g., utilities, raw chemical storage, non-contact cooling waters, etc.) are excluded from this permit condition [WAC 173-303-680, WAC 173-303-806(4)(i)(i)(A) through (B), and WAC 173-303-806(4)(i)(v)];

III.10.M.9.e.xi Supporting documentation for operating trips and expected operating range as specified in Permit Table III.10.M.A, as approved pursuant to Permit Condition III.10.M.9.e.x [WAC 173-303-680, WAC 173-303-806(4)(i)(i)(B), WAC 173-303-806(4)(i)(iv), and WAC 173-303-806(4)(i)(v)];

III.10.M.9.e.xii Documentation of process and leak detection instruments and monitors (as listed in Permit Table III.10.M.A) for the EMF Miscellaneous Unit Systems to include, but not be limited to, the following [WAC 173-303-680, WAC 173-303-806(4)(i)(i)(B), and WAC 173-303-806(4)(i)(v)]:

A. Procurement Specifications.
B. Location used.
C. Range, precision, and accuracy.
D. Detailed descriptions of calibration/functionality test procedures (e.g., method number [ASTM]) or provide a copy of manufacturer's recommended calibration procedures.
E. Calibration/functionality test, inspection, and routine maintenance schedules and checklists, including justification for calibration, inspection and maintenance frequencies, criteria for identifying instruments found to be significantly out of calibration, and corrective action to be taken for instruments found to be significantly out of calibration (e.g., increasing frequency of calibration, instrument replacement, etc.).
F. Equipment instrument control logic narrative description (e.g., descriptions of fail-safe conditions, etc.) [WAC 173-303-680(2), WAC 173-303-806(4)(i)(i)(B), and WAC 173-303-806(4)(i)(v)].

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Table III.10.M.A – EMF Plant Miscellaneous Unit System Description

Miscellaneous Unit System Description/Location	Miscellaneous Unit System Designation	Description Drawings	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
DEP-COND-00001 (Evaporator Primary Condenser) E-0102	DEP	**24590-BOF** -M5-V17T-00012 -M6-DEP-00003004 -MED-DEP-00004 -N1D-DEP-00007 -P1-25-00001 -3PS-MEVV-T0001 24590-CM-POA-MEVV-00003-05-00001 (Sheet 2 of 3, Sheet 3 of 3)	4G.3.2; Table 4G-2	NA
DEP-COND-00002 (Evaporator Inter-Condenser) E-0102	DEP	**24590-BOF** -M5-V17T-00012 -M6-DEP-00003004 -MED-DEP-00005 -N1D-DEP-00007 -P1-25-00001 24590-CM-POA-ME00-00003-04-00004 (Sheet 2 of 3, Sheet 3 of 3)	4G.3.3; Table 4G-2	NA

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Table III.10.M.A – EMF Plant Miscellaneous Unit System Description

Miscellaneous Unit System Description/Location	Miscellaneous Unit System Designation	Description Drawings	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
DEP-COND-00003 (Evaporator After-Condenser) E-0102	DEP	**24590-BOF** -M5-V17T-00012 -M6-DEP-00003004 -MED-DEP-00006 -N1D-DEP-00007 -P1-25-00001 24590-CM-POA-ME00-00003-04-00001 (Sheet 2 of 3, Sheet 3 of 3)	4G.3.4; Table 4G-2	NA
DEP-EVAP-00001 (Evaporator Separator Vessel) E-0103	DEP	**24590-BOF** -M5-V17T-00012 -M6-DEP-00003001 -MVD-DEP-00009 -N1D-DEP-00010 -P1-25-00001 -3PS-MEVV-T0001 24590-CM-POA-MEVV-00003-05-00002 (Sheet 2 of 6, Sheet 5 of 6)	4G.3.4; Table 4G-2	3,544
DVP-HTR-00001A (Process Ventilation Preheater) E-0102	DEP	Reserved	4G; Table 4G-2	NA
DVP-HTR-00001B (Process Ventilation Preheater) E-0102	DEP	Reserved	4G; Table 4G-2	NA

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Table III.10.M.A – EMF Plant Miscellaneous Unit System Description

Miscellaneous Unit System Description/Location	Miscellaneous Unit System Designation	Description Drawings	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
DVP-HEPA-00003A (Process Ventilation Primary HEPA Filter) E-0102A	DEP	Reserved	4G; Table 4G-2	NA
DVP-HEPA-00003B (Process Ventilation Primary HEPA Filter) E-0102A	DEP	Reserved	4G; Table 4G-2	NA
DVP-HEPA-00004A (Process Ventilation Secondary HEPA Filters) E-0102A	DEP	Reserved	4G; Table 4G-2	NA
DVP-HEPA-00004B (Process Ventilation Secondary HEPA Filters) E-0102A	DEP	Reserved	4G; Table 4G-2	NA
DEP-HX-00001 (Evaporator Concentrate/Feed Vessels LAW Effluent Cooler) E-0103	DEP	**24590-BOF** -M5-V17T-00013 -M6-DEP-00002006 -MED-DEP-00001 -N1D-DEP-00008 -P1-25-00001 -3PS-MEP0-T0001 24590-CM-POA-MEP0-00006-04-00004 (Sheet D3334)	4G.3.8; Table 4G-2	NA

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Table III.10.M.A – EMF Plant Miscellaneous Unit System Description

Miscellaneous Unit System Description/Location	Miscellaneous Unit System Designation	Description Drawings	Narrative Description, Tables & Figures	Maximum Capacity (gallons)
DEP-RBLR-00001 (Evaporator Reboiler) E-0103	DEP	**24590-BOF** -M5-V17T-00012 -M6-DEP-00003002 -MBD-DEP-00001 -N1D-DEP-00009 -P1-25-00001 -3PS-MEVV-T0001 24590-CM-POA-MEVV-00003-05-00003 (Sheet 2 of 4, Sheet 3 of 4)	4G.3.9; Table 4G-2	NA
DVP-EXHR-00001A (Process Ventilation Exhausters) E-0102	DEP	Reserved	4G; Table 4G-2	NA
DVP-EXHR-00001B (Process Ventilation Exhausters) E-0102	DEP	Reserved	4G; Table 4G-2	NA

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Table III.10.M.B – EMF Plant Penetration Seal Location

Row Number	Room Number	Orientation	Discipline	Sequence Number
1.	E-0102	E	PD	00220
2.	E-0102	E	PD	00283
3.	E-0102	N	PD	00173
4.	E-0102	N	PD	00175
5.	E-0102	N	PD	00176
6.	E-0102	N	PD	00177
7.	E-0102	N	PD	00179
8.	E-0102	N	PD	00180
9.	E-0102	N	PD	00181
10.	E-0102	N	PD	00182
11.	E-0102	N	PD	00183
12.	E-0102	N	PD	00184
13.	E-0102	N	PD	00188
14.	E-0102	N	PD	00189
15.	E-0102	N	PD	00190
16.	E-0102	N	PD	00191
17.	E-0102	N	PD	00195
18.	E-0102	N	PD	00196
19.	E-0102	N	PD	00197
20.	E-0102	N	PD	00198
21.	E-0102	N	PD	00199
22.	E-0102	N	PD	00200
23.	E-0102	N	PD	00201
24.	E-0102	W	PD	00209
25.	E-0102	W	PD	00211
26.	E-0102	W	PD	00227
27.	E-0102	N	PD	00237
28.	E-0102	N	PD	00238
29.	E-0102	N	PD	00239
30.	E-0102	W	PD	00295
31.	E-0102	W	PD	00305
32.	E-0102	W	BK	50100
33.	E-0102	W	BK	50200
34.	E-0103	E	PD	00212
35.	E-0103	E	PD	00228
36.	E-0103	E	PD	00258

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Table III.10.M.B – EMF Plant Penetration Seal Location

Row Number	Room Number	Orientation	Discipline	Sequence Number
37.	E-0103	E	PD	00260
38.	E-0103	E	PD	00261
39.	E-0103	E	PD	00276
40.	E-0103	E	PD	00286
41.	E-0103	E	PD	00294
42.	E-0103	N	PD	00204
43.	E-0103	N	PD	00206
44.	E-0103	N	PD	00215
45.	E-0103	N	PD	00242
46.	E-0103	N	PD	00243
47.	E-0103	N	PD	00244
48.	E-0103	N	PD	00249
49.	E-0103	N	PD	00251
50.	E-0103	N	PD	00267
51.	E-0103	N	PD	00268
52.	E-0103	N	PD	00269
53.	E-0103	N	PD	00270
54.	E-0103	N	PD	00271
55.	E-0103	N	PD	00274
56.	E-0103	N	PD	00275
57.	E-0103	N	PD	00280
58.	E-0103	N	PD	00281
59.	E-0103	N	PD	00287
60.	E-0103	N	PD	00288
61.	E-0103	N	PD	00599
62.	E-0105	S	PD	00163
63.	E-0105	S	PD	00164
64.	E-0105	S	PD	00165
65.	E-0105	S	PD	00166
66.	E-0105	S	PD	00205
67.	E-0105	S	PD	00210
68.	E-0105	E	PD	00256
69.	E-0106	S	PD	00019
70.	E-0106	S	PD	00021
71.	E-0106	S	PD	00170
72.	E-0106	S	PD	00171

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Table III.10.M.B – EMF Plant Penetration Seal Location

Row Number	Room Number	Orientation	Discipline	Sequence Number
73.	E-0106	S	PD	00187
74.	E-0106	S	PD	00240
75.	E-0106	S	PD	00257
76.	ED-0102	F	PD	00233
77.	ED-B001	C	PD	00231

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WASTE TREATMENT AND IMMOBILIZATION PLANT
APPENDIX 1.0
WTP INTERIM COMPLIANCE SCHEDULE

CHANGE CONTROL LOG

Change Control Logs ensure that changes to this unit are performed in a methodical, controlled, coordinated, and transparent manner. Each unit addendum will have its own change control log with a modification history table. The "**Modification Number**" represents Ecology's method for tracking the different versions of the permit. This log will serve as an up to date record of modifications and version history of the unit.

Modification History Table

Appendices	Modification Date	Modification Number
Appendix 1.0	06/12/2019	24590-WTP-PCN-ENV-19-002 (8C.2019.Q2)
Appendix 1.1	11/28/2017	8C.2017.8F
Appendix 1.2	05/11/2018	24590-WTP-PCN-ENV-18-005
Appendix 1.3	08/30/2018	8C.2018.3F
Appendix 1.4	06/12/2019	24590-WTP-PCN-ENV-19-002 (8C.2019.Q2)
Appendix 1.5	10/02/2018	24590-WTP-PCN-ENV-18-008 (8C.2018.Q4)

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OPERATING UNIT GROUP 10
APPENDIX 1.0
WTP INTERIM COMPLIANCE SCHEDULE

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OPERATING UNIT GROUP 10
APPENDIX 1.0
WTP INTERIM COMPLIANCE SCHEDULE

Where information regarding treatment, management, and disposal of the radioactive source, byproduct material, and/or special nuclear components of mixed waste (as defined by the *Atomic Energy Act of 1954*, as amended) has been incorporated into this permit, it is not incorporated for the purpose of regulating the radiation hazards of such components under the authority of this permit and Chapter 70.105 Revised Code of Washington. In the event of any conflict between Permit Condition III.10.A and any statement relating to the regulation of source, special nuclear, and byproduct material contained in portions of permit application that are incorporated into this permit, Permit Condition III.10.A will prevail.

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WASTE TREATMENT AND IMMOBILIZATION PLANT
APPENDIX 1.4
INTERIM COMPLIANCE SCHEDULE – WTP EFFLUENT MANAGEMENT FACILITY

CHANGE CONTROL LOG

Change Control Logs ensure that changes to this unit are performed in a methodical, controlled, coordinated, and transparent manner. Each unit addendum will have its own change control log with a modification history table. The "**Modification Number**" represents Ecology's method for tracking the different versions of the permit. This log will serve as an up to date record of modifications and version history of the unit.

Modification History Table

Modification Date	Modification Number
06/12/2019	24590-WTP-PCN-ENV-19-002 (8C.2019.Q2)
08/23/2018	8C.2018.4F
09/05/2017	8C.2017.6F

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Appendix 1.4
Interim Compliance Schedule – WTP Effluent Management Facility (EMF)

	EMF Compliance Schedule Submittal	Interim Compliance Date
	III.10.C.2	
EMF-1	Submit documentation stating the EMF has been constructed in compliance with the Permit.	12/31/2020
	III.10.C.3	
EMF-3	Update and submit for approval Waste Analysis Plan and associated Quality Assurance Project Plan (Chapter 3A and 3B) to Ecology for review and approval.	6/30/2020
	III.10.C.5	
EMF-4	Update and submit for approval Procedures to Prevent Hazards and Inspection Schedule (Chapter 6 and Appendix 6A) to Ecology for review and approval.	6/30/2020
	III.10.C.6	
EMF-5	Update and submit the Contingency Plan (Chapter 7) to Ecology for review and approval.	6/30/2020
	III.10.C.7	
EMF-6	Update and submit Training Program (Chapter 8) to Ecology for review and approval.	6/30/2020
EMF-7	Submit under separate cover the actual WTP Dangerous Waste Training Plan for incorporation into Administrative Record.	6/30/2020
	III.10.C.8	
EMF-8	Update and submit the Closure Plan (Chapter 11) to Ecology for review and approval.	6/30/2020
	III.10.C.11	
EMF-9	Update and submit Risk Assessment Work Plan, revised in consultation with Ecology to address the DFLAW configuration.	Complete~~08/30/2019~~
	Containers III.10.D.10	
EMF-11	Update and submit descriptions of container management practices (Appendix 4G) to Ecology for review and approval.	6/30/2020
	Prior to Installation III.10.E.9	
EMF-13	Update and submit engineering information for each dangerous waste tank (Appendix 4G) to Ecology for review and approval.	Complete
EMF-14	Update and submit engineering information for each tank system ancillary equipment (Appendix 4G) to Ecology for review and approval.	Complete
	Report of Progress	
EMF-45	Update and submit descriptions of tank management practices (Appendix 4G) to Ecology for review and approval.	6/30/2020

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	EMF Compliance Schedule Submittal	Interim Compliance Date
	EMF Misc. Units Systems III.10.M.A	
EMF-16	Submit engineering information for EMF Miscellaneous Treatment Unit Systems.	Complete
	Final Compliance Date	
EMF-32	Final Compliance Date (Hot Commissioning Complete)	12/31/2023

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WASTE TREATMENT AND IMMOBILIZATION PLANT
APPENDIX 6.0

CHANGE CONTROL LOG

Change Control Logs ensure that changes to this unit are performed in a methodical, controlled, coordinated, and transparent manner. Each unit addendum will have its own change control log with a modification history table. The "**Modification Number**" represents Ecology's method for tracking the different versions of the permit. This log will serve as an up to date record of modifications and version history of the unit.

Modification History Table

Appendices	Modification Date	Modification Number
Appendix 6.0	01/28/2016	8C.2016.1F
Appendix 6.1		
Appendix 6.2		

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OPERATING UNIT GROUP 10
APPENDIX 6.0

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OPERATING UNIT GROUP 10
APPENDIX 6.0

Where information regarding treatment, management, and disposal of the radioactive source, byproduct material, and/or special nuclear components of mixed waste (as defined by the *Atomic Energy Act of 1954*, as amended) has been incorporated into this permit, it is not incorporated for the purpose of regulating the radiation hazards of such components under the authority of this permit and Chapter 70.105 Revised Code of Washington (RCW). In the event of any conflict between Permit Condition III.10.A and any statement relating to the regulation of source, special nuclear, and byproduct material contained in portions of the permit application that are incorporated into this permit, Permit Condition III.10.A will prevail.

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DRAWINGS AND DOCUMENTS
OPERATING UNIT GROUP 10 – APPENDIX 6.2
FINAL RISK ASSESSMENT WORK PLAN

The documents listed in the following table are incorporated by reference into this permit and are subject to the requirements set forth in Part I Standard Conditions, Part II General Facility Conditions, and Part III Operating Unit Group 10 Conditions. Upon request, copies of the documents can be viewed at the Nuclear Waste Program Resource Center located at 3100 Port of Benton Blvd. Richland, WA. Appointments for viewing can be scheduled by calling (509) 372-7950.

Appendix	Drawing/Document Number	Description
Appendix 6.2	24590-WTP-RPT-ENV-14-002, Rev. 0	Final Risk Assessment Work Plan: Environmental Risk Assessment Work Plan for the Hanford Tank Waste Treatment and Immobilization Plant
Appendix 6.2.1	24590-WTP-RPT-ENV-10-001, Rev. 0	Supplement 1 – Constituents of Potential Concern for the WTP Air and Dangerous Waste Permits
Appendix 6.2.2	24590-WTP-ES-PE-17-001~~RPT-PO-03-008~~, Rev. 1~~2~~	Supplement 2 – ~~Integrated~~ Emissions Study ~~Baseline Report~~ for the Hanford Tank Waste Treatment and Immobilization Plant
Appendix 6.2.3	24590-WTP-RPT-ENV-17-008~~HAC-50-00001~~, Rev. 0~~C~~	Supplement 3 – Cell~~Estimated Organic~~ Emissions Estimate ~~from Process Cells~~
Appendix 6.2.4	24590-WTP-RPT-ENV~~S~~-14~~07~~-003~~2~~, Rev. 2~~0~~	Supplement 4 – Chemical Parameters and Toxicological Inputs for the Environmental Risk Assessment for the Hanford Tank Waste Treatment and Immobilization Plant
Appendix 6.2.5	24590-WTP-RPT-ENV-08-001, Rev. 5~~2~~	Supplement 5 – Hanford Tank Waste Treatment and Immobilization Plant Risk Assessment Air Quality Modeling Protocol
Appendix 6.2.6	24590-WTP-RPT-ENV-18-003, Rev. 0~~1~~	Supplement 6 – Risk Assessment Work Plan for the Direct Feed Low-Activity Waste Configuration

Source documents (which do not include a "P" in the last set of numbers, e.g. "-P0001," or "-TP001") should be used in conjunction with any document change notices issued against them.

We are currently transitioning from permit documents (which do include a "P" in the last set of numbers) to source documents. At the end of the transition period, permit submittals will contain source documents and will be incorporated into the permit as described in Ecology Publication # 07-05-006.

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Attachment 2
19-ECD-0066
REISSUE
(90 Pages Excluding Cover Sheet)

Hanford Facility RCRA Permit Modification WTP-002
Supplement 2

Issued by
RPP-WTP PDC

HANFORD TANK WASTE TREATMENT AND IMMOBILIZATION PLANT

Emissions Study for the Hanford Tank Waste Treatment and Immobilization Plant

DOE Contract No.
DE-AC27-01RV14136

REV	DATE	REASON FOR REVISION	ORIGINATOR	CALC CHECKER	APPROVER(S)
1	05/06/19	Updated results with iodine DF changes. Added Tables 2-1, 2-2 and 2-3 and updated Tables 2-4 and 2-5	NBrar	Nancy Wilkins	
0	08/27/18	Initial Release	Navpreet Brar	Nancy Wilkins	Bob Hanson

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Acronyms

ACM	Aspen Custom Modeler
AES	Aspen Engineering Suite
APPS	Aspen Process Performance Simulation
CASRN	Chemical Abstracts Service registry number
CFR	Code of Federal Regulations
COPC	constituent of potential concern
DFLAW	Direct Feed Low-Activity Waste
DWP	Dangerous Waste Permit
EMF	Effluent Management Facility
ETF	Effluent Treatment Facility
HEPA	high-efficiency particulate air (filter)
HLW	High-Level Waste (Facility)
LAW	Low-Activity Waste (Facility)
PCB	polychlorinated biphenyl
PIC	product of incomplete combustion
PJV	pulse jet ventilation
PT	Pretreatment (Facility)
RLD	radioactive liquid waste disposal system
SBS	Submerged Bed Scrubber
WAC	Washington Administrative Code
WTP	Hanford Tank Waste Treatment and Immobilization Plant

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Executive Summary

Since the release of 24590-WTP-RPT-PO-03-008, *Integrated Emissions Baseline Report for the Hanford Tank Waste Treatment and Immobilization Plant*, and 24590-WTP-RPT-PE-11-010, *WTP Feed and Organic Generation Rates and Decontamination Factors for 2011-2012 Emission Report*, there have been significant design changes affecting the Hanford Tank Waste Treatment and Immobilization Plant (WTP) emissions. The new information is reflected in this formal engineering study, which will supersede both reports.

This study provides an estimate of emissions that could result from vitrifying Hanford tank waste—using Process Emissions model (24590-WTP-UIF-PE-18-0001). 24590-WTP-RPT-ENV-10-001, *Constituents of Potential Concern for the WTP Air and Dangerous Waste Permits*, identified 309 organic constituents of potential concern (COPC), 54 inorganic COPCs, and 46 radionuclide COPCs. After consideration of bulk organics (non-COPCs contributing to feed total organic carbon), criteria pollutants, and greenhouse gases, this resulted in 3 non-COPC organics, 58 inorganic COPCs, and 46 radionuclide COPCs in addition to the 309 organics. Of the 309 organic COPCs, 97 were categorized as feed constituents, 157 were categorized as products of incomplete combustion (PIC), and 55 were categorized as both feed constituents and PICs. Feed vectors were developed from data in report 24590-WTP-RPT-ENV-16-001, *Feed Vector Development in Support of WTP Environmental Risk Assessment Activities*, to support the Hanford Tank Waste Treatment and Immobilization Plant (WTP) environmental risk assessment and stack emissions modeling efforts. To fully account for such constituents (feed constituents, PICs, and both), the Process Emissions model was run with the constituents in both forms (as a feed constituent and a PIC), tracked separately, and then combined at the stack to provide the total emissions for those constituents.

This emissions study provides the results of modeling the feed vector constituents in a Direct Feed Low-Activity Waste configuration (in which a filtered, ion exchange effluent is treated directly via vitrification) and in an integrated WTP configuration (in which waste is pretreated, separated into low-activity waste and high-level waste fractions, and immobilized in two dedicated vitrification facilities). Use of data presented within this study for purposes beyond its intent is subject to the Design Authority's approval on a case-by-case basis.

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1 Introduction

1.1 Objective

The objective of this formal engineering study is to provide an emissions estimate for both DFLAW and Integrated WTP flowsheet configurations (Section 1.2.1) as required to satisfy, in part, requirements established by condition III.10.C.11 of the WTP Dangerous Waste Permit (WA7890008967, herein referred to as the DWP), as well as providing estimates to address the provisions in Washington Administrative Code (WAC) 173-303-680 and applicable Code of Federal Regulations (CFR) incorporated by reference.

Following data is provided for organic, inorganic, and radionuclide constituents of potential concern (COPCs identified in Section 1.2.2) in the supporting engineering calculation, 24590-WTP-M4C-V20T-00001, *Emissions Estimate for DFLAW and Integrated WTP Configurations*:

- Mass and concentration in the feed vector.
- Emission rates (g/sec) and concentrations (mass fractions) for unabated and abated ventilation and melter offgas streams, and process streams related to critical systems identified in the Dangerous Waste Permit (DWP). Streams of interest are identified in Section 1.2.3. Emission rates for organic COPCs present in the feed in the abated streams were developed by the application of a minimum DRE of 99.99% (DWP performance standard).

The emissions estimate will support:

- The pre-demonstration test risk assessment required by DWP condition III.10.C.11.
- Air permitting new source review evaluations to determine if modifications to existing air permits are needed.
- LAB/cell emissions estimate

The results summarized in Section 2 of this study are obtained from the supporting engineering calculation, 24590-WTP-M4C-V20T-00001, Rev. B, *Emissions Estimate for DFLAW and Integrated WTP Configurations*. The emissions estimate provided for both DFLAW and Integrated WTP flowsheet configurations in 24590-WTP-M4C-V20T-00001 was developed:

- Using the bounding DFLAW and Integrated WTP feed vectors developed specifically for use in the emissions estimate (24590-WTP-RPT-ENV-16-001, *Feed Vector Development in Support of WTP Environmental Risk Assessment*).
- Using the steady state Process Emissions model (24590-WTP-UIF-PE-18-0001). Each COPC is tracked in the model using constituent-specific data (such as mass in the feed, molecular weight, vapor fraction, Henry's Law constant, PIC conversion factor, etc. as applicable).
- Using normal operating conditions: Normal operating conditions such as unit operation temperatures, pressures, air flowrates, release fractions, entrainment coefficients, etc. were used in the Process Emissions model. However, the results are developed for design throughput rates of 30 MTG/day and 7.5 MTG/day for LAW and HLW melters respectively with zero flow to supplemental facility (applicable only to integrated WTP configuration).
- Using the methodology as documented in Section 5 of the supporting engineering calculation. Application of PIC generation and a minimum DRE of 99.99% (DWP performance standard) on organic constituents in the VIT melter offgas systems is considered. Refer to Section 7.6.1 of the supporting engineering calculation for more details on the demonstration of conformance to DWP

DWP requirement (a minimum DRE of 99.99% applied on organics COPCs in the feed in the VIT offgas systems).

- Using Equipment decontamination factors (DFs) established in the engineering calculations, vendor data, test data, etc. When necessary (due to unavailability of DFs), a few conservative and simplifying assumptions (such as the use of a DF of 1 at the carbon bed for organic constituents) are used to close data gaps (Section 6 of 24590-WTP-M4C-V20T-00001).

The main changes since the release of last emissions report have been the introduction of a bounding feed vector developed specifically for the emissions estimate (24590-WTP-RPT-ENV-16-001) and the introduction of a Direct Feed Low-Activity Waste (DFLAW) configuration. The full WTP baseline configuration is referred to as the integrated[1] WTP configuration in this study. Both configurations are described in Section 1.2.1. Other significant changes include reducing the number of organic constituents of potential concern (COPC) to 309 (from 354) plus 3 non-COPCs as discussed in Section 3, use of a new pre-verified steady-state Process Emissions model (approved for use at WTP) to estimate emissions as described in Section 3, and tracking all organic constituents in the model (and not just a few representative constituents) as discussed in Section 3.1. In addition, the total throughput was decreased to 30 MTG/d (from 50) for both Low-Activity Waste (LAW) melters and increased to 7.5 MTG/d (from 6) for both High-Level Waste (HLW) melters, and product of incomplete combustion (PIC) rates were based on Vitreous State Laboratory (VSL) data (and not analytical detection limits).

Use of data presented within this study for purposes beyond its intent is subject to the Design Authority's approval on a case-by-case basis. The results presented in this study are developed using the Process Emissions model flowsheet which is steady-state representation of the current WTP design. The results of this study will need to be evaluated if any changes are made to the current WTP design.

1.2 Scope

The sub-sections provide the following information:

- Description of DFLAW and Integrated WTP flowsheet configurations for which the emissions estimate is provided.
- List of constituents of potential concern (COPCs) for the emissions estimate: Organic, inorganic and radionuclide constituents.
- List of streams of interest for the emissions estimate.

1.2.1 WTP Process Configuration

The WTP will initially be operated in a DFLAW configuration involving the LAW Facility and the Effluent Management Facility (EMF). A simplified overview of the WTP process in the DFLAW configuration is provided in Figure 1-1. The WTP will later be operated in an integrated WTP configuration when the Pretreatment (PT) Facility and the HLW Facility become operational.
A simplified overview of the WTP process in the integrated WTP configuration is provided in Figure 1-2

[1] The term "integrated" as used with this context, is synonymous with the term "baseline" as it appears in the DWP.

1.2.1.1 Direct Feed Low-Activity Waste Configuration

In the DFLAW configuration, the waste will be pretreated in the Hanford Site Tank Farms, to remove cesium and solids. The pretreated low-activity waste feed will bypass the PT Facility and will be directly fed from Tank Farms to the LAW Facility. The LAW Facility is where the low-activity fraction from Tank Farms is solidified via vitrification. The LAW Facility vitrifies the waste, creating immobilized low-activity waste using two dedicated melter trains, two primary offgas systems, a common effluent collection system, and a common secondary offgas system. The low-activity waste goes into a melter feed preparation vessel, where silica and other glass-forming materials are added. The mixture is fed into the melters, where it is heated to a temperature between 1750 and 2100°F, and then poured into stainless steel containers. The containers holding the immobilized low-activity waste will be transferred to permitted burial trenches located elsewhere on the Hanford Site. The LAW Facility offgas from each melter is treated through a submerged bed scrubber (SBS) and an electrostatic precipitator (WESP) within each melter's primary offgas system. Separately, vessels within the LAW Facility are actively ventilated to prevent the potential buildup of waste decomposition vapors. The vessel ventilation system joins the melter primary offgas systems upstream of the secondary offgas system, where the combined offgas streams are routed through high-efficiency particulate air (HEPA) filters, a carbon absorber, an oxidizer and (or) catalytic reducer, and a caustic scrubber before atmospheric discharge. A depiction of the low-activity waste vitrification process in the DFLAW configuration is provided in Figure 1-3. A more detailed process description of the systems within the LAW Facility is provided in Chapter 4E of the DWP (WA7890008967).

The LAW Facility will generate liquid effluent when water is boiled off during vitrification. The EMF will primarily manage and treat the liquid effluent from the LAW Facility via an evaporator system. The EMF will also process small amounts of effluent from the Analytical Laboratory radioactive liquid waste disposal system (RLD) vessels, as well as the waste transfer line flush effluent. The EMF will treat the bulk of the effluent via evaporation in the DFLAW configuration, whereas these waste streams are processed in the PT Facility in the integrated WTP configuration. The evaporator will be operated under vacuum to lower the boiling point of the concentrate. The overhead vapors, mainly water, will pass through an impingement plate and demister pads to remove entrained liquid, with the overhead vapor continuing to the condensers. Most of the evaporator bottoms will be recycled through the reboiler, with a small amount sent to the evaporator concentrate vessels. Evaporator overhead condensate is sent for final treatment and disposal at Hanford's Effluent Treatment Facility (ETF), while evaporator concentrate is normally recycled to the melter feed in the LAW Facility. After vapor removal, the evaporator overhead gases are combined with the vessel ventilation gases and routed through HEPA filters before atmospheric discharge. A depiction of the EMF process is provided in Figure 1-4. A more detailed process description of the systems within the EMF is provided in Chapter 4G of the DWP (WA7890008967).

1.2.1.2 Integrated WTP Configuration

The integrated WTP configuration is based on the issued documents (PFDs) referenced in Section 11 of 24590-WTP-SWD-PET-08-002, Rev 7, *APPS System Design Description*. Both low-activity waste and high-level waste are transferred from the Hanford Tank Farms for processing in the PT Facility via evaporation, ultrafiltration, cesium ion exchange, and offgas treatment. During pretreatment, water is removed from the waste via evaporators (as needed) to concentrate the waste; solids are filtered out; and soluble, highly radioactive isotopes in the low-activity waste (primarily cesium) are removed by ion exchange units for transfer to the high-level waste fraction. In some situations, before filtration, caustic and/or oxidative leaching and (or) precipitation is used to dissolve solids or to remove unwanted components prior to entering the LAW Facility. Process vessel vent gases are treated by equipment, such as a scrubber, high efficiency mist eliminator (HEME), HEPA filters, oxidizer, and a carbon bed absorber. Exhausts from pulse jet mixers, which are devices used to mix waste in vessels, are vented through a demister and HEPA filters. A depiction of the pretreatment process is provided in Figure 1-5. A more detailed process description of the systems within the PT Facility is provided in Chapter 4D of the DWP (WA7890008967).

In both the DFLAW and integrated WTP configurations, the LAW Facility is designed and operated similarly. A depiction of the low-activity waste vitrification process in the integrated WTP configuration is provided in Figure 1-6.

Pretreated high-level waste feed is transferred from the PT Facility for processing in the HLW Facility via two identical melter trains—with a dedicated primary and secondary offgas treatment system for each and a single effluent collection system supporting both trains. The high-level waste from the PT Facility is transferred to the HLW Facility, where it is mixed with glass formers and vitrified, creating immobilized high-level waste via two dedicated melters of similar design to the LAW melters. Each HLW melter offgas system includes an SBS, WESP, HEME, HEPA filters, carbon adsorber, silver mordenite column, and an oxidizer and a catalytic reducer. A depiction of the HLW Facility vitrification process is provided in Figure 1-7. A more detailed process description of the HLW Facility is provided in Chapter 4F of the DWP (WA7890008967).

It is important to note that the overall PT Facility design is currently undergoing design evolution to address technical issues (namely, design changes associated with enhancing the suspension of rapidly settling Newtonian slurries).

Figure 1-1 Simplified Overview of WTP Process in Direct Feed Low-Activity Waste (DFLAW) Configuration

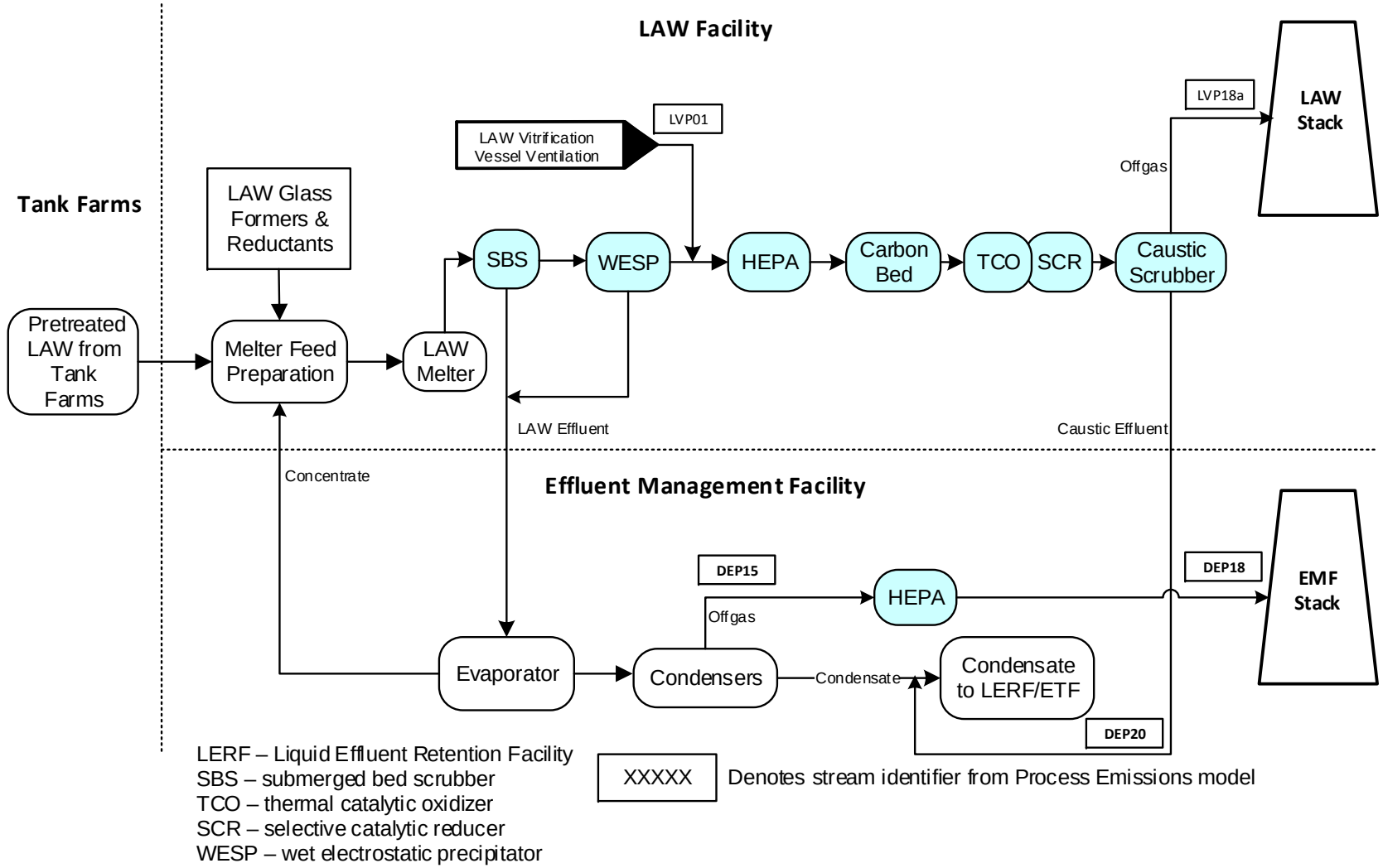

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Figure 1-2 Simplified Overview of WTP Process in Integrated WTP Configuration

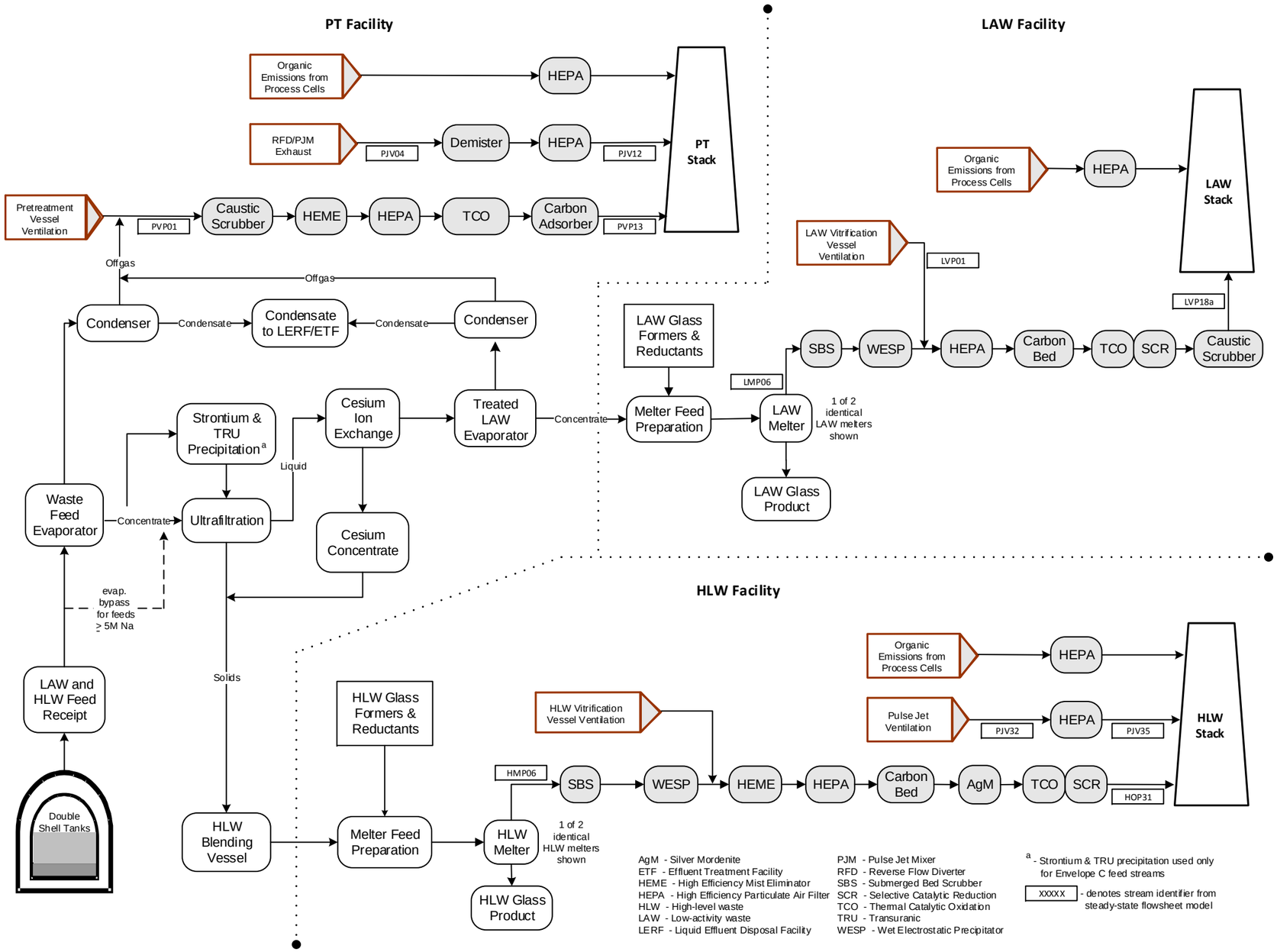

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Figure 1-3 Simplified Low-Activity Waste Vitrification Process in Direct Feed Low-Activity Waste (DFLAW) Configuration

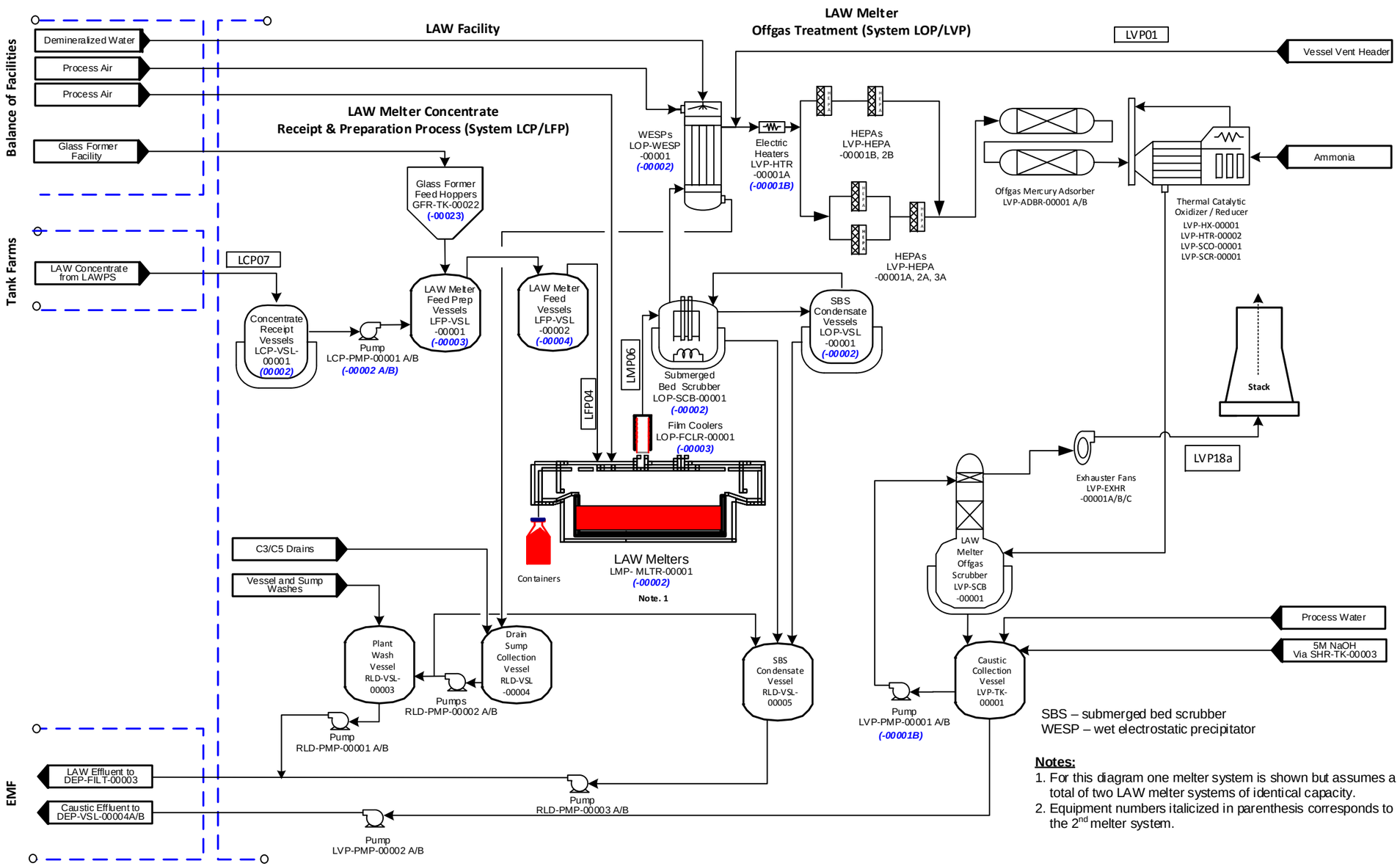

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Figure 1-4 Simplified Low-Activity Waste Effluent Management Process (EMF) in Direct Feed Low-Activity Waste (DFLAW) Configuration

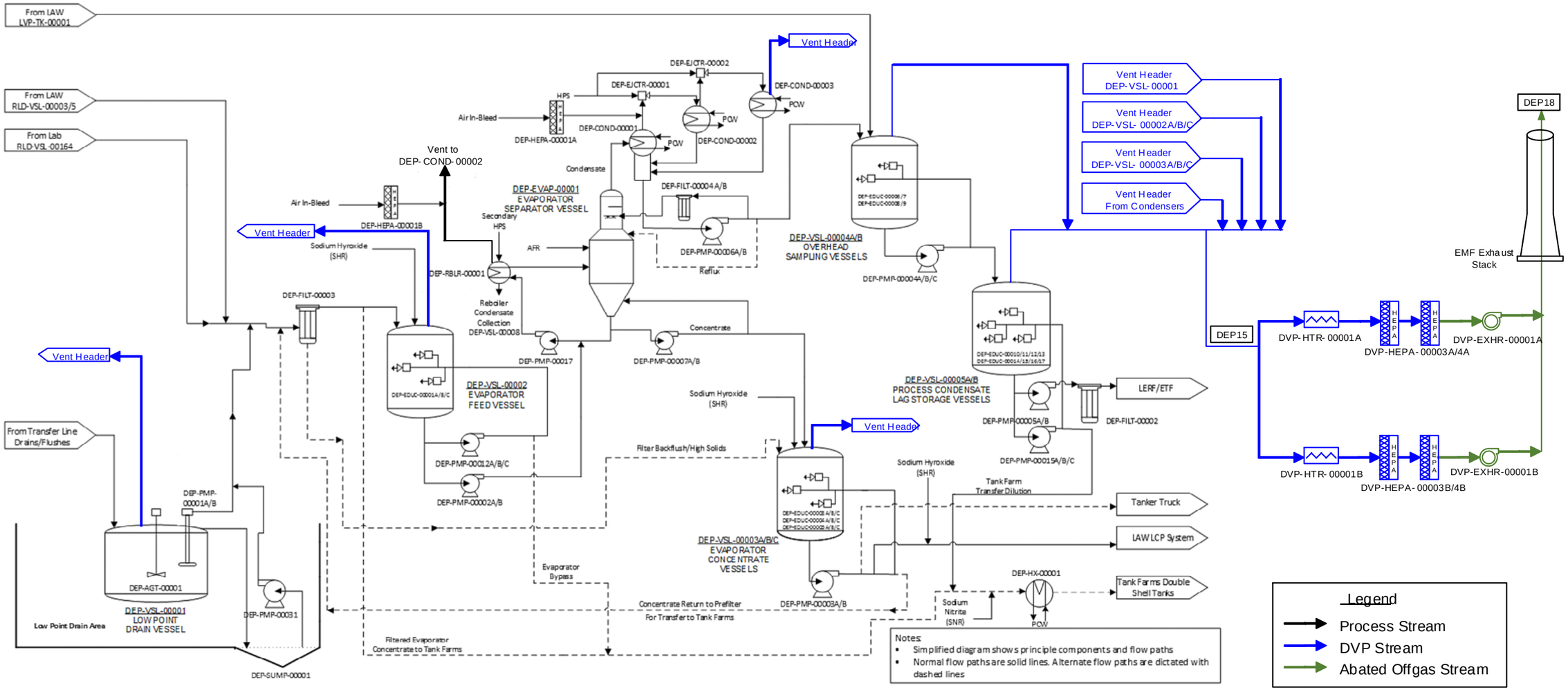

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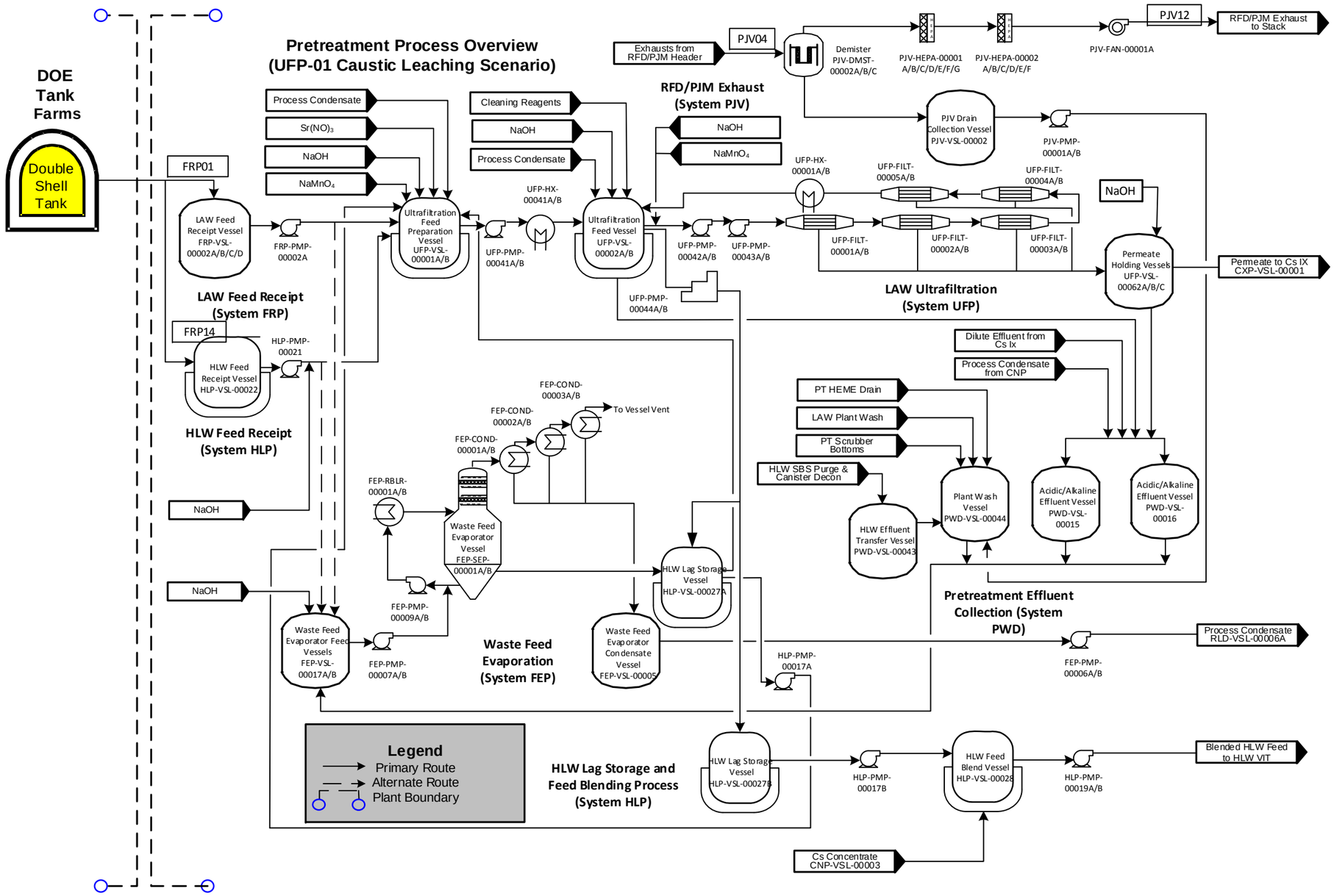
Figure 1-5 Simplified Pretreatment Process in Integrated WTP Configuration[2]



[2] This figure shows the current approved PT Facility Design.

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Figure 1-5 Simplified Pretreatment Process in Integrated WTP Configuration (continued)

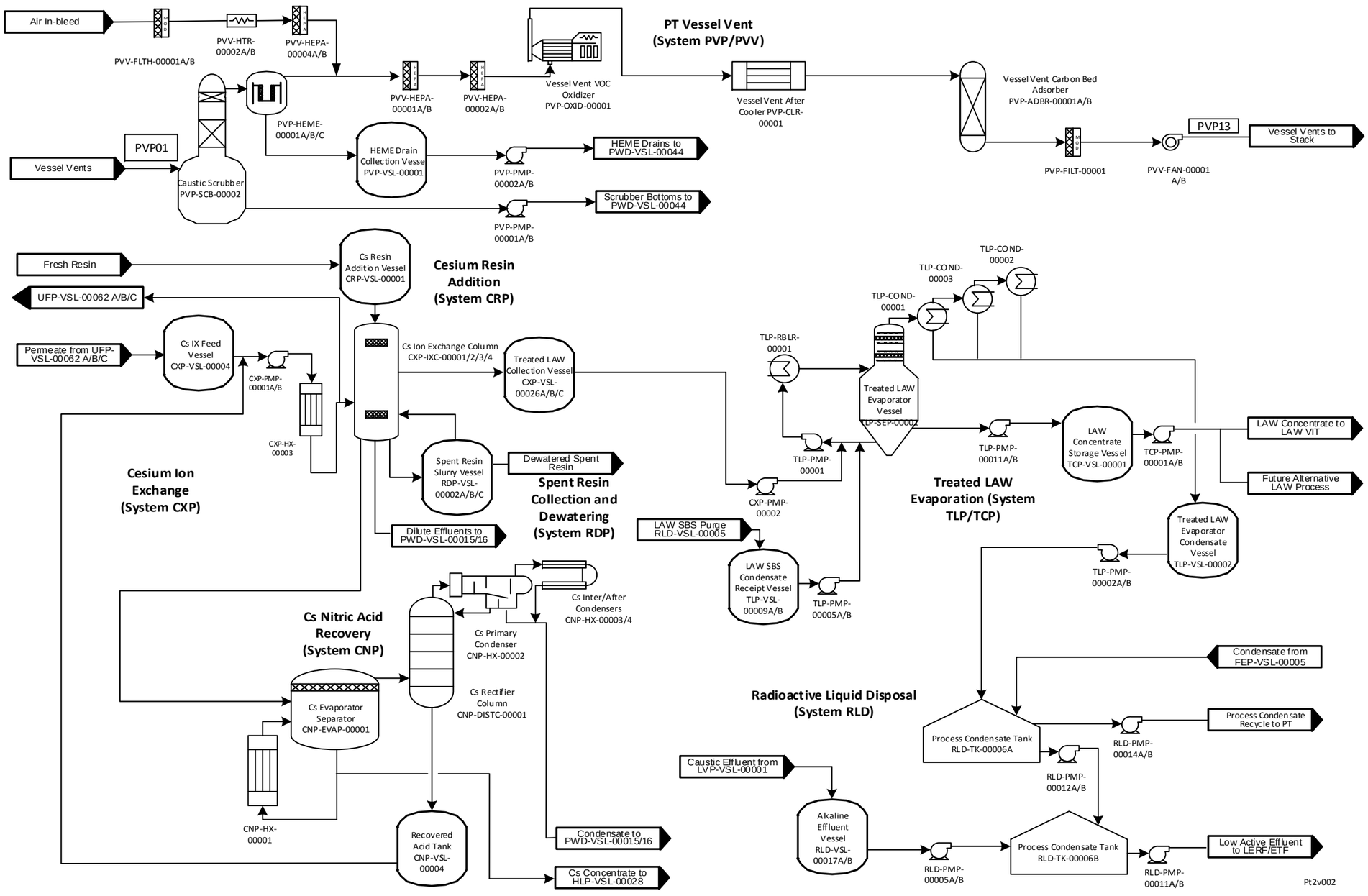

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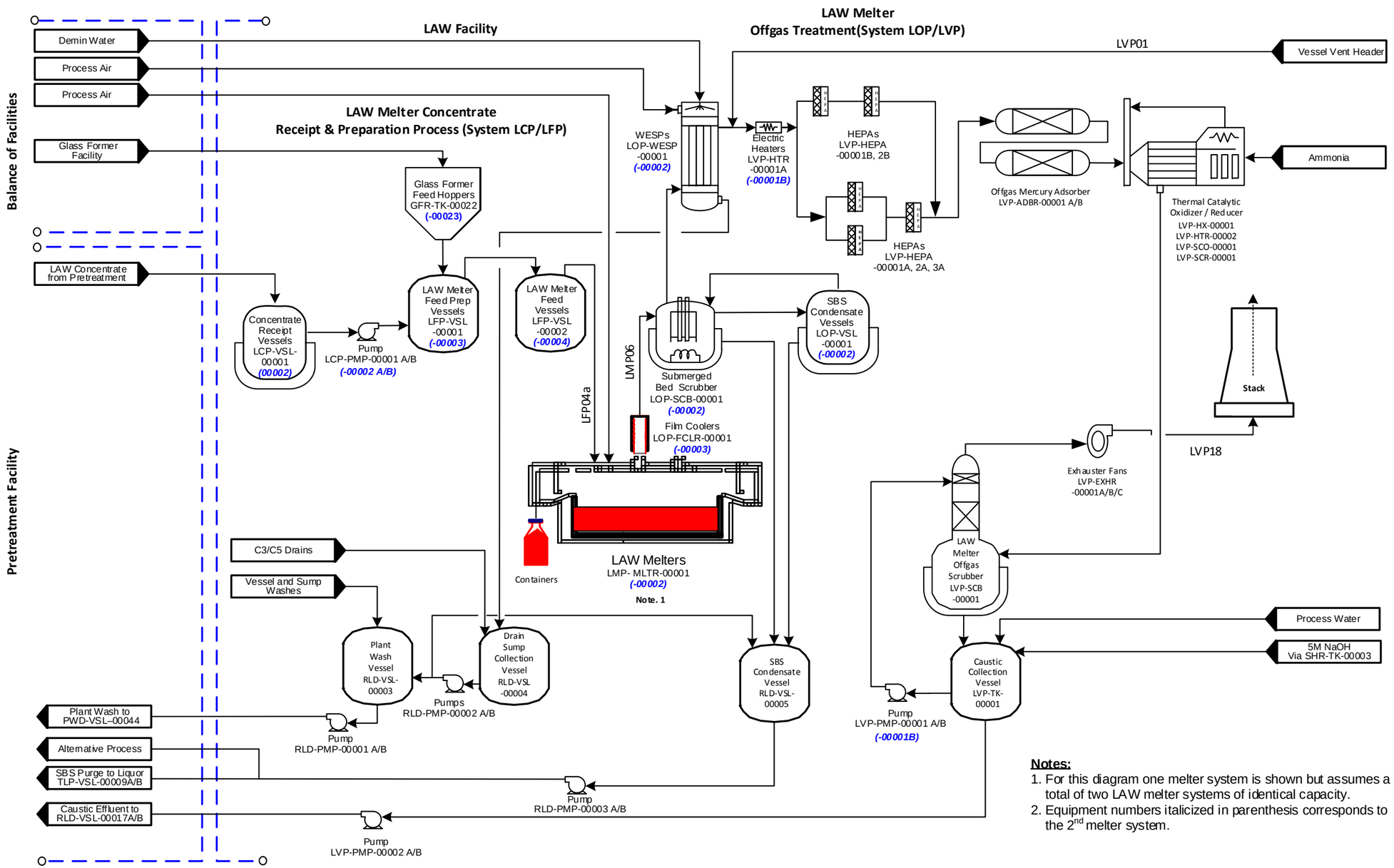
Figure 1-6 Simplified Low-Activity Waste Vitrification Process in Integrated WTP Configuration



Notes:

1. For this diagram one melter system is shown but assumes a total of two LAW melter systems of identical capacity.
2. Equipment numbers italicized in parenthesis corresponds to the 2nd melter system.

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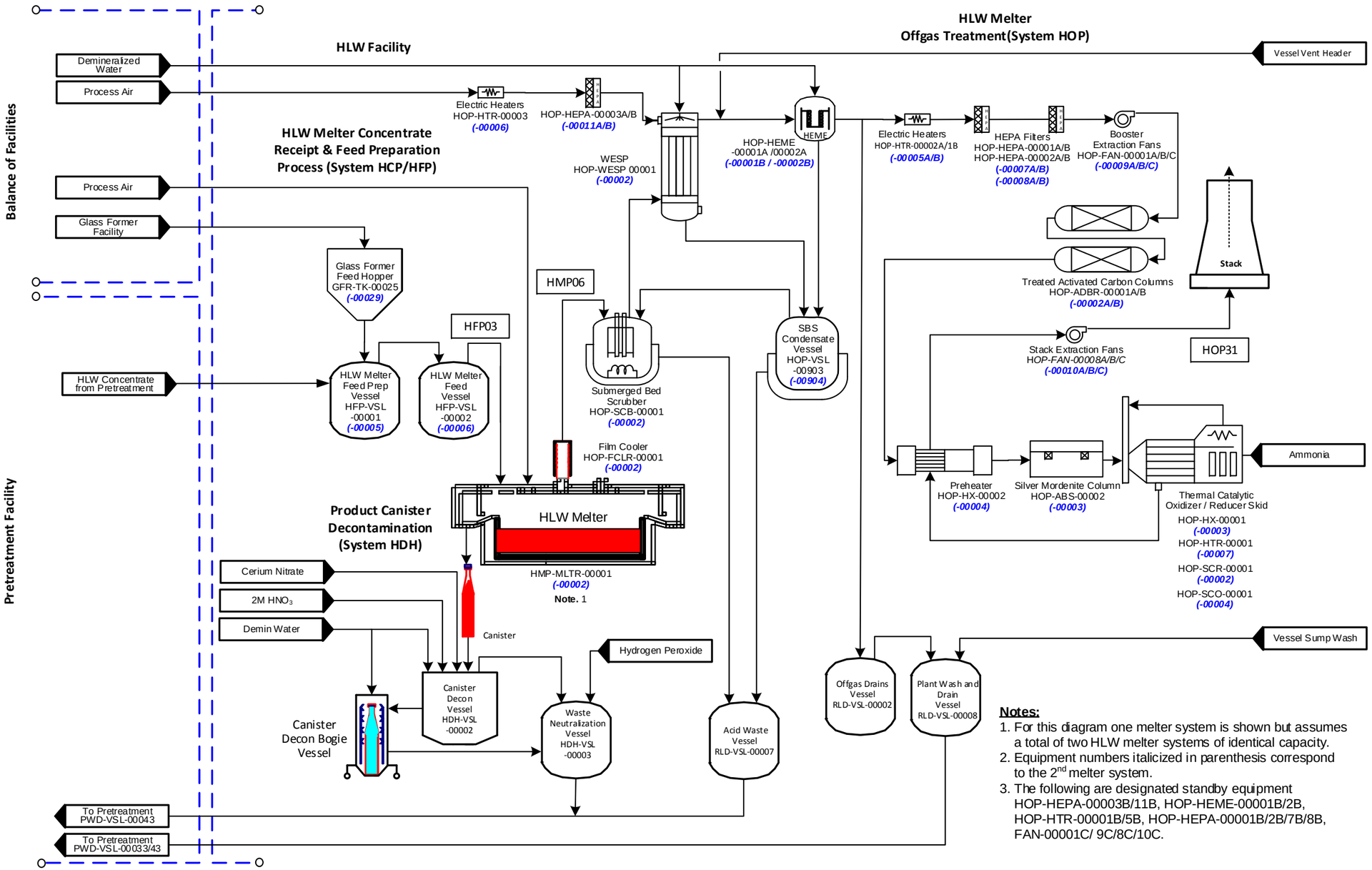
Figure 1-7 Simplified High-Level Waste Vitrification Process in Integrated WTP Configuration



Notes:

1. For this diagram one melter system is shown but assumes a total of two HLW melter systems of identical capacity.
2. Equipment numbers italicized in parenthesis correspond to the 2nd melter system.
3. The following are designated standby equipment HOP-HEPA-00003B/11B, HOP-HEME-00001B/2B, HOP-HTR-00001B/5B, HOP-HEPA-00001B/2B/7B/8B, FAN-00001C/ 9C/8C/10C.

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1.2.2 Constituents in the Emissions Estimate

The original WTP air emissions estimate scope included 409 COPCs, consisting of 309 organics, 54 inorganic COPCs, and 46 radionuclide COPCs, which were identified in report 24590-WTP-RPT-ENV-10-001, *Constituents of Potential Concern for the WTP Air and Dangerous Waste Permits*.

Subsequent to the issuance of the above report, 3 non-COPC organics and 4 inorganic COPCs (making a total of 58 inorganic COPCs) were added to the WTP emissions estimate scope. The 3 non-COPC organics (i.e., formate, acetate, and glycolate) contribute the majority of the carbon in non-COPC organics. The 4 inorganic COPCs are nitrogen oxides, sulfur oxides, criteria pollutants, and greenhouse gases.

1.2.2.1 Organic Constituents

The 312 (based on 309 original COPCs + 3 new non-COPCs) organic constituents that will be used for input to the WTP DWP environmental risk assessment are identified in Table 1-1, which also includes their Chemical Abstracts Service registry number (CASRN), designation (COPC or non-COPC), and categorization (feed constituent, product of incomplete combustion [PIC], or both).

Table 1-1 List of Organic Constituents in Emissions Estimate

CASRN or Chemical Formula	Organic Constituent	Designation	Categorization
100-02-7	p-Nitrophenol	COPC	Both
100-21-0	Phthalic acid	COPC	Feed
100-25-4	1,4-Dinitrobenzene	COPC	Both
100-40-3	4-Ethenylcyclohexene	COPC	Feed
100-41-4	Ethyl benzene	COPC	Feed
100-42-5	Styrene	COPC	Both
100-44-7	Benzyl chloride	COPC	PIC
100-47-0	Benzonitrile	COPC	PIC
100-51-6	Benzyl alcohol	COPC	PIC
100-52-7	Benzaldehyde	COPC	PIC
10061-01-5	cis-1,3-Dichloropropene	COPC	Feed
10061-02-6	trans-1,3-Dichloropropene	COPC	Feed
101-55-3	4-Bromophenylphenyl ether	COPC	Feed
101-77-9	4,4-Methylenedianiline	COPC	PIC
103-33-3	Azobenzene	COPC	PIC
103-65-1	n-Propyl benzene (Isocumene)	COPC	PIC
104-51-8	n-Butylbenzene	COPC	PIC
104-76-7	2-Ethyl-1-hexanol	COPC	Feed
105-67-9	2,4-Dimethylphenol	COPC	PIC
10595-95-6	n-Nitrosomethylethylamine	COPC	Feed

Table 1-1 List of Organic Constituents in Emissions Estimate

CASRN or Chemical Formula	Organic Constituent	Designation	Categorization
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	COPC	PIC
106-44-5	p-Cresol (4-methyl phenol)	COPC	PIC
106-46-7	1,4-Dichlorobenzene	COPC	Both
106-47-8	p-Chloroaniline	COPC	PIC
106-49-0	p-Toluidine	COPC	PIC
106-51-4	Quinone	COPC	PIC
106-88-7	1,2-Epoxybutane	COPC	Feed
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	COPC	PIC
106-93-4	Ethylene dibromide	COPC	Feed
106-99-0	1,3-Butadiene	COPC	Feed
107-02-8	Acrolein	COPC	Feed
107-05-1	3-Chloropropene	COPC	Feed
107-06-2	1,2-Dichloroethane	COPC	Both
107-12-0	Propionitrile	COPC	Feed
107-13-1	Acrylonitrile	COPC	Both
107-19-7	Propargyl alcohol	COPC	PIC
107-21-1	Ethylene glycol (1,2-ethanediol)	COPC	PIC
107-98-2	Propylene glycol monomethyl ether	COPC	PIC
108-05-4	Acetic acid vinyl ester	COPC	Feed
108-10-1	4-Methyl-2-pentanone	COPC	Feed
108-39-4	m-Cresol	COPC	Feed
108-60-1	bis (2-Chloroisopropyl)ether	COPC	PIC
108-67-8	1,3,5-Trimethylbenzene	COPC	PIC
108-86-1	Bromobenzene (Phenyl bromide)	COPC	PIC
108-87-2	Methylcyclohexane	COPC	Both
108-88-3	Toluene	COPC	Both
108-90-7	Chlorobenzene	COPC	Both
108-94-1	Cyclohexanone	COPC	Feed
108-95-2	Phenol	COPC	Both
109-74-0	n-Butanenitrile	COPC	Feed
109-75-1	3-Butenenitrile	COPC	PIC
109-77-3	Malononitrile	COPC	PIC
109-86-4	2-Methoxyethanol	COPC	PIC
109-99-9	Tetrahydrofuran	COPC	Both
110-00-9	Furan	COPC	PIC
110-54-3	n-Hexane	COPC	Feed

Table 1-1 List of Organic Constituents in Emissions Estimate

CASRN or Chemical Formula	Organic Constituent	Designation	Categorization
110-59-8	Pentanenitrile	COPC	Feed
110-80-5	2-Ethoxyethanol	COPC	Feed
110-82-7	Cyclohexane	COPC	Feed
110-83-8	Cyclohexene	COPC	Both
110-86-1	Pyridine	COPC	Feed
111-15-9	Ethylene glycol monoethyl ether acetate	COPC	PIC
111-44-4	Bis(2-chloroethyl)ether	COPC	PIC
111-65-9	n-Octane	COPC	Both
111-76-2	2-Butoxyethanol	COPC	Feed
111-84-2	n-Nonane	COPC	Both
111-91-1	Bis(2-chloroethoxy)methane	COPC	PIC
1120-21-4	Undecane	COPC	PIC
1120-71-4	1,3-Propane sultone	COPC	PIC
112-30-1	1-Decanol	COPC	PIC
112-31-2	Decanal	COPC	PIC
112-40-3	Dodecane	COPC	PIC
117-81-7	Bis(2-ethylhexyl)phthalate	COPC	Both
117-84-0	Di-n-octylphthalate	COPC	Feed
118-74-1	Hexachlorobenzene	COPC	Both
119-90-4	3,3'-Dimethoxybenzidine	COPC	PIC
120-12-7	Anthracene	COPC	Both
120-82-1	1,2,4-Trichlorobenzene	COPC	Feed
120-83-2	2,4-Dichlorophenol	COPC	Feed
121-14-2	2,4-Dinitrotoluene	COPC	Both
122-39-4	N,N-Diphenylamine	COPC	Feed
122-66-7	1,2-Diphenylhydrazine	COPC	PIC
123-33-1	Maleic hydrazide	COPC	PIC
123-38-6	Propionaldehyde	COPC	Both
123-72-8	Butanal	COPC	Feed
123-91-1	1,4-Dioxan	COPC	Feed
124-18-5	Decane	COPC	PIC
124-48-1	Chlorodibromomethane	COPC	PIC
126-73-8	Tributyl phosphate	COPC	Feed
126-98-7	2-Methyl-2-propenenitrile	COPC	Feed
127-18-4	1,1,2,2-Tetrachloroethene	COPC	Feed
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	COPC	Feed

Table 1-1 List of Organic Constituents in Emissions Estimate

CASRN or Chemical Formula	Organic Constituent	Designation	Categorization
129-00-0	Pyrene	COPC	Both
131-11-3	Dimethyl Phthalate	COPC	PIC
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	COPC	PIC
132-64-9	Dibenzofuran	COPC	PIC
1330-20-7	Xylenes (mixed isomers)	COPC	Both
133-06-2	Captan	COPC	PIC
1336-36-3	Polychlorinated biphenyls (PCB)	COPC	Feed
134-32-7	alpha-Naphthylamine	COPC	Feed
135-98-8	sec-Butylbenzene	COPC	PIC
141-78-6	Acetic acid ethyl ester	COPC	Feed
145-73-3	Endothall	COPC	PIC
156-59-2	cis-1,2-Dichloroethene	COPC	PIC
156-60-5	1,2-trans-Dichloroethene	COPC	Feed
1634-04-4	Methyl tert-butyl ether	COPC	Feed
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	COPC	PIC
189-55-9	Dibenzo[a,i]pyrene	COPC	Feed
189-64-0	Dibenzo[a,h]pyrene	COPC	Feed
191-24-2	Benzo(g,h,i)perylene	COPC	Both
191-30-0	Dibenzo(a,l)pyrene	COPC	Feed
192-65-4	Dibenzo[a,e]pyrene	COPC	Feed
192-97-2	Benzo(e)pyrene	COPC	PIC
193-39-5	Indeno(1,2,3-cd)pyrene	COPC	Both
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	COPC	PIC
205-82-3	Benzo[j]fluoranthene	COPC	PIC
205-99-2	Benzo(b)fluoranthene	COPC	PIC
206-44-0	Fluoranthene	COPC	Both
207-08-9	Benzo(k)fluoranthene	COPC	PIC
208-96-8	Acenaphthylene	COPC	Both
218-01-9	Chrysene	COPC	PIC
224-42-0	Dibenz[a,j]acridine	COPC	Feed
2245-38-7	2,3,5-Trimethylnaphthalene	COPC	PIC
226-36-8	Dibenz[a,h]acridine	COPC	Feed
23950-58-5	Pronamide	COPC	PIC
27154-33-2	Trichlorofluoroethane	COPC	Feed
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	COPC	PIC
319-84-6	alpha-BHC	COPC	Both

Table 1-1 List of Organic Constituents in Emissions Estimate

CASRN or Chemical Formula	Organic Constituent	Designation	Categorization
319-85-7	beta-BHC	COPC	Both
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	COPC	PIC
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	COPC	PIC
3268-87-9	Octachlorodibenzo(p)dioxin	COPC	PIC
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	COPC	PIC
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	COPC	PIC
3697-24-3	5-Methylchrysene	COPC	Feed
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	COPC	PIC
39001-02-0	Octachlorodibenzofuran	COPC	PIC
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	COPC	PIC
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	COPC	PIC
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	COPC	PIC
4170-30-3	Crotonaldehyde (Propylene aldehyde)	COPC	Both
41851-50-7	Chlorocyclopentadiene	COPC	PIC
460-19-5	Cyanogen (oxalonitrile)	COPC	PIC
4786-20-3	2-Butenenitrile	COPC	PIC
50-00-0	Formaldehyde	COPC	Feed
50-32-8	Benzo(a)pyrene	COPC	Both
506-68-3	Cyanogen bromide (bromocyanide)	COPC	PIC
506-77-4	Cyanogen chloride	COPC	PIC
510-15-6	Chlorobenzilate	COPC	PIC
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	COPC	PIC
51-28-5	2,4-Dinitrophenol	COPC	PIC
51-79-6	Ethyl carbamate (urethane)	COPC	PIC
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	COPC	PIC
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	COPC	PIC
532-27-4	2-Chloroacetophenone	COPC	PIC
534-52-1	4,6-Dinitro-o-cresol	COPC	PIC
53-70-3	Dibenz[a,h]anthracene	COPC	Both
5385-75-1	Dibenzo(a,e)fluoranthene	COPC	PIC
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	COPC	PIC
540-73-8	1,2-Dimethylhydrazine	COPC	PIC
540-84-1	2,2,4-Trimethylpentane	COPC	PIC
541-73-1	1,3-Dichlorobenzene	COPC	Feed
542-75-6	1,3-Dichloropropene	COPC	PIC
542-88-1	Bis(chloromethyl)ether	COPC	PIC

Table 1-1 List of Organic Constituents in Emissions Estimate

CASRN or Chemical Formula	Organic Constituent	Designation	Categorization
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	COPC	PIC
56-23-5	Carbon tetrachloride	COPC	Both
56-49-5	3-Methylcholanthrene	COPC	Feed
56-55-3	Benzo(a)anthracene	COPC	PIC
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	COPC	PIC
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	COPC	PIC
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	COPC	PIC
57-24-9	Strychnine	COPC	PIC
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	COPC	PIC
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo(p)dioxin	COPC	PIC
57-74-9	Chlordane	COPC	PIC
581-42-0	2,6-Dimethylnaphthalene	COPC	PIC
584-84-9	2,4-Toluene diisocyanate	COPC	PIC
58-89-9	gamma-BHC (Lindane)	COPC	Both
58-90-2	2,3,4,6-Tetrachlorophenol	COPC	Feed
589-38-8	3-Hexanone	COPC	Feed
591-50-4	Benzene, iodo-	COPC	PIC
591-78-6	2-Hexanone	COPC	Feed
593-60-2	Bromoethene (Vinyl bromide)	COPC	PIC
59-50-7	4-Chloro-3-methylphenol	COPC	Feed
59-89-2	N-Nitrosomorpholine	COPC	Feed
60-11-7	Dimethyl aminoazobenzene	COPC	PIC
602-87-9	5-Nitroacenaphthene	COPC	Feed
60-29-7	Ethyl ether	COPC	Feed
60-35-5	Acetamide	COPC	Feed
606-20-2	2,6-Dinitrotoluene	COPC	PIC
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	COPC	PIC
608-93-5	Pentachlorobenzene	COPC	PIC
61626-71-9	Dichloropentadiene	COPC	PIC
621-64-7	N-Nitroso-di-n-propylamine	COPC	Feed
624-83-9	Methyl isocyanate	COPC	PIC
62-50-0	Ethyl methanesulfonate	COPC	PIC
62-53-3	Aniline	COPC	PIC
62-75-9	N-Nitroso-N,N-dimethylamine	COPC	Feed
628-73-9	Hexanenitrile	COPC	Feed
630-20-6	1,1,1,2-Tetrachloroethane	COPC	Feed

Table 1-1 List of Organic Constituents in Emissions Estimate

CASRN or Chemical Formula	Organic Constituent	Designation	Categorization
64-18-6	Formic acid (methanoic acid)	COPC	PIC
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	COPC	PIC
65-85-0	Benzoic acid	COPC	PIC
67-56-1	Methyl alcohol	COPC	Feed
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	COPC	PIC
67-63-0	2-Propyl alcohol	COPC	Feed
67-64-1	2-Propanone (Acetone)	COPC	Both
67-66-3	Chloroform	COPC	Both
67-72-1	Hexachloroethane	COPC	Feed
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	COPC	PIC
70-30-4	Hexachlorophene	COPC	PIC
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	COPC	PIC
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	COPC	PIC
71-36-3	n-Butyl alcohol	COPC	Feed
71-43-2	Benzene	COPC	Both
71-55-6	1,1,1-Trichloroethane	COPC	Feed
72-43-5	Methoxychlor	COPC	PIC
72-55-9	4,4-DDE	COPC	Feed
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	COPC	PIC
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	COPC	PIC
74-83-9	Bromomethane	COPC	Both
74-87-3	Chloromethane	COPC	Both
74-88-4	Iodomethane	COPC	PIC
74-95-3	Methylene bromide	COPC	PIC
74-97-5	Bromochloromethane	COPC	PIC
75-00-3	Chloroethane	COPC	Feed
75-01-4	1-Chloroethene	COPC	Feed
75-02-5	Fluoroethene (vinyl fluoride)	COPC	Feed
75-05-8	Acetonitrile	COPC	Both
75-07-0	Acetaldehyde	COPC	Feed
75-09-2	Dichloromethane (Methylene Chloride)	COPC	Both
75-15-0	Carbon disulfide	COPC	Both
75-21-8	Ethylene oxide (Oxirane)	COPC	Feed
75-25-2	Bromoform	COPC	PIC
75-27-4	Bromodichloromethane	COPC	Feed
75-29-6	2-Chloropropane	COPC	PIC

Table 1-1 List of Organic Constituents in Emissions Estimate

CASRN or Chemical Formula	Organic Constituent	Designation	Categorization
75-34-3	1,1-Dichloroethane	COPC	Feed
75-35-4	1,1-Dichloroethene	COPC	Feed
75-44-5	Phosgene (hydrogen phosphide)	COPC	PIC
75-45-6	Chlorodifluoromethane	COPC	Feed
75-50-3	Trimethylamine	COPC	Feed
75-69-4	Trichlorofluoromethane	COPC	Feed
75-71-8	Dichlorodifluoromethane	COPC	Feed
76-01-7	Pentachloroethane	COPC	PIC
76-13-1	1,2,2-Trichlorotrifluoroethane	COPC	Feed
764-41-0	1,4-Dichloro-2-butene	COPC	PIC
76-44-8	Heptachlor	COPC	Both
765-34-4	Glycidylaldehyde	COPC	PIC
77-47-4	Hexachlorocyclopentadiene	COPC	PIC
77-78-1	Dimethyl sulfate	COPC	PIC
78-83-1	2-Methylpropyl alcohol	COPC	Feed
78-87-5	1,2-Dichloropropane	COPC	Feed
78-93-3	2-Butanone	COPC	Both
79-00-5	1,1,2-Trichloroethane	COPC	Feed
79-01-6	1,1,2-Trichloroethylene	COPC	Both
79-10-7	2-Propenoic acid	COPC	Feed
79-34-5	1,1,2,2-Tetrachloroethane	COPC	Feed
79-46-9	2-Nitropropane	COPC	Feed
80-62-6	Methyl methacrylate	COPC	PIC
822-06-0	Hexamethylene-1,5-diisocyanate	COPC	PIC
823-40-5	Toluene-2,6-diamine	COPC	PIC
82-68-8	Pentachloronitrobenzene (PCNB)	COPC	Both
832-69-9	1-Methylphenanthrene	COPC	PIC
83-32-9	Acenaphthene	COPC	Both
84-66-2	Diethyl phthalate	COPC	Both
84-74-2	Di-n-butylphthalate	COPC	Both
85-01-8	Phenanthrene	COPC	Both
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	COPC	PIC
85-68-7	Butylbenzylphthalate	COPC	Both
86-73-7	Fluorene	COPC	Both
87-61-6	1,2,3-Trichlorobenzene	COPC	PIC
87-68-3	Hexachlorobutadiene	COPC	Feed

Table 1-1 List of Organic Constituents in Emissions Estimate

CASRN or Chemical Formula	Organic Constituent	Designation	Categorization
87-86-5	Pentachlorophenol	COPC	Feed
88-06-2	2,4,6-Trichlorophenol	COPC	Feed
88-74-4	o-Nitroaniline (2-nitroaniline)	COPC	PIC
88-75-5	2-Nitrophenol	COPC	Both
90-04-0	o-Anisidine	COPC	PIC
90-12-0	1-Methylnaphthalene	COPC	PIC
91-20-3	Naphthalene	COPC	Both
91-22-5	Quinoline	COPC	PIC
91-57-6	2-Methylnaphthalene	COPC	PIC
91-58-7	2-Chloronaphthalene	COPC	Feed
91-94-1	3,3'-Dichlorobenzidine	COPC	PIC
924-16-3	N-Nitroso-di-n-Buetylamine	COPC	PIC
92-52-4	1,1`-Biphenyl	COPC	Both
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	COPC	PIC
94-75-7	2,4-D	COPC	PIC
95-48-7	o-Cresol	COPC	Feed
95-49-8	o-Chlorotoluene	COPC	PIC
95-50-1	1,2-Dichlorobenzene	COPC	Feed
95-53-4	o-Toluidine	COPC	PIC
95-57-8	2-Chlorophenol	COPC	Feed
95-63-6	1,2,4-Trimethyl benzene	COPC	PIC
95-94-3	1,2,4,5-Tetrachlorobenzene	COPC	PIC
95-95-4	2,4,5-Trichlorophenol	COPC	Feed
96-12-8	1,2-Dibromo-3-chloropropane	COPC	PIC
96-18-4	1,2,3-Trichloropropane	COPC	PIC
96-45-7	Ethylene thiourea	COPC	PIC
97-63-2	Ethyl methacrylate	COPC	PIC
98-01-1	Furfural	COPC	PIC
98-06-6	tert-Butyl benzene	COPC	PIC
98-07-7	Benzotrichloride	COPC	PIC
98-82-8	Cumene	COPC	Feed
98-83-9	Methyl styrene (mixed isomers)	COPC	PIC
98-86-2	Acetophenone	COPC	Both
98-95-3	Nitrobenzene	COPC	Both
99-35-4	1,3,5-Trinitrobenzene	COPC	PIC
99-65-0	1,3-Dinitrobenzene	COPC	PIC

Table 1-1 List of Organic Constituents in Emissions Estimate

CASRN or Chemical Formula	Organic Constituent	Designation	Categorization
99-87-6	p-Cymene	COPC	PIC
71-47-6	Formate	Non-COPC	Feed
71-50-1	Acetate	Non-COPC	Feed
$C_2H_3O_3^-$	Glycolate	Non-COPC	Feed

1.2.2.2 Inorganic Constituents

The 58 (based on 54 original plus 4 new) inorganic constituents of potential concern are identified in Table 1-2, which also includes their CASRN, designation (COPC or non-COPC), and categorization (feed constituents, reaction by-products, or both).

Table 1-2 List of Inorganic Constituents in Emissions Estimate

CASRN or Chemical Formula	Inorganic Constituent	Designation	Categorization
10028-15-6	Ozone	COPC	Not tracked in model
10102-44-0	Nitrogen dioxide	COPC	Reaction by-product
124-38-9	Carbon dioxide	COPC	Reaction by-product
14265-44-2	Phosphate	COPC	Feed
14797-55-8	Nitrate	COPC	Feed
14797-65-0	Nitrite	COPC	Feed
14808-79-8	Sulfate	COPC	Feed
16887-00-6	Chloride	COPC	Feed
16984-48-8	Fluoride	COPC	Feed
22967-92-6	Methylmercury	COPC	Not tracked in model
24959-67-9	Bromide	COPC	Not tracked in model
57-12-5	Cyanide	COPC	Feed
593-74-8	Dimethylmercury	COPC	Both
630-08-0	Carbon monoxide	COPC	Reaction by-product
7429-90-5	Aluminum	COPC	Feed
7439-89-6	Iron	COPC	Feed
7439-92-1	Lead	COPC	Feed
7439-93-2	Lithium	COPC	Feed
7439-95-4	Magnesium	COPC	Feed
7439-96-5	Manganese	COPC	Feed
7439-97-6	Mercury	COPC	Feed
7439-98-7	Molybdenum	COPC	Feed
7440-02-0	Nickel	COPC	Feed
7440-16-6	Rhodium	COPC	Feed
7440-22-4	Silver	COPC	Feed
7440-23-5	Sodium	COPC	Feed
7440-24-6	Strontium (total)	COPC	Feed
7440-25-7	Tantalum	COPC	Feed

Table 1-2 List of Inorganic Constituents in Emissions Estimate

CASRN or Chemical Formula	Inorganic Constituent	Designation	Categorization
7440-28-0	Thallium	COPC	Feed
7440-31-5	Tin	COPC	Feed
7440-33-7	Tungsten	COPC	Feed
7440-36-0	Antimony	COPC	Feed
7440-38-2	Arsenic	COPC	Feed
7440-39-3	Barium	COPC	Feed
7440-41-7	Beryllium	COPC	Feed
7440-43-9	Cadmium	COPC	Feed
7440-47-3	Chromium	COPC	Feed
7440-48-4	Cobalt	COPC	Feed
7440-50-8	Copper	COPC	Feed
7440-61-1	Uranium	COPC	Feed
7440-62-2	Vanadium	COPC	Feed
7440-65-5	Yttrium	COPC	Feed
7440-66-6	Zinc	COPC	Feed
7440-67-7	Zirconium	COPC	Feed
7446-09-5	Sulfur dioxide	COPC	Reaction by-product
7647-01-0	Hydrogen chloride	COPC	Reaction by-product
7664-39-3	Hydrogen fluoride	COPC	Reaction by-product
7664-41-7	Ammonia/Ammonium	COPC	Reaction by-product
7704-34-9	Total sulfur (thermodynamically stable)	COPC	Feed
7723-14-0	Phosphorus	COPC	Feed
7782-41-4	Fluorine gas F2	COPC	Reaction by-product
7782-49-2	Selenium	COPC	Feed
7782-50-5	Chlorine	COPC	Neither
PM	Particulate matter	COPC	Both
NO_x	Nitrogen oxides	COPC	Reaction by-product
SO_x	Sulfur oxides	COPC	Reaction by-product
N/A	Criteria pollutants	COPC	Both
N/A	Greenhouse gases	COPC	Both

1.2.2.3 Radionuclide Constituents

The 46 radionuclide constituents that will be used for input to the WTP DWP environmental risk assessment are identified in Table 1-3, which also includes their CASRN and designation (COPC or non-COPC).

Table 1-3 List of Radionuclide Constituents in Emissions Estimate

CASRN	Radionuclide Constituent	Designation
10028-17-8	Tritium	COPC
10045-97-3	Cesium-137	COPC
10098-91-6	Yttrium-90	COPC
10098-97-2	Strontium-90	COPC
10198-40-0	Cobalt-60	COPC
13966-29-5	Uranium-234	COPC
13967-48-1	Ruthenium-106	COPC
13967-70-9	Cesium-134	COPC
13968-55-3	Uranium-233	COPC
13981-15-2	Curium-244	COPC
13981-16-3	Plutonium-238	COPC
13981-37-8	Nickel-63	COPC
13982-10-0	Plutonium-242	COPC
13982-63-3	Radium-226	COPC
13982-70-2	Uranium-236	COPC
13994-20-2	Neptunium-237	COPC
14119-32-5	Plutonium-241	COPC
14119-33-6	Plutonium-240	COPC
14133-76-7	Technetium-99	COPC
14158-29-3	Uranium-232	COPC
14234-35-6	Antimony-125	COPC
14331-85-2	Protactinium-231	COPC
14336-70-0	Nickel-59	COPC
14391-16-3	Europium-155	COPC
14596-10-2	Americium-241	COPC
14683-23-9	Europium-152	COPC
14762-75-5	Carbon-14	COPC
14952-40-0	Actinium-227	COPC
14993-75-0	Americium-243	COPC
15046-84-1	Iodine-129/Iodine-129 (s)	COPC
15117-48-3	Plutonium-239	COPC
15117-96-1	Uranium-235	COPC

Table 1-3 List of Radionuclide Constituents in Emissions Estimate

CASRN	Radionuclide Constituent	Designation
15262-20-1	Radium-228	COPC
15510-73-3	Curium-242	COPC
15585-10-1	Europium-154	COPC
15594-54-4	Thorium-229	COPC
15715-94-3	Samarium-151	COPC
15751-77-6	Zirconium-93	COPC
15757-87-6	Curium-243	COPC
15758-45-9	Selenium-79	COPC
15832-50-5	Tin-126	COPC
378253-40-8	Barium-137m	COPC
378253-44-2	Cadmium-113m	COPC
378782-82-2	Niobium-93m	COPC
7440-29-1	Thorium-232	COPC
7440-61-1R	Uranium-238	COPC

1.2.3 Selection of Streams

A subset of the streams modeled in Process Emissions model, 11 of the 227 streams for the DFLAW configuration and 31 of the 613 streams for the integrated WTP configuration, is selected for reporting. These waste streams were selected from the critical systems list in Appendix 2 of the DWP (WA7890008967) since they were considered to represent or bound the concentration of waste, recycles, or emissions, or were considered to represent before and after the major process streams of interest (e.g., raw feed and melter feed, unabated and abated emissions). Liquid process streams are used for the cell emissions estimate. Consideration of every liquid process stream was not practical given that the cell emissions of those streams could be bounded by simply considering the composition of critical system streams. The DFLAW and integrated WTP steams selected for reporting are listed in Table 1-4, which also includes their corresponding facility, system, description, number of trains[3], and type or use.

Table 1-4 DFLAW and Integrated WTP Streams Selected for Reporting

Facility	System	Stream	Description	No. of Trains	Type/Use
DFLAW Streams					
LAW Facility	LCP	LCP07	Treated low-activity waste from Tank Farms	2	Feed vector; cell emissions
LAW Facility	LCP	LCP01	Treated low-activity waste with recycles	2	Cell emissions
LAW Facility	LFP	LFP04	LAW melter feed	2	Cell emissions
LAW Facility	RLD	RLD21	RLD effluent to recycle or EMF (from offgas controls)	1	Cell emissions
LAW Facility	LMP	LMP06	LAW melter exhaust	2	Unabated emissions
LAW Facility	LVP	LVP01	Vessel vent emissions	1	Unabated emissions (not included in LMP06)
LAW Facility	LVP	LVP18a	LAW Facility exhaust	1	Abated emissions
EMF	DEP	DEP13	Concentrate recycle	1	Cell emissions
EMF	DEP	DEP20	Condensate to LERF/ETF	1	Cell emissions
EMF	DEP	DEP15	Vessel vent emissions	1	Unabated vessel emissions
EMF	DEP	DEP18	EMF exhaust	1	Abated vessel emissions
Integrated WTP Streams					
PT Facility	CNP	CNP12	Concentrated elute to HCP (HLW Facility)	1	Cell emissions
PT Facility	CXP	CXP23	Ion exchange effluent (low-activity waste) to TLP evaporator	1	Cell emissions
PT Facility	FRP	FRP01	LAW feed from tank farms	1	Feed vector; cell emissions

[3] Process Emissions model (where only one LAW melter train is modeled) results for one train also represent a second train for streams LCP07_1, LCP01, LFP04, LMP06, and TCP03f_1. The mass flowrate of each constituent in the stream is doubled to report the total mass flowrate to both LAW melters for streams LCP07, LCP01, LFP04, LMP06, and TCP03f.

Table 1-4 DFLAW and Integrated WTP Streams Selected for Reporting

Facility	System	Stream	Description	No. of Trains	Type/Use
PT Facility	FRP	FRP14	HLW feed from tank farms	1	Feed vector; cell emissions
PT Facility	FEP	FEP03	FEP concentrate to HLP/UFP	1	Cell emissions
PT Facility	HLP	HLP12	HLW feed with LAW blend	1	Cell emissions
PT Facility	PWD	PWD01	UFP/CXP flush water (recycle)	1	Cell emissions
PT Facility	RDP	RDP01	RDP recycle	1	Cell emissions
PT Facility	RLD	RLD01	RLD tank to LERF/ETF	1	Cell emissions
PT Facility	TCP	TCP03f	TCP concentrate from TLP to LCP (LAW Facility)	2	Cell emissions
PT Facility	TLP	TLP02	TLP concentrate from CXP to TCP	1	Cell emissions
PT Facility	UFP	UFP33	UFP effluent to CXP (after filtration)	1	Cell emissions
PT Facility	PJV	PJV04	PJV vent header	1	Unabated vent emissions
PT Facility	PJV	PJV12	PJV treated exhaust	1	Abated vent emissions
PT Facility	PVP	PVP01	PVP vent header	1	Unabated vent emissions
PT Facility	PVP	PVP13	PVP treated exhaust	1	Abated vent emissions
LAW Facility	TCP	TCP03f	Treated low-activity waste from PT Facility	2	Cell emissions
LAW Facility	LCP	LCP01	Treated low-activity waste	2	Cell emissions
LAW Facility	LFP	LFP04	LAW melter feed	2	Cell emissions
LAW Facility	RLD	RLD21	RLD effluent to recycle or EMF (from offgas controls)	1	Cell emissions
LAW Facility	LMP	LMP06	LAW melter exhaust	2	Unabated emissions
LAW Facility	LVP	LVP01	Vessel vent emissions	1	Unabated emissions (not included in LMP06)
LAW Facility	LVP	LVP18a	LAW Facility exhaust	1	Abated emissions
HLW Facility	HCP	HCP01	High-level waste from PT Facility to HLW Facility (same as HLP09)	2	Cell emissions
HLW Facility	HFP	HFP03	HLW melter feed	2	Cell emissions
HLW Facility	RLD	RLD62	RDP recycle to PWD (from offgas controls)	1	Cell emissions
HLW Facility	PJV	PJV32	PJV vent header	1	Unabated vent emissions
HLW Facility	PJV	PJV35	PJV treated exhaust	1	Abated vent emissions
HLW Facility	HLP	HLP09a	High-level waste from PT Facility to HLW Facility (same as HCP01)	1	Cell emissions
HLW Facility	HMP	HMP06	HLW melter exhaust	2	Unabated emissions
HLW Facility	HOP	HOP31	HLW Facility exhaust	2	Abated emissions

Notes:
CNP = cesium nitric acid recovery process system
CXP = cesium ion exchange process system
DEP = DFLAW EMF process system

FRP = waste feed receipt process system
HCP = HLW concentrate receipt process system
HFP = HLW melter feed process system
HLP = HLW lag storage and feed blending process system
HMP = HLW melter process system
HOP = HLW melter offgas treatment process system
LCP = LAW concentrate receipt process system
LERF = Liquid Effluent Retention Facility
LFP = LAW melter feed process system
LMP = LAW melter process system
LVP = LAW secondary offgas/vessel vent process system
PJV = pulse jet ventilation system
PVP = pretreatment vessel vent process system
PWD = plant wash and disposal system
RDP = spent resin collection and dewatering process system
TCP = treated LAW concentrate storage process system
TLP = treated LAW evaporation process system
UFP = ultrafiltration process system

2 Summary of Emissions Estimate Results

The emissions estimate results for the DFLAW and integrated WTP configurations are provided in Table 8-1 through Table 8-27 of the supporting engineering calculation, 24590-WTP-M4C-V20T-00001.

COPC concentrations in the DFLAW and Integrated WTP feeds are provided in Table 2-1, Table 2-2 and Table 2-3. COPC emissions rates in the abated streams are summarized in Table 2-5, Table 2-6 and Table 2-7 of this engineering study.

Table 2-4 of this engineering study provides a summary of total emissions rates (for organic, selected inorganic and radionuclide constituents) for feed streams and abated stacks (both DFLAW and Integrated WTP configurations).

Emission rates for each stream shown in Table 2-4 is categorized as described below:

- Feed portion of organic COPCs (non-PICs): vapor phase, particle-bound phase, aqueous phase, solid phase, and subtotal (g/sec).
- PIC portion of organic COPCs: vapor phase, particle-bound phase, aqueous phase, solid phase, and subtotal (g/sec).
- Non-COPC organics: vapor phase, particle-bound phase, aqueous phase, solid phase, and subtotal (g/sec).
- Total organics (g/sec): sum of organic COPC and non-COPC emission rates.
- Inorganics COPCs: elemental mercury, mercuric ion (Hg^{2+}), dimethylmercury (DMHg), nitrogen oxides (NO_x), sulfur oxides (SO_x), greenhouse gases, and criteria pollutants (g/sec), and particulate matter (tons/yr). Refer to Section 7.7 of 24590-WTP-M4C-V20T-00001 for details.
- Radionuclide COPCs: aqueous phase, solid phase, and total (Ci/sec).

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Table 2-1 Organic Constituent Feed Concentrations in DFLAW and Integrated WTP Configurations

CASRN or Chemical Formula	Organic	DFLAW Feed Concentration		Integrated WTP Feed Concentration			
		LAW Liquid (mg/L)	LAW Sol (mg/kg)	LAW Liquid (mg/L)	HLW Liquid (mg/L)	LAW Sol (mg/kg)	HLW Sol (mg/kg)
	COPC						
100-02-7	p-Nitrophenol	7.35E+00	7.86E+01	1.05E+01	5.47E+00	0.00E+00	6.10E+01
100-21-0	Phthalic acid	2.80E+00	3.00E+01	3.99E+00	2.09E+00	0.00E+00	2.33E+01
100-25-4	1,4-Dinitrobenzene	5.57E-03	5.95E-02	7.92E-03	4.15E-03	0.00E+00	4.62E-02
100-40-3	4-Ethenylcyclohexene	1.83E+00	1.95E+01	2.60E+00	1.36E+00	0.00E+00	1.52E+01
100-41-4	Ethyl benzene	4.98E-05	5.33E-04	7.09E-05	3.71E-05	0.00E+00	4.14E-04
100-42-5	Styrene	2.39E-05	2.55E-04	3.40E-05	1.78E-05	0.00E+00	1.98E-04
10061-01-5	cis-1,3-Dichloropropene	8.81E-05	9.42E-04	1.25E-04	6.57E-05	0.00E+00	7.31E-04
10061-02-6	trans-1,3-Dichloropropene	9.20E-05	9.84E-04	1.31E-04	6.86E-05	0.00E+00	7.64E-04
101-55-3	4-Bromophenylphenyl ether	2.80E+00	3.00E+01	3.99E+00	2.09E+00	0.00E+00	2.33E+01
104-76-7	2-Ethyl-1-hexanol	2.20E+00	2.35E+01	3.13E+00	1.64E+00	0.00E+00	1.82E+01
10595-95-6	n-Nitrosomethylethylamine	3.97E+00	4.24E+01	5.65E+00	2.96E+00	0.00E+00	3.29E+01
106-42-3	Xylene (m & p)	Included in 1330-20-7					
106-46-7	1,4-Dichlorobenzene	1.51E-02	1.62E-01	2.15E-02	1.13E-02	0.00E+00	1.25E-01
106-88-7	1,2-Epoxybutane	2.43E+00	2.60E+01	3.46E+00	1.81E+00	0.00E+00	2.02E+01
106-93-4	Ethylene dibromide	2.39E-05	2.55E-04	3.40E-05	1.78E-05	0.00E+00	1.98E-04
106-99-0	1,3-Butadiene	8.01E-04	8.57E-03	1.14E-03	5.97E-04	0.00E+00	6.65E-03
107-02-8	Acrolein	1.29E-03	1.38E-02	1.84E-03	9.65E-04	0.00E+00	1.07E-02
107-05-1	3-Chloropropene	8.81E-05	9.42E-04	1.25E-04	6.57E-05	0.00E+00	7.31E-04
107-06-2	1,2-Dichloroethane	2.79E-05	2.99E-04	3.97E-05	2.08E-05	0.00E+00	2.32E-04
107-12-0	Propionitrile	8.08E-03	8.64E-02	1.15E-02	6.02E-03	0.00E+00	6.71E-02
107-13-1	Acrylonitrile	8.81E-04	9.42E-03	1.25E-03	6.57E-04	0.00E+00	7.31E-03
108-05-4	Acetic acid vinyl ester	2.91E+00	3.11E+01	4.14E+00	2.17E+00	0.00E+00	2.41E+01
108-10-1	4-Methyl-2-pentanone	3.11E-04	3.33E-03	4.43E-04	2.32E-04	0.00E+00	2.58E-03
108-39-4	m-Cresol	6.41E+00	6.85E+01	9.12E+00	4.77E+00	0.00E+00	5.32E+01
108-87-2	Methylcyclohexane	1.01E-04	1.08E-03	1.44E-04	7.56E-05	0.00E+00	8.42E-04
108-88-3	Toluene	1.24E-04	1.33E-03	1.77E-04	9.27E-05	0.00E+00	1.03E-03
108-90-7	Chlorobenzene	2.87E-05	3.07E-04	4.09E-05	2.14E-05	0.00E+00	2.38E-04
108-94-1	Cyclohexanone	8.61E-02	9.21E-01	1.23E-01	6.42E-02	0.00E+00	7.15E-01
108-95-2	Phenol	2.00E-02	2.14E-01	2.84E-02	1.49E-02	0.00E+00	1.66E-01
109-74-0	n-Butanenitrile	2.33E+00	2.50E+01	3.32E+00	1.74E+00	0.00E+00	1.94E+01
109-99-9	Tetrahydrofuran	9.59E-04	1.03E-02	1.37E-03	7.15E-04	0.00E+00	7.96E-03
110-54-3	n-Hexane	4.65E-03	4.97E-02	6.62E-03	3.46E-03	0.00E+00	3.86E-02
110-59-8	Pentanenitrile	2.25E+00	2.40E+01	3.20E+00	1.67E+00	0.00E+00	1.86E+01
110-80-5	2-Ethoxyethanol	1.69E+01	1.80E+02	2.40E+01	1.26E+01	0.00E+00	1.40E+02
110-82-7	Cyclohexane	8.81E-05	9.42E-04	1.25E-04	6.57E-05	0.00E+00	7.31E-04
110-83-8	Cyclohexene	8.81E-05	9.42E-04	1.25E-04	6.57E-05	0.00E+00	7.31E-04
110-86-1	Pyridine	2.08E-02	2.22E-01	2.96E-02	1.55E-02	0.00E+00	1.72E-01
111-65-9	n-Octane	1.06E-03	1.14E-02	1.51E-03	7.92E-04	0.00E+00	8.82E-03
111-76-2	2-Butoxyethanol	2.66E+00	2.84E+01	3.79E+00	1.98E+00	0.00E+00	2.21E+01
111-84-2	n-Nonane	7.12E-04	7.62E-03	1.01E-03	5.31E-04	0.00E+00	5.91E-03
117-81-7	Bis(2-ethylhexyl) phthalate	2.20E+00	2.35E+01	3.13E+00	1.64E+00	0.00E+00	1.82E+01
117-84-0	Di-n-octylphthalate	9.62E+00	1.03E+02	1.37E+01	7.17E+00	0.00E+00	7.98E+01
118-74-1	Hexachlorobenzene	5.00E-05	5.35E-04	7.12E-05	3.73E-05	0.00E+00	4.15E-04
120-12-7	Anthracene	1.72E+00	1.84E+01	2.45E+00	1.28E+00	0.00E+00	1.43E+01
120-82-1	1,2,4-Trichlorobenzene	1.77E-03	1.89E-02	2.51E-03	1.32E-03	0.00E+00	1.47E-02
120-83-2	2,4-Dichlorophenol	3.67E+00	3.92E+01	5.22E+00	2.73E+00	0.00E+00	3.04E+01
121-14-2	2,4-Dinitrotoluene	8.47E+00	9.06E+01	1.21E+01	6.31E+00	0.00E+00	7.03E+01
123-38-6	Propionaldehyde	2.94E-03	3.14E-02	4.18E-03	2.19E-03	0.00E+00	2.44E-02

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CASRN or Chemical Formula	Organic	DFLAW Feed Concentration		Integrated WTP Feed Concentration			
		LAW Liquid (mg/L)	LAW Sol (mg/kg)	LAW Liquid (mg/L)	HLW Liquid (mg/L)	LAW Sol (mg/kg)	HLW Sol (mg/kg)
	COPC						
122-39-4	N,N-Diphenylamine	2.67E-03	2.86E-02	3.80E-03	1.99E-03	0.00E+00	2.22E-02
123-72-8	Butanal	2.43E+00	2.60E+01	3.46E+00	1.81E+00	0.00E+00	2.02E+01
123-91-1	1,4-Dioxan	8.81E-04	9.42E-03	1.25E-03	6.57E-04	0.00E+00	7.31E-03
126-73-8	Tributyl phosphate	2.51E+00	2.69E+01	3.58E+00	1.87E+00	0.00E+00	2.09E+01
126-98-7	2-Methyl-2-propenenitrile	8.81E-04	9.42E-03	1.25E-03	6.57E-04	0.00E+00	7.31E-03
127-18-4	1,1,2,2-Tetrachloroethene	2.90E-05	3.11E-04	4.13E-05	2.16E-05	0.00E+00	2.41E-04
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	4.22E-02	4.51E-01	6.00E-02	3.14E-02	0.00E+00	3.50E-01
129-00-0	Pyrene	8.34E+00	8.92E+01	1.19E+01	6.22E+00	0.00E+00	6.92E+01
1330-20-7	Xylenes (total)	8.51E-03	9.11E-02	1.21E-02	6.34E-03	0.00E+00	7.07E-02
1336-36-3	Polychlorinated biphenyls – Note 1	3.87E+00	4.14E+01	5.51E+00	2.88E+00	0.00E+00	3.63E+00
134-32-7	alpha-Naphthylamine	1.93E+00	2.07E+01	2.75E+00	1.44E+00	0.00E+00	1.60E+01
141-78-6	Acetic acid ethyl ester	9.41E-05	1.01E-03	1.34E-04	7.01E-05	0.00E+00	7.81E-04
156-60-5	1,2-trans-Dichloroethene	6.55E+00	7.00E+01	9.32E+00	4.88E+00	0.00E+00	5.43E+01
1634-04-4	Methyl tert-butyl ether	2.38E+00	2.55E+01	3.39E+00	1.77E+00	0.00E+00	1.98E+01
189-55-9	Dibenzo[a,i]pyrene	1.70E+00	1.82E+01	2.42E+00	1.27E+00	0.00E+00	1.41E+01
189-64-0	Dibenzo[a,h]pyrene	1.70E+00	1.82E+01	2.42E+00	1.27E+00	0.00E+00	1.41E+01
191-24-2	Benzo(g,h,i)perylene	1.70E+00	1.81E+01	2.41E+00	1.26E+00	0.00E+00	1.41E+01
191-30-0	Dibenzo(a,l)pyrene	1.70E+00	1.82E+01	2.42E+00	1.27E+00	0.00E+00	1.41E+01
192-65-4	Dibenzo[a,e]pyrene	1.70E+00	1.82E+01	2.42E+00	1.27E+00	0.00E+00	1.41E+01
193-39-5	Indeno(1,2,3-cd)pyrene	1.70E+00	1.81E+01	2.41E+00	1.26E+00	0.00E+00	1.41E+01
206-44-0	Fluoranthene	8.37E+00	8.95E+01	1.19E+01	6.24E+00	0.00E+00	6.95E+01
208-96-8	Acenaphthylene	1.71E+00	1.83E+01	2.44E+00	1.28E+00	0.00E+00	1.42E+01
224-42-0	Dibenz[a,j]acridine	1.80E+00	1.92E+01	2.56E+00	1.34E+00	0.00E+00	1.49E+01
226-36-8	Dibenz[a,h]acridine	1.80E+00	1.92E+01	2.56E+00	1.34E+00	0.00E+00	1.49E+01
27154-33-2	Trichlorofluoroethane	1.02E+01	1.09E+02	1.45E+01	7.62E+00	0.00E+00	8.48E+01
319-84-6	alpha-BHC	9.86E-05	1.05E-03	1.40E-04	7.35E-05	0.00E+00	8.18E-04
319-85-7	beta-BHC	1.34E-04	1.43E-03	1.91E-04	9.98E-05	0.00E+00	1.11E-03
3697-24-3	5-Methylchrysene	1.72E+00	1.84E+01	2.45E+00	1.28E+00	0.00E+00	1.43E+01
4170-30-3	Crotonaldehyde (Propylene aldehyde)	1.20E-03	1.29E-02	1.71E-03	8.97E-04	0.00E+00	9.98E-03
50-00-0	Formaldehyde	4.05E+00	4.34E+01	5.77E+00	3.02E+00	0.00E+00	3.37E+01
50-32-8	Benzo(a)pyrene	3.49E-03	3.73E-02	4.96E-03	2.60E-03	0.00E+00	2.89E-02
53-70-3	Dibenz[a,h]anthracene	4.01E-03	4.29E-02	5.71E-03	2.99E-03	0.00E+00	3.33E-02
541-73-1	1,3-Dichlorobenzene	1.16E-03	1.24E-02	1.65E-03	8.63E-04	0.00E+00	9.61E-03
56-23-5	Carbon tetrachloride	4.56E-05	4.87E-04	6.48E-05	3.40E-05	0.00E+00	3.78E-04
56-49-5	3-Methylcholanthrene	1.73E+00	1.85E+01	2.46E+00	1.29E+00	0.00E+00	1.43E+01
58-89-9	gamma-BHC (Lindane)	1.33E-04	1.43E-03	1.90E-04	9.94E-05	0.00E+00	1.11E-03
58-90-2	2,3,4,6-Tetrachlorophenol	5.22E+00	5.58E+01	7.43E+00	3.89E+00	0.00E+00	4.33E+01
589-38-8	3-Hexanone	2.25E+00	2.41E+01	3.21E+00	1.68E+00	0.00E+00	1.87E+01
591-78-6	2-Hexanone	3.81E-03	4.07E-02	5.42E-03	2.84E-03	0.00E+00	3.16E-02
59-50-7	4-Chloro-3-methylphenol	7.74E+00	8.27E+01	1.10E+01	5.77E+00	0.00E+00	6.42E+01
59-89-2	N-Nitrosomorpholine	1.71E+01	1.83E+02	2.43E+01	1.27E+01	0.00E+00	1.42E+02
602-87-9	5-Nitroacenaphthene	2.24E+00	2.40E+01	3.19E+00	1.67E+00	0.00E+00	1.86E+01
60-29-7	Ethyl ether	3.31E-03	3.54E-02	4.71E-03	2.47E-03	0.00E+00	2.75E-02
60-35-5	Acetamide	3.99E+00	4.27E+01	5.68E+00	2.97E+00	0.00E+00	3.31E+01
621-64-7	N-Nitroso-di-n-propylamine	7.50E+00	8.02E+01	1.07E+01	5.59E+00	0.00E+00	6.22E+01
62-75-9	N-Nitroso-N,N-dimethylamine	3.97E-02	4.25E-01	5.66E-02	2.96E-02	0.00E+00	3.30E-01
628-73-9	Hexanenitrile	2.19E+00	2.34E+01	3.11E+00	1.63E+00	0.00E+00	1.81E+01
630-20-6	1,1,1,2-Tetrachloroethane	1.13E+01	1.21E+02	1.61E+01	8.45E+00	0.00E+00	9.41E+01
67-56-1	Methyl alcohol	4.33E+00	4.63E+01	6.16E+00	3.22E+00	0.00E+00	3.59E+01

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CASRN or Chemical Formula	Organic	DFLAW Feed Concentration		Integrated WTP Feed Concentration			
		LAW Liquid (mg/L)	LAW Sol (mg/kg)	LAW Liquid (mg/L)	HLW Liquid (mg/L)	LAW Sol (mg/kg)	HLW Sol (mg/kg)
	COPC						
67-63-0	2-Propyl alcohol	2.46E-03	2.63E-02	3.50E-03	1.83E-03	0.00E+00	2.04E-02
67-64-1	2-Propanone (acetone)	4.18E-02	4.47E-01	5.95E-02	3.11E-02	0.00E+00	3.47E-01
67-66-3	Chloroform	2.98E-05	3.19E-04	4.25E-05	2.22E-05	0.00E+00	2.48E-04
67-72-1	Hexachloroethane	3.52E-01	3.77E+00	5.01E-01	2.63E-01	0.00E+00	2.92E+00
71-36-3	n-Butyl alcohol	7.12E-02	7.61E-01	1.01E-01	5.30E-02	0.00E+00	5.91E-01
71-43-2	Benzene	7.54E-05	8.06E-04	1.07E-04	5.62E-05	0.00E+00	6.25E-04
71-55-6	1,1,1-Trichloroethane	2.95E-05	3.16E-04	4.20E-05	2.20E-05	0.00E+00	2.45E-04
72-55-9	4,4-DDE	3.07E+00	3.28E+01	4.37E+00	2.29E+00	0.00E+00	2.55E+01
74-83-9	Bromomethane	5.96E-05	6.37E-04	8.48E-05	4.44E-05	0.00E+00	4.94E-04
74-87-3	Chloromethane	1.19E-04	1.27E-03	1.69E-04	8.84E-05	0.00E+00	9.85E-04
75-00-3	Chloroethane	5.96E-05	6.37E-04	8.48E-05	4.44E-05	0.00E+00	4.94E-04
75-01-4	1-Chloroethene	6.05E-05	6.47E-04	8.60E-05	4.50E-05	0.00E+00	5.02E-04
75-02-5	Fluoroethene (vinyl fluoride)	3.11E+00	3.33E+01	4.43E+00	2.32E+00	0.00E+00	2.58E+01
75-05-8	Acetonitrile	2.17E-02	2.32E-01	3.09E-02	1.62E-02	0.00E+00	1.80E-01
75-07-0	Acetaldehyde	2.97E+00	3.18E+01	4.23E+00	2.22E+00	0.00E+00	2.47E+01
75-09-2	Dichloromethane (methylene chloride)	1.77E-02	1.89E-01	2.51E-02	1.32E-02	0.00E+00	1.47E-01
75-21-8	Ethylene oxide (Oxirane)	5.13E-03	5.49E-02	7.31E-03	3.83E-03	0.00E+00	4.26E-02
75-27-4	Bromodichloromethane	2.21E+01	2.37E+02	3.15E+01	1.65E+01	0.00E+00	1.84E+02
75-34-3	1,1-Dichloroethane	2.39E-05	2.55E-04	3.40E-05	1.78E-05	0.00E+00	1.98E-04
75-35-4	1,1-Dichloroethene	3.75E-05	4.02E-04	5.34E-05	2.80E-05	0.00E+00	3.12E-04
75-45-6	Chlorodifluoromethane	8.81E-05	9.42E-04	1.25E-04	6.57E-05	0.00E+00	7.31E-04
75-50-3	Trimethylamine	2.66E+00	2.85E+01	3.79E+00	1.98E+00	0.00E+00	2.21E+01
75-69-4	Trichlorofluoromethane	7.25E-05	7.76E-04	1.03E-04	5.40E-05	0.00E+00	6.02E-04
75-71-8	Dichlorodifluoromethane	7.38E-05	7.90E-04	1.05E-04	5.50E-05	0.00E+00	6.13E-04
76-13-1	1,2,2-Trichlorotrifluoroethane	7.30E-05	7.81E-04	1.04E-04	5.44E-05	0.00E+00	6.06E-04
76-44-8	Heptachlor	6.86E-05	7.34E-04	9.76E-05	5.11E-05	0.00E+00	5.69E-04
78-83-1	2-Methylpropyl alcohol	4.14E+01	4.43E+02	5.89E+01	3.08E+01	0.00E+00	3.44E+02
78-87-5	1,2-Dichloropropane	2.39E-05	2.55E-04	3.40E-05	1.78E-05	0.00E+00	1.98E-04
78-93-3	2-Butanone	9.55E-03	1.02E-01	1.36E-02	7.11E-03	0.00E+00	7.92E-02
79-00-5	1,1,2-Trichloroethane	2.80E-05	2.99E-04	3.98E-05	2.08E-05	0.00E+00	2.32E-04
79-01-6	1,1,2-Trichloroethylene	3.18E-05	3.40E-04	4.52E-05	2.37E-05	0.00E+00	2.64E-04
79-10-7	2-Propenoic acid	6.22E+00	6.65E+01	8.85E+00	4.63E+00	0.00E+00	5.16E+01
79-34-5	1,1,2,2-Tetrachloroethane	2.80E-05	2.99E-04	3.98E-05	2.09E-05	0.00E+00	2.32E-04
79-46-9	2-Nitropropane	5.89E-03	6.30E-02	8.39E-03	4.39E-03	0.00E+00	4.89E-02
82-68-8	Pentachloronitrobenzene (PCNB)	5.57E-03	5.95E-02	7.92E-03	4.15E-03	0.00E+00	4.62E-02
83-32-9	Acenaphthene	8.44E+00	9.03E+01	1.20E+01	6.29E+00	0.00E+00	7.01E+01
84-66-2	Diethyl phthalate	2.50E+00	2.67E+01	3.56E+00	1.86E+00	0.00E+00	2.08E+01
84-74-2	Di-n-butylphthalate	5.11E+01	5.46E+02	7.27E+01	3.81E+01	0.00E+00	4.24E+02
85-01-8	Phenanthrene	1.72E+00	1.84E+01	2.45E+00	1.28E+00	0.00E+00	1.43E+01
85-68-7	Butylbenzylphthalate	1.64E+01	1.76E+02	2.34E+01	1.22E+01	0.00E+00	1.36E+02
86-73-7	Fluorene	1.73E+00	1.85E+01	2.46E+00	1.29E+00	0.00E+00	1.43E+01
87-68-3	Hexachlorobutadiene	1.51E-02	1.62E-01	2.15E-02	1.13E-02	0.00E+00	1.26E-01
87-86-5	Pentachlorophenol	1.46E-02	1.56E-01	2.07E-02	1.09E-02	0.00E+00	1.21E-01
88-06-2	2,4,6-Trichlorophenol	7.44E+00	7.95E+01	1.06E+01	5.54E+00	0.00E+00	6.17E+01
88-75-5	2-Nitrophenol	7.52E+00	8.05E+01	1.07E+01	5.61E+00	0.00E+00	6.24E+01
91-20-3	Naphthalene	7.90E+00	8.44E+01	1.12E+01	5.88E+00	0.00E+00	6.55E+01
91-58-7	2-Chloronaphthalene	2.20E+00	2.35E+01	3.13E+00	1.64E+00	0.00E+00	1.82E+01
92-52-4	1,1`-Biphenyl	5.57E-03	5.95E-02	7.92E-03	4.15E-03	0.00E+00	4.62E-02
95-47-6	Xylene (o)	Included in 1330-20-7					

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CASRN or Chemical Formula	Organic	DFLAW Feed Concentration		Integrated WTP Feed Concentration			
		LAW Liquid (mg/L)	LAW Sol (mg/kg)	LAW Liquid (mg/L)	HLW Liquid (mg/L)	LAW Sol (mg/kg)	HLW Sol (mg/kg)
	COPC						
95-48-7	o-Cresol	8.89E+00	9.51E+01	1.27E+01	6.63E+00	0.00E+00	7.38E+01
95-50-1	1,2-Dichlorobenzene	2.30E-02	2.46E-01	3.28E-02	1.72E-02	0.00E+00	1.91E-01
95-57-8	2-Chlorophenol	8.00E+00	8.56E+01	1.14E+01	5.96E+00	0.00E+00	6.64E+01
95-95-4	2,4,5-Trichlorophenol	7.26E+00	7.77E+01	1.03E+01	5.41E+00	0.00E+00	6.03E+01
98-82-8	Cumene	1.80E+00	1.93E+01	2.57E+00	1.34E+00	0.00E+00	1.50E+01
98-86-2	Acetophenone	5.57E-03	5.95E-02	7.92E-03	4.15E-03	0.00E+00	4.62E-02
98-95-3	Nitrobenzene	1.95E-02	2.08E-01	2.77E-02	1.45E-02	0.00E+00	1.61E-01
	Non-COPC						
71-47-6	Formate	1.29E+03	1.38E+04	1.83E+03	9.59E+02	0.00E+00	1.07E+04
71-50-1	Acetate	4.11E+02	4.40E+03	5.85E+02	3.06E+02	0.00E+00	3.41E+03
$C_2H_3O_3^-$	Glycolate	6.87E+02	7.35E+03	9.78E+02	5.12E+02	0.00E+00	5.70E+03

Notes:
Note 1 – DFLAW feed vector concentration for the refined feed vector is 6.52E-02 mg/L and 00E+00 mg/Kg for DFLAW liquid and DFLAW solids.
Integrated WTP feed vector concentration for the refined feed vector is 6.52E-02 mg/L and 1.34E+00 mg/L for LAW and HLW liquids, respectively.
Integrated WTP feed vector concentration for the refined feed vector is 0.00E+00 mg/Kg and 8.00E+00 mg/kg for LAW and HLW solids, respectively.
Refer to Section 6.1.11 and Attachment D of 24590-WTP-M4C-V20T-00001, *Air Emissions Estimate for DFLAW and Integrated WTP Configurations* for details.

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Table 2-2 Inorganic Constituent Feed Concentrations in the DFLAW and Integrated WTP Configurations

CASRN or Chemical Formula	Inorganic	DFLAW Feed Concentration		Integrated WTP Feed Concentration			
		LAW Liq (mg/L)	LAW Sol (mg/kg)	LAW Liq (mg/L)	HLW Liq (mg/L)	LAW Sol (mg/kg)	HLW Sol (mg/kg)
	COPC						
14265-44-2	Phosphate	5.62E+03	2.00E+05	1.42E+04	1.18E+04	0.00E+00	5.12E+04
14797-55-8	Nitrate	1.80E+05	0.00E+00	2.06E+05	1.58E+05	0.00E+00	1.92E+04
14797-65-0	Nitrite	8.50E+04	0.00E+00	5.45E+04	4.25E+04	0.00E+00	2.03E+03
14808-79-8	Sulfate	5.00E+03	0.00E+00	7.88E+03	7.06E+03	0.00E+00	5.36E+03
16887-00-6	Chloride	3.43E+03	0.00E+00	2.93E+03	2.34E+03	0.00E+00	1.52E+00
16984-48-8	Fluoride	5.00E+02	3.02E+04	2.52E+03	4.47E+03	0.00E+00	9.87E+03
57-12-5	Cyanide	2.29E+00	0.00E+00	4.30E-01	5.34E-01	0.00E+00	3.76E+01
593-74-8	Dimethylmercury	1.00E-06	0.00E+00	1.00E-06	1.00E-06	0.00E+00	0.00E+00
7429-90-5	Aluminum	5.51E+03	6.03E+00	9.72E+03	7.86E+03	0.00E+00	1.97E+05
7439-89-6	Iron (2+)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7439-89-6	Iron (3+)	4.37E+01	4.44E+01	5.68E+01	8.63E+01	0.00E+00	4.91E+04
7439-92-1	Lead	1.85E+02	0.00E+00	3.21E+01	2.37E+01	0.00E+00	3.06E+03
7439-93-2	Lithium	7.99E+00	0.00E+00	1.52E+00	4.00E-01	0.00E+00	6.71E+01
7439-95-4	Magnesium	0.00E+00	3.48E-01	5.51E+00	3.36E+00	0.00E+00	8.62E+02
7439-96-5	Manganese	0.00E+00	1.27E-01	7.28E+00	5.99E+00	0.00E+00	7.30E+03
7439-97-6	Mercury	2.38E+00	0.00E+00	9.75E-01	2.12E+00	0.00E+00	4.40E+01
7439-98-7	Molybdenum	2.50E+01	0.00E+00	1.87E+01	6.54E+00	0.00E+00	1.39E+02
7440-02-0	Nickel	1.58E+00	4.12E+02	5.07E+01	3.86E+01	0.00E+00	4.22E+03
7440-16-6	Rhodium	0.00E+00	0.00E+00	1.34E+00	7.94E-01	0.00E+00	2.68E+01
7440-22-4	Silver	7.88E-01	3.93E+01	1.80E+00	8.06E-01	0.00E+00	1.45E+02
7440-23-5	Sodium	1.29E+05	4.97E+03	1.51E+05	1.06E+05	0.00E+00	7.35E+04
7440-24-6	Strontium (total)	7.79E-02	1.59E+00	2.63E+01	1.68E+01	0.00E+00	1.81E+03
7440-25-7	Tantalum	1.25E-05	6.42E-05	1.03E+00	5.73E-01	0.00E+00	2.30E+00
7440-28-0	Thallium	0.00E+00	6.96E-01	6.98E+00	5.04E+00	0.00E+00	2.11E+02
7440-33-7	Tungsten	4.49E+01	0.00E+00	2.37E+00	3.73E+00	0.00E+00	1.27E+02
7440-36-0	Antimony	1.52E+01	0.00E+00	5.48E+00	3.98E+00	0.00E+00	9.35E+01
7440-38-2	Arsenic	2.03E+01	0.00E+00	6.44E+00	3.05E+00	0.00E+00	1.43E+02
7440-39-3	Barium	1.03E-02	5.25E+00	1.40E+00	6.62E-01	0.00E+00	3.58E+02
7440-41-7	Beryllium	1.12E+00	0.00E+00	3.18E-01	1.62E-01	0.00E+00	1.70E+01
7440-43-9	Cadmium	4.80E+00	1.06E+02	6.66E+00	2.36E+00	0.00E+00	3.13E+02
7440-47-3	Chromium (3+)	1.75E+02	6.76E-01	1.61E+01	5.92E+01	0.00E+00	1.39E+04
7440-47-3	Chromium (6+)	5.12E+02	0.00E+00	6.33E+02	6.97E+02	0.00E+00	0.00E+00
7440-48-4	Cobalt	0.00E+00	6.96E-02	1.61E+00	8.85E-01	0.00E+00	4.95E+01
7440-50-8	Copper	1.34E+00	0.00E+00	2.75E+00	5.65E-01	0.00E+00	9.99E+01
7440-61-1	Uranium	2.42E+01	4.56E-11	0.00E+00	6.26E+01	0.00E+00	1.69E+04
7440-62-2	Vanadium	1.00E-03	3.53E-02	1.96E+00	8.07E-01	0.00E+00	8.68E+01
7440-65-5	Yttrium	1.03E-01	0.00E+00	6.37E-01	4.07E-01	0.00E+00	1.75E+01
7440-66-6	Zinc	1.44E+01	0.00E+00	2.84E+00	9.33E-01	0.00E+00	2.19E+02
7440-67-7	Zirconium	0.00E+00	0.00E+00	4.39E+00	4.91E+01	0.00E+00	1.73E+04
7664-41-7	Ammonia/Ammonium	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7782-49-2	Selenium	2.40E+01	0.00E+00	1.55E+01	1.67E+01	0.00E+00	9.93E+00

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Table 2-3 Radionuclide Constituent Feed Concentrations in the DFLAW and Integrated WTP Configurations

CASRN	Radionuclide	DFLAW Feed Concentration		Integrated WTP Feed Concentration			
		LAW Liq (pCi/L)	LAW Sol (pCi/g)	LAW Liq (pCi/L)	HLW Liq (pCi/L)	LAW Sol (pCi/g)	HLW Sol (pCi/g)
	COPC						
10028-17-8	Tritium	1.92E+06	0.00E+00	5.51E+05	1.03E+06	0.00E+00	7.40E+00
10045-97-3	Cesium-137	1.43E+07	0.00E+00	4.94E+10	4.09E+10	0.00E+00	4.77E+07
10098-97-2	Strontium-90	4.56E+08	7.87E+06	9.21E+08	1.08E+09	0.00E+00	7.21E+08
10198-40-0	Cobalt-60	0.00E+00	2.70E+01	1.91E+04	2.06E+04	0.00E+00	1.17E+03
13966-29-5	Uranium-234	8.98E+03	1.72E-11	8.61E+03	1.43E+04	0.00E+00	5.23E+03
13967-48-1	Ruthenium-106	1.15E+00	0.00E+00	3.69E-05	7.71E-05	0.00E+00	1.25E-06
13967-70-9	Cesium-134	2.05E+00	0.00E+00	8.50E+01	1.46E+02	0.00E+00	1.88E-02
13968-55-3	Uranium-233	3.06E+04	7.69E-11	5.94E+07	5.88E+07	0.00E+00	4.32E+07
13981-15-2	Curium-244	1.02E+06	0.00E+00	3.05E+04	1.53E+04	0.00E+00	2.25E+03
13981-16-3	Plutonium-238	1.21E+05	5.98E+05	1.23E+05	1.10E+05	0.00E+00	6.48E+04
13981-37-8	Nickel-63	3.45E+06	5.31E+05	4.73E+07	3.02E+07	0.00E+00	2.01E+06
13982-10-0	Plutonium-242	9.91E+01	2.86E+02	1.79E+02	5.54E+01	0.00E+00	1.65E+01
13982-63-3	Radium-226	4.41E+01	0.00E+00	2.26E+01	1.66E+01	0.00E+00	1.46E-01
13982-70-2	Uranium-236	2.98E+02	7.99E-13	2.30E+02	4.77E+02	0.00E+00	1.45E+02
13994-20-2	Neptunium-237	8.75E+04	1.56E-01	6.81E+04	6.26E+04	0.00E+00	4.54E+03
14119-32-5	Plutonium-241	1.69E+06	9.14E+06	2.95E+05	5.78E+05	0.00E+00	2.55E+05
14119-33-6	Plutonium-240	6.21E+05	3.83E+06	3.79E+05	3.37E+05	0.00E+00	2.19E+05
14133-76-7	Technetium-99	1.31E+08	0.00E+00	1.03E+08	8.47E+07	0.00E+00	7.26E+04
14158-29-3	Uranium-232	5.67E+02	1.81E-12	5.07E+02	5.77E+02	0.00E+00	2.22E+02
14234-35-6	Antimony-125	3.76E+05	0.00E+00	1.90E+03	2.98E+03	0.00E+00	2.87E+01
14331-85-2	Protactinium-231	0.00E+00	1.52E-01	1.03E+04	4.57E+03	0.00E+00	1.27E+02
14336-70-0	Nickel-59	4.58E+04	7.01E+03	8.47E+05	4.64E+05	0.00E+00	3.14E+04
14391-16-3	Europium-155	0.00E+00	1.28E+02	1.92E+04	3.14E+04	0.00E+00	7.49E+03
14596-10-2	Americium-241	1.59E+07	1.06E+02	9.47E+06	1.98E+07	0.00E+00	6.35E+06
14683-23-9	Europium-152	0.00E+00	5.77E+01	1.37E+05	1.27E+05	0.00E+00	1.06E+04
14762-75-5	Carbon-14	3.19E+06	0.00E+00	2.02E+06	2.36E+06	0.00E+00	1.16E+03
14952-40-0	Actinium-227	9.14E+03	4.76E-04	7.78E+03	3.07E+03	0.00E+00	1.47E+02
14993-75-0	Americium-243	9.21E+03	5.04E-05	4.70E+03	8.42E+03	0.00E+00	2.73E+03
15046-84-1	Iodine-129	1.24E+05	2.23E-02	1.11E+05	8.59E+04	0.00E+00	9.53E+01
15117-48-3	Plutonium-239	2.67E+06	1.66E+07	1.88E+06	1.58E+06	0.00E+00	1.04E+06
15117-96-1	Uranium-235	3.64E+02	7.54E-13	3.31E+02	5.52E+02	0.00E+00	1.96E+02
15262-20-1	Radium-228	2.70E+03	1.91E-03	5.87E+02	6.59E+02	0.00E+00	2.28E+02
15510-73-3	Curium-242	8.29E+05	0.00E+00	2.86E+04	1.90E+04	0.00E+00	1.99E+03
15585-10-1	Europium-154	0.00E+00	3.40E+02	3.18E+05	5.15E+05	0.00E+00	1.11E+05
15594-54-4	Thorium-229	0.00E+00	7.63E-02	3.71E+02	2.96E+02	0.00E+00	5.45E+01
15715-94-3	Samarium-151	0.00E+00	3.37E+05	7.68E+08	5.37E+08	0.00E+00	5.42E+07
15751-77-6	Zirconium-93	0.00E+00	1.36E+03	4.95E+06	2.90E+06	0.00E+00	4.59E+04
15757-87-6	Curium-243	5.90E+04	0.00E+00	2.55E+03	1.18E+03	0.00E+00	1.75E+02
15758-45-9	Selenium-79	3.08E+06	0.00E+00	2.72E+06	2.25E+06	0.00E+00	8.95E+02
15832-50-5	Tin-126	3.34E+06	0.00E+00	3.87E+06	1.32E+06	0.00E+00	1.76E+04
378253-44-2	Cadmium-113m	5.69E+06	9.03E+04	1.40E+06	1.13E+06	0.00E+00	8.38E+03
378782-82-2	Niobium-93m	0.00E+00	1.22E+03	5.25E+06	3.15E+06	0.00E+00	4.90E+04
7440-29-1	Thorium-232	0.00E+00	1.68E-01	5.17E+02	5.59E+02	0.00E+00	2.27E+02
7440-61-1R	Uranium-238	8.07E+03	1.52E-11	9.86E+03	1.72E+04	0.00E+00	5.65E+03

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Table 2-4 Emissions Summary for DFLAW and Integrated WTP Configurations

Category	Group or Constituent	DFLAW Emissions			Integrated WTP Emissions						
		Feed	LAW Abated	EMF Abated	Feed		PT Abated		LAW Abated	HLW Abated	
		LCP07	LVP18a	DEP18	FRP01	FRP14	PJV12	PVP13	LVP18a	PJV35	HOP31
		DFLAW Feed	LAW Exhaust	EMF Exhaust	LAW Waste	HLW Waste	PJV Exhaust	PT Exhaust	LAW Exhaust	PJV Exhaust	HLW Exhaust
		g/sec	g/sec	g/sec	g/sec	g/sec	g/sec	g/sec	g/sec	g/sec	g/sec
Organic COPCs - Feed	Vapor phase	0.00E+00	1.67E-05	2.02E-03	0.00E+00	0.00E+00	5.38E-02	1.84E-04	7.09E-06	2.55E-03	9.41E-06
	Particle-bound phase	0.00E+00	1.21E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.85E-11	0.00E+00	4.00E-14
	Aqueous phase	1.50E-01	2.49E-14	5.38E-12	8.66E-02	4.97E-02	1.31E-09	3.14E-17	3.09E-14	6.85E-10	5.69E-15
	Solid phase	1.59E-05	4.45E-19	1.53E-17	0.00E+00	6.25E-02	0.00E+00	2.17E-15	0.00E+00	0.00E+00	1.11E-14
	Subtotal	1.50E-01	1.67E-05	2.02E-03	8.66E-02	1.12E-01	5.38E-02	1.84E-04	7.09E-06	2.55E-03	9.41E-06
Organic COPCs - PICs	Vapor phase	0.00E+00	1.20E-01	1.19E-02	0.00E+00	0.00E+00	8.07E-03	3.26E-04	8.98E-02	4.36E-04	6.41E-05
	Particle-bound phase	0.00E+00	2.26E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.72E-04	0.00E+00	2.33E-07
	Aqueous phase	0.00E+00	0.00E+00	6.56E-12	0.00E+00	0.00E+00	2.76E-10	9.13E-18	0.00E+00	5.49E-11	0.00E+00
	Solid phase	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Subtotal	0.00E+00	1.21E-01	1.19E-02	0.00E+00	0.00E+00	8.07E-03	3.26E-04	8.99E-02	4.36E-04	6.43E-05
Non-COPC Organics	Vapor phase	0.00E+00	5.98E-05	1.09E-04	0.00E+00	0.00E+00	8.28E-03	1.31E-05	3.59E-05	1.12E-04	7.12E-05
	Particle-bound phase	0.00E+00	1.58E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.18E-11	0.00E+00	8.81E-14
	Aqueous phase	8.38E-01	3.71E-14	4.14E-12	4.82E-01	2.76E-01	8.99E-09	1.04E-16	2.50E-14	5.94E-10	2.81E-14
	Solid phase	7.48E-05	2.08E-18	6.60E-17	0.00E+00	3.47E-01	0.00E+00	9.78E-15	0.00E+00	0.00E+00	2.81E-14
	Subtotal	8.38E-01	5.98E-05	1.09E-04	4.82E-01	6.23E-01	8.28E-03	1.31E-05	3.59E-05	1.12E-04	7.12E-05
Total Organics		9.88E-01	1.21E-01	1.40E-02	5.69E-01	7.35E-01	7.02E-02	5.23E-04	9.00E-02	3.10E-03	1.45E-04
		g/sec	g/sec	g/sec	g/sec	g/sec	g/sec	g/sec	g/sec	g/sec	g/sec
Inorganic COPCs	Dimethylmercury (DMHg)	3.52E-10	3.84E-08	9.55E-07	1.42E-10	1.55E-10	5.84E-06	3.00E-08	7.09E-08	3.06E-08	1.32E-12
	Nitrogen oxides (NO_x)	0.00E+00	3.21E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.29E-02	2.33E-01	0.00E+00	7.59E-02
	Sulfur oxides (SO_x)	0.00E+00	1.18E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.84E-06	0.00E+00	3.20E-04
	Carbon dioxide (CO_2)	0.00E+00	6.61E+01	3.57E-02	0.00E+00	0.00E+00	5.85E+00	6.74E-01	5.99E+01	5.22E-01	1.25E+01
	Carbon monoxide (CO)	0.00E+00	1.62E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.48E-02	0.00E+00	6.81E-03
		tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr
	Particulate matter	3.74E-02	7.87E-03	1.71E-09	0.00E+00	4.70E+02	0.00E+00	3.57E-09	6.02E-03	0.00E+00	2.79E-03
		Ci/sec	Ci/sec	Ci/sec	Ci/sec	Ci/sec	Ci/sec	Ci/sec	Ci/sec	Ci/sec	Ci/sec
Radionuclide COPCs	Aqueous phase	2.28E-04	1.25E-06	2.78E-12	7.28E-03	6.61E-03	2.96E-09	2.61E-11	5.93E-07	1.54E-10	9.48E-08
	Solid phase	1.15E-07	1.57E-17	2.10E-19	0.00E+00	1.47E-02	0.00E+00	1.15E-13	0.00E+00	0.00E+00	2.06E-08
	Total Radionuclides	2.28E-04	1.25E-06	2.78E-12	7.28E-03	2.13E-02	2.95E-09	2.62E-11	5.93E-07	1.54E-10	1.15E-07

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Table 2-5 Estimated Abated Emission Rates for Organic Constituents of Potential Concern

CASRN	Organic COPC	DFLAW		Integrated WTP				
		Abated LVP18a LAW Exhaust	Abated DEP18 EMF Exhaust	Abated PJV12 PJV Exhaust	Abated PVP13 PT Exhaust	Abated LVP18a LAW Exhaust	Abated PJV35 PJV Exhaust	Abated HOP31 HLW Exhaust
		g/sec	g/sec	g/sec	g/sec	(g/sec)	g/sec	g/sec
100-02-7	p-Nitrophenol	9.60E-05	1.39E-07	3.11E-07	2.68E-12	7.16E-05	2.00E-08	1.07E-07
100-21-0	Phthalic acid	1.16E-11	3.25E-11	1.56E-10	8.67E-16	3.50E-11	2.23E-11	4.14E-12
100-25-4	1,4-Dinitrobenzene	2.58E-10	6.93E-09	2.83E-07	3.45E-10	9.09E-10	3.06E-08	6.11E-10
100-40-3	4-Ethenylcyclohexene	6.43E-08	6.49E-06	5.10E-04	7.22E-07	3.41E-24	1.67E-06	2.66E-08
100-41-4	Ethyl benzene	1.75E-12	1.83E-10	1.39E-08	1.99E-11	1.00E-24	1.86E-10	7.27E-13
100-42-5	Styrene	3.17E-05	2.60E-05	9.48E-06	2.19E-08	2.36E-05	1.61E-10	3.48E-13
100-44-7	Benzyl chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
100-47-0	Benzonitrile	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
100-51-6	Benzyl alcohol	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
100-52-7	Benzaldehyde	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10061-01-5	cis-1,3-Dichloropropene	3.11E-12	3.79E-10	2.45E-08	3.58E-11	3.92E-22	5.94E-10	1.29E-12
10061-02-6	trans-1,3-Dichloropropene	3.24E-12	5.89E-10	2.54E-08	3.95E-11	1.17E-19	8.94E-10	1.34E-12
101-55-3	4-Bromophenylphenyl ether	9.88E-08	3.13E-05	7.26E-04	4.41E-07	1.43E-11	3.47E-05	4.10E-08
101-77-9	4,4-Methylenedianiline	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
103-33-3	Azobenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
103-65-1	n-Propyl benzene (Isocumene)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
104-51-8	n-Butylbenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
104-76-7	2-Ethyl-1-hexanol	7.76E-08	2.22E-05	4.49E-04	5.62E-07	4.34E-10	2.55E-05	3.32E-08
105-67-9	2,4-Dimethylphenol	1.42E-05	8.55E-05	1.60E-04	6.56E-07	1.06E-05	8.03E-06	6.01E-08
10595-95-6	n-Nitrosomethylethylamine	1.48E-07	9.19E-06	1.50E-04	3.02E-07	2.78E-08	1.99E-05	1.13E-07
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
106-44-5	p-Cresol (4-methyl phenol)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
106-46-7	1,4-Dichlorobenzene	3.46E-06	1.05E-05	8.00E-06	3.81E-09	2.58E-06	3.91E-06	1.49E-08
106-47-8	p-Chloroaniline	1.45E-05	5.91E-05	1.14E-04	3.63E-07	1.08E-05	5.34E-06	6.13E-08
106-49-0	p-Toluidine	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
106-51-4	Quinone	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
106-88-7	1,2-Epoxybutane	8.58E-08	2.58E-05	6.46E-04	3.36E-06	2.78E-12	2.95E-05	3.56E-08
106-89-8	Epichlorohydrin (1-Chloro-2,3 epoxypropane)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
106-93-4	Ethylene dibromide	8.41E-13	1.64E-10	6.57E-09	5.19E-12	6.69E-20	2.40E-10	3.49E-13
106-99-0	1,3-Butadiene	2.82E-11	2.85E-09	2.24E-07	1.58E-09	0.00E+00	4.62E-10	1.17E-11
107-02-8	Acrolein	4.56E-11	1.44E-08	3.36E-07	2.02E-09	5.88E-15	1.60E-08	1.90E-11
107-05-1	3-Chloropropene	3.10E-12	3.19E-10	2.46E-08	1.40E-10	2.57E-25	2.53E-10	1.29E-12
107-06-2	1,2-Dichloroethane	3.17E-05	6.68E-05	2.39E-05	2.00E-07	2.36E-05	2.64E-10	4.07E-13
107-12-0	Propionitrile	2.85E-10	8.69E-08	1.80E-06	1.91E-08	8.21E-13	9.71E-08	1.20E-10
107-13-1	Acrylonitrile	3.17E-05	2.61E-04	1.44E-04	4.00E-06	2.36E-05	1.80E-07	1.40E-06
107-19-7	Propargyl alcohol	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
107-21-1	Ethylene glycol (1,2-Ethanediol)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
107-98-2	Propylene glycol monomethyl ether	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
108-05-4	Acetic acid vinyl ester	1.03E-07	2.30E-05	7.96E-04	3.29E-06	4.65E-14	3.13E-05	4.25E-08
108-10-1	4-Methyl-2-pentanone	1.09E-11	3.43E-09	8.14E-08	1.84E-10	8.51E-16	3.82E-09	4.54E-12
108-39-4	m-Cresol	2.47E-07	1.06E-05	1.64E-04	2.83E-07	7.39E-08	2.30E-05	2.01E-07
108-60-1	bis(2-Chloroisopropyl)ether	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
108-67-8	1,3,5-Trimethylbenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
108-86-1	Bromobenzene (Phenyl bromide)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
108-87-2	Methylcyclohexane	3.57E-12	3.60E-10	2.83E-08	4.01E-11	0.00E+00	1.05E-11	1.48E-12
108-88-3	Toluene	3.17E-05	1.07E-05	4.03E-06	7.84E-09	2.36E-05	4.07E-08	1.40E-06
108-90-7	Chlorobenzene	3.17E-05	1.90E-05	7.01E-06	1.51E-08	2.36E-05	5.60E-08	1.40E-06
108-94-1	Cyclohexanone	3.05E-09	6.05E-07	1.12E-05	2.13E-08	8.75E-11	8.53E-07	1.54E-09
108-95-2	Phenol	7.23E-06	7.77E-06	1.41E-05	2.13E-08	5.39E-06	6.18E-07	3.58E-08
109-74-0	n-Butanenitrile	8.23E-08	2.60E-05	5.53E-04	1.97E-06	1.08E-10	2.87E-05	3.44E-08
109-75-1	3-Butenenitrile	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
109-77-3	Malononitrile	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
109-86-4	2-Methoxyethanol	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
109-99-9	Tetrahydrofuran	3.38E-11	1.09E-08	2.38E-07	1.79E-09	1.93E-14	1.19E-08	1.41E-11
110-00-9	Furan	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
110-54-3	n-Hexane	1.64E-10	1.65E-08	1.30E-06	4.59E-09	0.00E+00	1.16E-10	6.78E-11
110-59-8	Pentanenitrile	7.92E-08	2.54E-05	5.56E-04	1.69E-06	4.68E-11	2.79E-05	3.29E-08
110-80-5	2-Ethoxyethanol	7.00E-07	1.92E-05	2.68E-04	1.37E-06	3.31E-07	3.76E-05	5.69E-07
110-82-7	Cyclohexane	3.10E-12	3.13E-10	2.46E-08	8.70E-11	0.00E+00	2.56E-11	1.29E-12
110-83-8	Cyclohexene	3.10E-12	3.13E-10	2.46E-08	8.71E-11	0.00E+00	7.95E-11	1.29E-12

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Table 2-5 Estimated Abated Emission Rates for Organic Constituents of Potential Concern

CASRN	Organic COPC	DFLAW		Integrated WTP				
		Abated LVP18a LAW Exhaust	Abated DEP18 EMF Exhaust	Abated PJV12 PJV Exhaust	Abated PVP13 PT Exhaust	Abated LVP18a LAW Exhaust	Abated PJV35 PJV Exhaust	Abated HOP31 HLW Exhaust
		g/sec	g/sec	g/sec	g/sec	(g/sec)	g/sec	g/sec
110-86-1	Pyridine	7.36E-10	1.45E-07	2.68E-06	2.05E-08	2.16E-11	2.05E-07	3.74E-10
111-15-9	Ethylene glycol monoethyl ether acetate	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
111-44-4	bis(2-Chloroethyl)ether	2.95E-06	5.63E-05	6.16E-05	2.94E-07	2.20E-06	4.76E-06	1.22E-08
111-65-9	n-Octane	3.74E-11	3.78E-09	2.97E-07	4.20E-10	0.00E+00	1.48E-11	1.55E-11
111-76-2	2-Butoxyethanol	9.83E-08	6.61E-06	1.08E-04	2.23E-07	1.69E-08	1.42E-05	7.41E-08
111-84-2	n-Nonane	2.51E-11	2.53E-09	1.99E-07	7.03E-11	4.71E-22	9.39E-12	1.04E-11
111-91-1	bis(2-Chloroethoxy)methane	2.61E-06	2.44E-05	4.12E-05	2.02E-07	1.95E-06	2.29E-06	1.10E-08
1120-21-4	Undecane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1120-71-4	1,3-Propane sultone	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
112-30-1	1-Decanol	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
112-31-2	Decanal	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
112-40-3	Dodecane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
117-81-7	bis(2-Ethylhexyl)phthalate	3.45E-05	1.84E-05	3.75E-05	1.15E-08	2.60E-05	2.26E-06	1.96E-07
117-84-0	Di-n-octylphthalate	3.39E-07	1.14E-04	2.36E-03	1.85E-06	2.61E-10	1.20E-04	1.41E-07
118-74-1	Hexachlorobenzene	2.98E-06	1.64E-05	5.88E-06	4.34E-09	2.22E-06	4.11E-06	1.29E-08
119-90-4	3,3'-Dimethoxybenzidine	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
120-12-7	Anthracene	2.39E-06	7.20E-05	4.57E-04	4.53E-07	1.73E-06	2.57E-05	3.51E-08
120-82-1	1,2,4-Trichlorobenzene	6.23E-11	9.33E-09	4.89E-07	1.84E-10	2.15E-19	1.51E-08	2.58E-11
120-83-2	2,4-Dichlorophenol	1.29E-07	1.62E-05	1.02E-03	3.74E-07	3.00E-17	2.60E-05	5.35E-08
121-14-2	2,4-Dinitrotoluene	3.69E-05	9.94E-06	5.51E-05	1.68E-08	2.85E-05	4.92E-06	3.65E-07
122-39-4	N,N-Diphenylamine	9.77E-11	9.85E-09	1.64E-07	3.58E-10	1.38E-11	1.87E-08	6.65E-11
122-66-7	1,2-Diphenylhydrazine	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
123-33-1	Maleic hydrazide	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
123-38-6	Propionaldehyde	1.03E-10	3.33E-08	7.29E-07	8.74E-09	5.71E-14	3.65E-08	4.31E-11
123-72-8	Butanal	8.58E-08	2.72E-05	6.30E-04	3.86E-06	1.27E-11	3.02E-05	3.57E-08
123-91-1	1,4-Dioxan	3.15E-11	4.44E-09	7.89E-08	6.76E-10	1.85E-12	7.57E-09	1.87E-11
124-18-5	Decane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
124-48-1	Chlorodibromomethane	3.17E-05	8.11E-05	2.90E-05	5.40E-08	2.36E-05	7.13E-16	0.00E+00
126-73-8	Tributyl phosphate	9.58E-08	6.24E-06	9.80E-05	1.95E-07	2.79E-08	1.26E-05	7.32E-08
126-98-7	Methacrylonitrile	3.11E-11	8.74E-09	2.37E-07	1.13E-09	3.08E-16	1.04E-08	1.29E-11
127-18-4	1,1,2,2-Tetrachloroethene	1.02E-12	1.04E-10	8.10E-09	5.76E-12	0.00E+00	5.87E-11	4.23E-13
128-37-0	2,6-bis(tert-Butyl)-4-methylphenol	1.52E-09	2.00E-07	3.53E-06	7.84E-09	1.38E-10	1.82E-12	9.57E-10
129-00-0	Pyrene	2.91E-06	1.09E-04	1.29E-03	2.55E-06	1.96E-06	9.02E-05	1.56E-07
131-11-3	Dimethyl phthalate	1.87E-05	1.97E-06	2.39E-06	7.12E-10	1.40E-05	9.12E-08	9.82E-09
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
132-64-9	Dibenzofuran	2.45E-05	5.49E-05	2.48E-05	4.67E-08	1.82E-05	5.62E-06	1.29E-08
1330-20-7	Xylenes (total)	3.16E-05	1.37E-05	7.43E-06	1.36E-08	2.36E-05	8.79E-08	1.40E-06
133-06-2	Captan	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1336-36-3	Aroclors (Total PCB) - Note 1	1.37E-07	4.05E-05	1.03E-03	1.04E-05	1.26E-12	4.686E-05	5.67E-08
134-32-7	alpha-Naphthylamine	1.34E-07	1.54E-06	1.27E-05	4.66E-09	2.49E-07	1.16E-06	6.96E-08
135-98-8	sec-Butyl Benzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
141-78-6	Acetic acid ethyl ester	3.32E-12	1.04E-09	2.46E-08	1.42E-10	2.98E-16	1.16E-09	1.38E-12
145-73-3	Endothall	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
156-59-2	cis-1,2-Dichloroethene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
156-60-5	1,2-trans-Dichloroethene	2.30E-07	2.38E-05	1.82E-03	6.51E-06	5.36E-20	2.17E-05	9.55E-08
1634-04-4	Methyl tert-butyl ether	8.39E-08	1.79E-05	6.53E-04	2.65E-06	1.99E-14	2.50E-05	3.48E-08
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	2.02E-12	2.12E-13	1.96E-13	8.06E-16	1.50E-12	2.23E-14	1.12E-13
189-55-9	Dibenzo[a,i]pyrene	1.75E-07	4.83E-07	1.80E-06	1.89E-09	4.08E-07	1.35E-07	6.30E-08
189-64-0	Dibenzo[a,h]pyrene	1.75E-07	4.83E-07	1.80E-06	1.89E-09	4.08E-07	1.35E-07	6.30E-08
191-24-2	Benzo(g,h,i)perylene	4.92E-05	1.53E-05	4.82E-05	3.88E-08	3.68E-05	3.87E-06	9.26E-08
191-30-0	Dibenzo[a,l]pyrene	1.75E-07	4.83E-07	1.80E-06	1.89E-09	4.08E-07	1.35E-07	6.30E-08
192-65-4	Dibenzo[a,e]pyrene	1.75E-07	4.83E-07	1.80E-06	1.89E-09	4.08E-07	1.35E-07	6.30E-08
192-97-2	Benzo(e)pyrene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
193-39-5	Indeno(1,2,3-cd)pyrene	4.11E-05	3.37E-05	1.28E-04	3.13E-07	3.06E-05	1.14E-05	6.84E-08
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	2.27E-12	1.27E-13	2.07E-13	4.82E-16	1.69E-12	2.44E-13	3.82E-14
205-82-3	Benzo[j]fluoranthene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
205-99-2	Benzo(b)fluoranthene	4.78E-05	1.30E-04	1.28E-04	6.23E-07	3.57E-05	8.53E-06	2.51E-08
206-44-0	Fluoranthene	2.76E-06	1.17E-04	1.49E-03	2.50E-06	1.84E-06	9.49E-05	1.44E-07
207-08-9	Benzo(k)fluoranthene	5.61E-05	2.60E-05	4.65E-05	8.68E-08	4.18E-05	1.93E-06	2.94E-08

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Table 2-5 Estimated Abated Emission Rates for Organic Constituents of Potential Concern

CASRN	Organic COPC	DFLAW		Integrated WTP				
		Abated LVP18a LAW Exhaust	Abated DEP18 EMF Exhaust	Abated PJV12 PJV Exhaust	Abated PVP13 PT Exhaust	Abated LVP18a LAW Exhaust	Abated PJV35 PJV Exhaust	Abated HOP31 HLW Exhaust
		g/sec	g/sec	g/sec	g/sec	(g/sec)	g/sec	g/sec
208-96-8	Acenaphthylene	1.87E-05	6.84E-05	4.70E-04	3.43E-07	1.39E-05	2.57E-05	3.49E-08
218-01-9	Chrysene	2.95E-06	7.10E-05	4.52E-05	1.27E-07	2.20E-06	5.58E-06	1.22E-08
224-42-0	Dibenz[a,j]acridine	3.31E-08	9.76E-08	2.99E-07	8.12E-11	8.38E-08	2.07E-08	1.07E-08
2245-38-7	2,3,5-Trimethylnaphthalene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
226-36-8	Dibenz[a,h]acridine	3.30E-08	9.40E-08	2.89E-07	7.88E-11	7.80E-08	1.94E-08	1.00E-08
23950-58-5	Pronamide	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
27154-33-2	Trichlorofluoroethane	3.60E-07	3.71E-05	2.85E-03	2.03E-05	5.11E-20	3.17E-05	1.49E-07
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	1.24E-09	3.26E-11	1.55E-11	4.97E-13	9.24E-10	2.33E-12	9.17E-12
319-84-6	alpha-BHC (a-Lindane)	3.49E-12	7.65E-10	1.43E-08	2.54E-11	8.95E-14	1.01E-09	1.69E-12
319-85-7	beta-BHC (b-Lindane)	5.49E-12	2.31E-10	5.46E-07	1.28E-09	6.19E-09	2.37E-08	2.30E-09
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	3.77E-10	7.15E-12	1.02E-11	1.07E-12	2.81E-10	7.76E-13	8.88E-13
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	5.17E-10	5.54E-12	2.40E-12	4.34E-14	3.85E-10	8.69E-13	4.01E-12
3268-87-9	Octachlorodibenzo(p)dioxin	3.27E-11	2.25E-12	4.53E-12	2.16E-14	2.44E-11	2.78E-18	7.74E-13
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	2.46E-10	5.89E-12	3.81E-12	1.26E-14	1.83E-10	5.81E-14	2.62E-13
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	9.56E-12	6.41E-13	1.10E-12	1.01E-13	7.13E-12	3.95E-13	1.91E-13
3697-24-3	5-Methylchrysene	6.16E-08	9.68E-06	1.70E-04	7.13E-06	3.81E-09	1.53E-05	3.50E-08
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	2.17E-10	6.71E-12	3.71E-12	1.74E-13	1.61E-10	2.58E-13	1.04E-12
39001-02-0	Octachlorodibenzofuran	5.22E-11	2.03E-13	4.33E-13	1.43E-15	3.89E-11	1.81E-19	1.24E-12
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	1.73E-12	8.66E-14	2.36E-13	2.00E-14	1.29E-12	1.56E-13	2.77E-14
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	4.86E-11	2.20E-12	1.74E-12	1.28E-13	3.62E-11	4.91E-14	3.17E-13
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	1.30E-12	8.10E-14	2.11E-13	1.79E-14	9.70E-13	6.58E-14	4.04E-14
4170-30-3	Crotonaldehyde (Propylene aldehyde)	4.26E-11	8.74E-09	3.90E-07	5.67E-10	3.39E-21	1.07E-08	1.76E-11
41851-50-7	Chlorocyclopentadiene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
460-19-5	Cyanogen (Oxalonitrile)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4786-20-3	2-Butenenitrile (Crotononitrile)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
50-00-0	Formaldehyde	1.76E-07	3.82E-06	4.90E-05	1.01E-06	1.01E-07	6.68E-06	1.38E-07
50-32-8	Benzo(a)pyrene	2.58E-05	2.93E-05	5.12E-05	2.17E-07	1.92E-05	2.61E-06	1.36E-08
506-68-3	Cyanogen bromide (Bromocyanide)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
506-77-4	Cyanogen chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
510-15-6	Chlorobenzilate	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	1.06E-11	6.57E-13	9.78E-13	4.45E-15	7.91E-12	3.16E-13	1.40E-13
51-28-5	2,4-Dinitrophenol	3.38E-04	9.67E-05	1.64E-04	2.09E-07	2.52E-04	6.59E-06	4.70E-07
51-79-6	Ethyl carbamate (Urethane)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	1.77E-10	5.57E-12	3.77E-12	2.59E-13	1.32E-10	8.82E-14	4.03E-13
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
532-27-4	2-Chloroacetophenone	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
534-52-1	4,6-Dinitro-o-cresol	2.95E-05	1.01E-04	1.91E-04	5.88E-07	2.20E-05	8.71E-06	8.57E-08
53-70-3	Dibenz[a,h]anthracene	4.32E-05	1.03E-06	8.54E-07	1.72E-11	3.22E-05	3.15E-08	2.31E-08
5385-75-1	Dibenzo[a,e]fluoranthene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	3.17E-05	1.73E-05	6.37E-06	3.36E-08	2.36E-05	1.71E-19	0.00E+00
540-73-8	1,2-Dimethylhydrazine	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
540-84-1	2,2,4-Trimethylpentane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
541-73-1	1,3-Dichlorobenzene	4.08E-11	4.83E-09	3.22E-07	1.17E-10	2.63E-21	7.35E-09	1.69E-11
542-75-6	1,3-Dichloropropene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
542-88-1	bis(Chloromethyl)ether	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	2.41E-11	1.32E-13	1.75E-13	1.67E-14	1.80E-11	2.64E-14	4.59E-13
56-23-5	Carbon tetrachloride	3.17E-05	2.36E-06	9.08E-07	1.58E-09	2.36E-05	1.26E-08	1.40E-06
56-49-5	3-Methylcholanthrene	6.18E-08	9.49E-06	1.65E-04	6.96E-06	4.08E-09	1.52E-05	3.56E-08
56-55-3	Benzo(a)anthracene	2.98E-06	2.80E-05	4.85E-05	2.06E-07	2.22E-06	2.48E-06	1.29E-08

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Table 2-5 Estimated Abated Emission Rates for Organic Constituents of Potential Concern

CASRN	Organic COPC	DFLAW		Integrated WTP				
		Abated LVP18a LAW Exhaust	Abated DEP18 EMF Exhaust	Abated PJV12 PJV Exhaust	Abated PVP13 PT Exhaust	Abated LVP18a LAW Exhaust	Abated PJV35 PJV Exhaust	Abated HOP31 HLW Exhaust
		g/sec	g/sec	g/sec	g/sec	(g/sec)	g/sec	g/sec
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	7.92E-12	2.02E-13	3.32E-13	1.54E-15	5.91E-12	2.18E-14	1.83E-13
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	1.06E-11	1.37E-13	2.53E-13	1.15E-15	7.91E-12	4.22E-14	2.09E-13
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	1.73E-11	1.19E-13	1.86E-13	1.84E-14	1.29E-11	2.08E-14	3.02E-13
57-24-9	Strychnine	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	2.63E-10	2.70E-12	3.50E-12	1.77E-14	1.96E-10	5.65E-14	4.42E-13
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo(p)dioxin	1.62E-12	1.55E-13	2.90E-13	2.59E-14	1.21E-12	1.16E-13	3.82E-14
57-74-9	Chlordane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
581-42-0	2,6-Dimethylnaphthalene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
584-84-9	2,4-Toluene diisocyanate	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
58-89-9	gamma-BHC (g-Lindane)	4.78E-12	7.16E-10	1.28E-08	5.50E-10	4.12E-13	1.31E-09	3.22E-12
58-90-2	2,3,4,6-Tetrachlorophenol	1.88E-07	2.58E-05	4.45E-04	9.59E-07	1.52E-08	4.35E-05	1.13E-07
589-38-8	3-Hexanone	7.95E-08	2.50E-05	5.87E-04	1.39E-06	8.97E-12	2.79E-05	3.30E-08
591-50-4	Benzene, iodo-	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
591-78-6	2-Hexanone	1.34E-10	4.30E-08	9.69E-07	2.60E-09	3.76E-14	4.74E-08	5.58E-11
593-60-2	Bromoethene (Vinyl bromide)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
59-50-7	4-Chloro-3-methylphenol	2.91E-07	1.59E-05	4.34E-04	9.46E-07	3.23E-08	5.17E-05	1.97E-07
59-89-2	N-Nitrosomorpholine	1.24E-06	3.22E-06	2.04E-05	2.30E-09	1.10E-06	2.43E-06	6.55E-07
60-11-7	Dimethyl aminoazobenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
602-87-9	5-Nitroacenaphthene	8.77E-08	4.84E-06	7.35E-05	2.72E-06	3.23E-08	9.49E-06	6.68E-08
60-29-7	Ethyl ether	1.17E-10	1.84E-08	9.16E-07	5.55E-09	7.67E-19	2.95E-08	4.83E-11
60-35-5	Acetamide	7.71E-08	1.64E-07	7.78E-07	2.24E-11	9.86E-08	9.32E-08	4.79E-08
606-20-2	2,6-Dinitrotoluene	3.04E-05	1.22E-05	2.25E-05	4.51E-08	2.26E-05	9.50E-07	1.59E-08
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	7.36E-12	8.38E-14	1.15E-13	1.13E-14	5.49E-12	1.15E-14	1.13E-13
608-93-5	Pentachlorobenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
61626-71-9	Dichloropentadiene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
621-64-7	N-Nitroso-di-n-propylamine	2.73E-07	2.34E-05	3.95E-04	8.55E-07	3.41E-08	4.81E-05	1.94E-07
624-83-9	Methyl isocyanate	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
62-50-0	Ethyl methanesulfonate	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
62-53-3	Aniline	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
62-75-9	N-Nitroso-N,N-Dimethylamine	1.46E-09	1.07E-07	1.79E-06	3.76E-09	2.24E-10	2.28E-07	1.07E-09
628-73-9	Hexanenitrile	7.71E-08	2.47E-05	5.57E-04	3.70E-07	2.05E-11	2.72E-05	3.20E-08
630-20-6	1,1,1,2-Tetrachloroethane	4.00E-07	5.02E-05	3.15E-03	2.31E-06	8.89E-17	8.01E-05	1.65E-07
64-18-6	Formic acid (Methanoic acid)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	1.21E-10	4.10E-12	4.37E-10	1.13E-10	8.99E-11	6.41E-14	2.26E-13
65-85-0	Benzoic acid	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
67-56-1	Methyl alcohol	1.55E-07	2.11E-05	3.70E-04	7.87E-06	7.50E-09	3.30E-05	8.21E-08
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	5.88E-11	4.04E-13	5.49E-13	5.24E-14	4.38E-11	7.93E-14	9.38E-13
67-63-0	2-Propyl alcohol	8.71E-11	1.64E-08	3.02E-07	5.89E-09	2.78E-12	2.37E-08	4.49E-11
67-64-1	2-Propanone (Acetone)	9.99E-05	4.36E-04	3.52E-04	1.40E-05	7.45E-05	8.82E-07	3.81E-05
67-66-3	Chloroform	3.17E-05	1.90E-05	7.01E-06	3.77E-08	2.36E-05	5.60E-08	1.40E-06
67-72-1	Hexachloroethane	1.24E-08	1.41E-06	9.80E-05	3.54E-08	2.57E-19	2.00E-06	5.14E-09
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	2.17E-10	7.31E-12	5.26E-12	3.86E-13	1.62E-10	2.57E-13	1.04E-12
70-30-4	Hexachlorophene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	6.52E-11	2.56E-12	2.54E-12	2.31E-13	4.86E-11	1.37E-13	2.84E-13
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	3.97E-11	2.54E-13	4.37E-13	3.93E-14	2.96E-11	1.91E-13	6.47E-13
71-36-3	n-Butyl alcohol	2.52E-09	4.95E-07	9.18E-06	7.00E-08	7.44E-11	7.02E-07	1.28E-09
71-43-2	Benzene	3.17E-05	1.26E-05	4.71E-06	2.35E-08	2.36E-05	8.00E-08	1.40E-06
71-55-6	1,1,1-Trichloroethane	1.04E-12	1.06E-10	8.23E-09	2.93E-11	0.00E+00	6.25E-11	4.30E-13
72-43-5	Methoxychlor	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
72-55-9	4,4-DDE	1.08E-07	2.95E-05	5.82E-04	8.12E-07	1.02E-09	3.46E-05	4.73E-08
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	4.35E-12	5.04E-14	6.84E-14	3.40E-16	3.25E-12	4.93E-15	5.88E-14
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	1.04E-10	2.96E-12	1.82E-12	1.05E-13	7.74E-11	1.56E-13	3.23E-13
74-83-9	Bromomethane	2.67E-03	1.13E-05	4.24E-06	4.16E-08	1.99E-03	4.19E-08	1.40E-06

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Table 2-5 Estimated Abated Emission Rates for Organic Constituents of Potential Concern

CASRN	Organic COPC	DFLAW		Integrated WTP				
		Abated LVP18a LAW Exhaust	Abated DEP18 EMF Exhaust	Abated PJV12 PJV Exhaust	Abated PVP13 PT Exhaust	Abated LVP18a LAW Exhaust	Abated PJV35 PJV Exhaust	Abated HOP31 HLW Exhaust
		g/sec	g/sec	g/sec	g/sec	(g/sec)	g/sec	g/sec
74-87-3	Chloromethane	1.30E-03	8.02E-06	3.04E-06	2.86E-08	9.68E-04	3.37E-08	1.47E-06
74-88-4	Iodomethane	2.28E-03	1.29E-05	4.75E-06	3.83E-08	1.70E-03	4.61E-08	1.40E-06
74-95-3	Methylene bromide	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
74-97-5	Bromochloromethane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
75-00-3	Chloroethane	2.10E-12	2.18E-10	1.66E-08	1.19E-10	6.86E-25	2.07E-10	8.69E-13
75-01-4	1-Chloroethene	2.13E-12	2.15E-10	1.69E-08	1.20E-10	0.00E+00	8.69E-11	8.82E-13
75-02-5	Fluoroethene (Vinyl fluoride)	1.09E-07	1.11E-05	8.68E-04	6.14E-06	3.06E-26	1.14E-06	4.54E-08
75-05-8	Acetonitrile	4.41E-04	4.22E-03	3.47E-03	2.91E-04	3.28E-04	2.06E-06	4.02E-06
75-07-0	Acetaldehyde	1.05E-07	3.38E-05	7.45E-04	1.08E-05	4.74E-11	3.70E-05	4.36E-08
75-09-2	Dichloromethane (Methylene Chloride)	1.12E-01	8.27E-04	3.04E-04	2.97E-06	8.35E-02	2.00E-07	1.42E-06
75-15-0	Carbon disulfide	3.16E-05	2.41E-06	4.17E-07	1.82E-10	2.36E-05	1.26E-08	1.40E-06
75-21-8	Ethylene oxide (Oxirane)	1.81E-10	5.59E-08	1.35E-06	1.50E-08	1.17E-14	6.30E-08	7.51E-11
75-25-2	Bromoform	3.17E-05	1.10E-08	4.13E-09	3.49E-12	2.36E-05	0.00E+00	0.00E+00
75-27-4	Bromodichloromethane	7.80E-07	1.11E-04	6.13E-03	9.15E-06	1.38E-15	1.82E-04	3.23E-07
75-29-6	2-Chloropropane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
75-34-3	1,1-Dichloroethane	8.41E-13	9.05E-11	6.65E-09	2.39E-11	2.78E-24	1.11E-10	3.48E-13
75-35-4	1,1-Dichloroethene	1.32E-12	1.34E-10	1.05E-08	5.95E-11	0.00E+00	5.57E-11	5.48E-13
75-44-5	Phosgene (Carbonyl dichloride)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
75-45-6	Chlorodifluoromethane	3.10E-12	3.13E-10	2.46E-08	1.74E-10	0.00E+00	8.82E-11	1.29E-12
75-50-3	Trimethylamine	9.38E-08	3.00E-05	6.83E-04	8.72E-06	1.89E-11	3.31E-05	3.90E-08
75-69-4	Trichlorofluoromethane	2.55E-12	2.58E-10	2.02E-08	1.43E-10	0.00E+00	3.21E-11	1.06E-12
75-71-8	Dichlorodifluoromethane	2.60E-12	2.62E-10	2.06E-08	1.46E-10	0.00E+00	9.55E-12	1.08E-12
76-01-7	Pentachloroethane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
76-13-1	1,2,2-Trichlorotrifluoroethane	2.57E-12	2.59E-10	2.04E-08	7.21E-11	4.64E-22	6.18E-12	1.06E-12
764-41-0	1,4-Dichloro-2-butene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
76-44-8	Heptachlor	2.41E-12	2.44E-10	1.91E-08	6.77E-12	0.00E+00	2.05E-12	1.00E-12
765-34-4	Glycidylaldehyde	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
77-47-4	Hexachlorocyclopentadiene	2.70E-04	9.11E-06	3.42E-06	1.50E-09	2.01E-04	7.40E-06	1.41E-07
77-78-1	Dimethyl sulfate	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
78-83-1	2-Methylpropyl alcohol	1.47E-06	3.02E-04	5.64E-03	4.18E-05	3.78E-08	4.16E-04	7.27E-07
78-87-5	1,2-Dichloropropane	8.41E-13	1.02E-10	6.64E-09	2.42E-11	9.02E-23	1.59E-10	3.48E-13
78-93-3	2-Butanone	3.41E-05	2.20E-04	1.54E-04	5.45E-06	2.54E-05	2.36E-07	1.40E-06
79-00-5	1,1,2-Trichloroethane	9.86E-13	1.76E-10	7.73E-09	1.20E-11	2.88E-20	2.69E-10	4.08E-13
79-01-6	1,1,2-Trichloroethylene	3.17E-05	7.07E-06	2.67E-06	1.24E-08	2.36E-05	3.26E-08	1.79E-06
79-10-7	2-Propenoic acid	2.67E-07	6.16E-06	8.16E-05	8.98E-08	1.47E-07	1.13E-05	2.15E-07
79-34-5	1,1,2,2-Tetrachloroethane	9.86E-13	2.55E-10	7.60E-09	6.72E-12	2.66E-18	3.19E-10	4.09E-13
79-46-9	2-Nitropropane	2.08E-10	6.56E-08	1.53E-06	3.69E-09	2.74E-14	7.30E-08	8.63E-11
80-62-6	Methyl methacrylate	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
822-06-0	Hexamethylene-1,5-Diisocyanate	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
823-40-5	Toluene-2,6-diamine	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
82-68-8	Pentachloronitrobenzene (PCNB)	1.96E-10	4.90E-08	1.51E-06	6.56E-10	3.34E-16	6.26E-08	8.13E-11
832-69-9	1-Methylphenanthrene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
83-32-9	Acenaphthene	2.02E-05	1.39E-04	2.25E-03	1.26E-06	1.48E-05	1.08E-04	1.34E-07
84-66-2	Diethyl phthalate	3.29E-05	1.28E-05	6.08E-05	7.39E-08	2.45E-05	6.20E-06	1.06E-07
84-74-2	Di-n-butylphthalate	1.93E-05	2.50E-04	2.55E-03	5.60E-06	1.34E-05	9.09E-06	1.46E-06
85-01-8	Phenanthrene	2.53E-06	6.79E-05	3.88E-04	6.81E-07	1.83E-06	2.39E-05	3.67E-08
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
85-68-7	Butylbenzylphthalate	5.76E-06	5.68E-05	6.36E-04	1.27E-06	4.02E-06	7.87E-05	4.93E-07
86-73-7	Fluorene	2.34E-05	8.53E-05	4.67E-04	4.88E-07	1.74E-05	2.70E-05	3.76E-08
87-61-6	1,2,3-Trichlorobenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
87-68-3	Hexachlorobutadiene	5.33E-10	5.55E-08	4.22E-06	1.51E-09	2.68E-22	5.56E-08	2.21E-10
87-86-5	Pentachlorophenol	1.81E-09	5.99E-09	2.89E-08	2.42E-12	3.62E-09	2.14E-09	5.93E-10
88-06-2	2,4,6-Trichlorophenol	2.64E-07	4.88E-05	8.96E-04	1.76E-06	9.00E-09	7.17E-05	1.38E-07
88-74-4	o-Nitroaniline (2-Nitroaniline)	2.58E-05	2.78E-06	3.41E-06	1.05E-09	1.92E-05	1.30E-07	1.35E-08
88-75-5	2-Nitrophenol	1.03E-05	1.60E-04	1.15E-03	2.62E-06	7.51E-06	8.45E-05	5.05E-07
90-04-0	o-Anisidine	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
90-12-0	1-Methylnaphthalene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
91-20-3	Naphthalene	1.70E-05	4.13E-03	3.70E-03	2.75E-06	1.25E-05	3.73E-04	2.71E-07
91-22-5	Quinoline	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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Table 2-5 Estimated Abated Emission Rates for Organic Constituents of Potential Concern

CASRN	Organic COPC	DFLAW		Integrated WTP				
		Abated LVP18a LAW Exhaust	Abated DEP18 EMF Exhaust	Abated PJV12 PJV Exhaust	Abated PVP13 PT Exhaust	Abated LVP18a LAW Exhaust	Abated PJV35 PJV Exhaust	Abated HOP31 HLW Exhaust
		g/sec	g/sec	g/sec	g/sec	(g/sec)	g/sec	g/sec
91-57-6	2-Methylnaphthalene	2.81E-06	3.11E-05	5.57E-05	1.70E-07	2.10E-06	5.21E-06	1.16E-08
91-58-7	2-Chloronaphthalene	7.74E-08	2.05E-05	5.95E-04	2.67E-07	2.91E-13	2.53E-05	3.21E-08
91-94-1	3,3'-Dichlorobenzidine	1.88E-05	8.71E-07	7.58E-07	1.19E-11	1.40E-05	2.87E-08	7.97E-08
924-16-3	N-Nitroso-di-n-butylamine	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
92-52-4	1,1`-Biphenyl	1.96E-10	5.21E-08	1.51E-06	6.80E-10	7.98E-16	6.42E-08	8.14E-11
94-59-7	Safrole (5-(2-propenyl)-1,3-benzodioxole)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
94-75-7	2,4-D	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
95-48-7	o-Cresol	3.34E-07	1.83E-05	2.92E-04	5.62E-07	7.49E-08	3.99E-05	2.63E-07
95-49-8	o-Chlorotoluene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
95-50-1	1,2-Dichlorobenzene	8.11E-10	1.10E-07	6.39E-06	2.36E-09	6.08E-19	1.79E-07	3.36E-10
95-53-4	o-Toluidine	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
95-57-8	2-Chlorophenol	2.82E-07	6.97E-05	2.18E-03	9.39E-07	4.18E-13	8.97E-05	1.17E-07
95-63-6	1,2,4-Trimethyl benzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
95-94-3	1,2,4,5-Tetrachlorobenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
95-95-4	2,4,5-Trichlorophenol	2.60E-07	3.45E-05	6.07E-04	1.31E-06	1.70E-08	6.05E-05	1.59E-07
96-12-8	1,2-Dibromo-3-chloropropane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
96-18-4	1,2,3-Trichloropropane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
96-45-7	Ethylene thiourea	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
97-63-2	Ethyl methacrylate	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
98-01-1	Furfural	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
98-06-6	tert-Butyl benzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
98-07-7	Benzotrichloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
98-82-8	Cumene	6.33E-08	6.40E-06	5.02E-04	1.78E-07	0.00E+00	6.70E-08	2.62E-08
98-83-9	Methyl styrene (mixed isomers)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
98-86-2	Acetophenone	1.97E-10	4.22E-08	1.11E-06	2.91E-09	1.22E-11	6.96E-08	1.28E-10
98-95-3	Nitrobenzene	3.85E-06	5.92E-05	6.22E-05	2.68E-07	2.87E-06	5.01E-06	1.19E-08
99-35-4	1,3,5-Trinitrobenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
99-65-0	1,3-Dinitrobenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
99-87-6	p-Cymene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total Organic COPCs		1.21E-01	1.39E-02	6.19E-02	5.10E-04	8.99E-02	2.99E-03	7.37E-05

Notes:

Note 1 – 1336-36-3 emissions rates reported in this table are developed using COPC to TOC ratio provided in the original feed vector, 24590-WTP-RPT-ENV-16-001. Refer to Section 6.1.11 and Attachment D of 24590-WTP- M4C-V20T-00001, *Air Emissions Estimate for DFLAW and Integrated WTP Configurations* for details.

Emission rates (g/sec) for the refined feed vector (refer to Section 6.1.11 of 24590-WTP-M4C-V20T-00001 for details) are provided below:

CASRN	Organic COPC	DFLAW		Integrated WTP				
		Abated LVP18a LAW Exhaust	Abated DEP18 EMF Exhaust	Abated PJV12 PJV Exhaust	Abated PVP13 PT Exhaust	Abated LVP18a LAW Exhaust	Abated PJV35 PJV Exhaust	Abated HOP31 HLW Exhaust
		g/sec	g/sec	g/sec	g/sec	(g/sec)	g/sec	g/sec
1336-36-3	Aroclors (Total PCB)	2.30E-09	6.81E-07	1.85E-04	1.75E-06	7.58E-13	1.16E-05	1.41E-08

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Table 2-6 Estimated Abated Emission Rates for Inorganic Constituents of Potential Concern

CASRN	Inorganic COPC	DFLAW		Integrated WTP				
		Abated	Abated	Abated	Abated	Abated	Abated	Abated
		LVP18a	DEP18	PJV12	PVP13	LVP18a	PJV35	HOP31
		LAW	EMF	PJV	PT	LAW	PJV	HLW
		Exhaust	Exhaust	Exhaust	Exhaust	Exhaust	Exhaust	Exhaust
		g/sec	g/sec	g/sec	g/sec	g/sec	g/sec	g/sec
10028-15-6	Ozone - Note 13	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10102-44-0	Nitrogen dioxide - Note 13	1.26E-01	0.00E+00	0.00E+00	1.29E-02	9.21E-02	0.00E+00	3.09E-02
124-38-9	Carbon dioxide	6.61E+01	3.57E-02	5.85E+00	6.74E-01	5.99E+01	5.22E-01	1.25E+01
14265-44-2	Phosphate	4.30E-09	4.16E-12	2.82E-08	1.12E-11	2.72E-09	3.36E-10	2.26E-10
14265-44-2	Phosphate (ppt) - Note 7	0.00E+00	0.00E+00	0.00E+00	2.24E-11	6.63E-14	0.00E+00	0.00E+00
14797-55-8	Nitrate	4.89E-09	6.41E-11	7.68E-07	1.07E-10	3.95E-09	1.76E-08	7.75E-11
14797-65-0	Nitrite	1.68E-11	3.01E-11	1.79E-07	2.33E-11	9.18E-12	1.93E-09	1.57E-11
14808-79-8	Sulfate	9.52E-12	1.81E-12	2.80E-08	4.15E-12	3.06E-11	9.22E-10	5.34E-11
16887-00-6	Chloride	1.63E-07	1.01E-10	1.11E-08	1.30E-12	1.15E-07	1.98E-10	1.10E-12
16984-48-8	Fluoride	3.42E-09	2.56E-11	1.64E-08	3.55E-12	4.16E-08	3.72E-09	2.11E-11
16984-48-8	Fluoride (ppt) - Note 6	0.00E+00	0.00E+00	0.00E+00	2.24E-12	6.64E-15	0.00E+00	0.00E+00
22967-92-6	Methylmercury	N/A	N/A	N/A	N/A	N/A	N/A	N/A
24959-67-9	Bromide	N/A	N/A	N/A	N/A	N/A	N/A	N/A
57-12-5	Cyanide	4.51E-16	8.12E-16	1.77E-12	2.60E-15	9.09E-17	3.73E-17	2.40E-15
593-74-8	Dimethylmercury	3.84E-08	9.55E-07	5.84E-06	3.00E-08	7.09E-08	3.06E-08	1.32E-12
630-08-0	Carbon monoxide - Note 13	1.62E-02	0.00E+00	0.00E+00	0.00E+00	1.48E-02	0.00E+00	6.81E-03
7429-90-5	Aluminum	1.23E-10	3.87E-12	3.22E-08	1.67E-11	1.25E-10	2.69E-11	2.17E-11
7429-90-5	Aluminum (ppt) - Note 1	4.91E-15	9.47E-16	0.00E+00	5.38E-15	0.00E+00	0.00E+00	3.66E-15
7439-89-6	Iron - Note 3	6.09E-11	2.20E-12	2.64E-10	3.36E-12	6.24E-11	2.87E-13	9.75E-12
7439-92-1	Lead - Note 13	2.02E-11	1.73E-13	1.02E-10	2.09E-13	2.18E-12	1.86E-13	1.67E-12
7439-93-2	Lithium	7.84E-14	5.30E-15	3.71E-12	7.64E-14	1.07E-10	6.64E-14	1.14E-11
7439-95-4	Magnesium	1.00E-10	8.82E-14	2.20E-11	7.70E-14	1.01E-10	7.15E-12	5.40E-13
7439-96-5	Manganese	4.28E-10	6.65E-14	2.44E-11	4.68E-13	5.86E-10	1.29E-14	9.76E-13
7439-97-6	Mercury (elemental) - Note 4	6.34E-07	0.00E+00	0.00E+00	1.90E-06	1.17E-06	0.00E+00	2.18E-11
7439-97-6	Mercury (Hg+2)	8.40E-15	3.84E-13	2.39E-11	4.41E-13	1.83E-14	1.06E-11	1.03E-16
7439-98-7	Molybdenum	2.09E-10	2.02E-14	4.62E-11	1.48E-14	7.59E-11	8.20E-14	1.25E-14
7440-02-0	Nickel	1.87E-10	2.37E-14	1.64E-10	2.99E-13	2.53E-10	1.50E-13	5.88E-13
7440-16-6	Rhodium	4.70E-20	1.97E-19	3.91E-12	2.21E-15	5.93E-15	5.42E-15	1.44E-14
7440-22-4	Silver	6.58E-12	6.51E-16	4.77E-12	9.84E-15	7.87E-12	4.17E-15	1.03E-14
7440-23-5	Sodium	1.00E-06	1.52E-10	4.82E-07	7.06E-11	1.02E-06	3.21E-08	3.35E-11
7440-23-5	Sodium (ppt) - Note 5	0.00E+00	0.00E+00	0.00E+00	1.90E-11	6.43E-14	0.00E+00	0.00E+00
7440-24-6	Strontium (total)	3.29E-13	4.80E-17	7.92E-11	1.26E-13	6.65E-11	9.42E-14	3.39E-13
7440-25-7	Tantalum	1.86E-18	8.19E-21	2.94E-12	5.24E-16	8.73E-14	4.07E-15	2.43E-16
7440-28-0	Thallium	1.60E-16	2.28E-18	2.35E-11	2.08E-14	1.23E-11	6.23E-13	2.60E-14
7440-31-5	Tin	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7440-33-7	Tungsten	6.72E-12	2.95E-14	1.13E-11	9.60E-15	3.40E-13	1.58E-14	8.59E-15
7440-36-0	Antimony	2.01E-09	1.14E-13	1.79E-11	8.15E-15	4.57E-10	7.13E-15	2.91E-14
7440-38-2	Arsenic	2.69E-09	1.53E-13	1.79E-11	1.14E-14	4.55E-10	3.44E-14	1.09E-13
7440-39-3	Barium	4.41E-14	8.85E-18	3.78E-12	2.33E-14	3.16E-12	3.83E-15	6.66E-14
7440-41-7	Beryllium	1.68E-13	7.40E-16	8.80E-13	1.20E-15	2.61E-14	1.22E-15	1.13E-15
7440-43-9	Cadmium	1.92E-13	3.43E-15	1.65E-11	2.20E-14	1.46E-13	1.38E-14	4.77E-14
7440-47-3	Chromium - Note 2	8.71E-10	2.10E-12	2.62E-09	1.24E-12	6.71E-10	3.62E-12	2.05E-11
7440-48-4	Cobalt	7.50E-16	5.60E-18	4.57E-12	3.74E-15	3.83E-12	6.34E-15	3.83E-15
7440-50-8	Copper	6.04E-11	3.76E-15	6.11E-12	7.11E-15	5.34E-11	5.16E-15	7.48E-14
7440-61-1	Uranium	3.62E-12	1.59E-14	1.17E-10	1.10E-12	3.61E-12	1.68E-13	1.10E-12
7440-62-2	Vanadium	2.90E-10	1.53E-14	5.07E-12	6.31E-15	2.99E-10	1.07E-14	7.27E-15
7440-65-5	Yttrium	4.35E-13	6.03E-17	1.91E-12	1.35E-15	1.61E-12	3.02E-16	1.18E-15
7440-66-6	Zinc	8.52E-10	2.48E-12	6.89E-12	1.05E-13	8.54E-10	6.91E-15	3.93E-12
7440-67-7	Zirconium	1.54E-10	1.32E-13	9.95E-11	1.16E-12	1.55E-10	6.68E-14	3.70E-12
7446-09-5	Sulfur dioxide - Note 13	1.18E-06	0.00E+00	0.00E+00	0.00E+00	3.84E-06	0.00E+00	3.20E-04
7647-01-0	Hydrogen chloride	2.65E-02	0.00E+00	0.00E+00	0.00E+00	1.70E-02	0.00E+00	1.77E-02
7664-39-3	Hydrogen fluoride	5.60E-04	0.00E+00	0.00E+00	0.00E+00	6.19E-03	0.00E+00	9.81E-08

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Table 2-6 Estimated Abated Emission Rates for Inorganic Constituents of Potential Concern

CASRN	Inorganic COPC	DFLAW		Integrated WTP				
		Abated	Abated	Abated	Abated	Abated	Abated	Abated
		LVP18a	DEP18	PJV12	PVP13	LVP18a	PJV35	HOP31
		LAW	EMF	PJV	PT	LAW	PJV	HLW
		Exhaust	Exhaust	Exhaust	Exhaust	Exhaust	Exhaust	Exhaust
		g/sec	g/sec	g/sec	g/sec	g/sec	g/sec	g/sec
7664-41-7	Ammonia/Ammonium	2.56E+00	1.51E-08	1.30E-10	3.39E-11	1.86E+00	1.54E-10	2.35E-01
7704-34-9	Total sulfur - Note 9	7.11E-07	6.35E-13	9.60E-09	1.43E-12	2.31E-06	6.62E-10	1.92E-04
7723-14-0	Phosphorus - Note 8	1.40E-09	1.36E-12	9.19E-09	1.10E-11	8.87E-10	1.09E-10	7.38E-11
7782-41-4	Fluorine gas	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7782-49-2	Selenium	5.01E-13	2.57E-13	6.44E-11	9.38E-15	2.62E-13	3.38E-12	3.65E-14
7782-50-5	Chlorine	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PM	Particulate Matter - Note 12, 13	2.26E-04	4.91E-11	0.00E+00	1.03E-10	1.73E-04	0.00E+00	8.02E-05
NOx	Nitrogen oxides - Note 10	3.21E-01	0.00E+00	0.00E+00	1.29E-02	2.33E-01	0.00E+00	7.59E-02
SOx	Sulfur oxides - Note 11	1.18E-06	0.00E+00	0.00E+00	0.00E+00	3.84E-06	0.00E+00	3.20E-04
N/A	Criteria Pollutants - Note 13	1.42E-01	4.93E-11	1.02E-10	1.29E-02	1.07E-01	1.86E-13	3.81E-02
N/A	Greenhouse Gases - Note 14	1.62E-02	1.11E-05	8.68E-04	6.14E-06	1.48E-02	1.14E-06	6.81E-03
PM	Particulate Matter (tons/yr)	7.87E-03	1.71E-09	0.00E+00	3.57E-09	6.02E-03	0.00E+00	2.79E-03

Notes:

1. Aluminum (ppt) is aluminum ion precipitated as gibbsite.
2. Chromium includes Cr^{3+} and Cr^{6+} ions.
3. Iron includes Fe^{2+} and Fe^{3+} ions.
4. Hg (elemental) includes Hg (aqueous) and Hg (gaseous).
5. Na+p is sodium ion precipitated as sodium fluoride phosphate, sodium phosphate, or sodium oxalate.
6. Fluoride (ppt) is fluoride ion precipitated as sodium fluoride phosphate.
7. Phosphate (ppt) is phosphate ion precipitated as sodium fluoride phosphate or sodium phosphate
8. Phosphorus includes portions of phosphate, phosphate (ppt), dihydrogen phosphate, hydrogen phosphate, phosphorus dioxide, and diphosphorus pentoxide (s).
9. Total sulfur includes portions of sulfate, hydrogen sulfite, hydrogen sulfate, sulfite, sulfur dioxide, and sulfur trioxide (s).
10. Nitrogen oxides includes nitrogen dioxide and nitrogen oxide.
11. Sulfur oxides includes sulfur dioxide and sulfur oxide.
12. Particulate matter includes solid organics, solid cations, solid anions, solid radionuclides, sodium chloride (s), sodium cyanide (s), sodium fluoride (s), sodium iodide (s), diphosphorus pentoxide (s), and sulfur trioxide(s).
13. Criteria pollutants include ozone, nitrogen dioxide, carbon monoxide, lead, sulfur dioxide, and particulate matter.
14. Greenhouse gases include carbon monoxide and vinyl fluoride.

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Table 2-7 Estimated Abated Emission Rates for Radionuclide Constituents of Potential Concern

CASRN	Radionuclide COPC	DFLAW		Integrated WTP				
		Abated LVP18a LAW Exhaust Ci/sec	Abated DEP18 EMF Exhaust Ci/sec	Abated PJV12 PJV Exhaust Ci/sec	Abated PVP13 PT Exhaust Ci/sec	Abated LVP18a LAW Exhaust Ci/sec	Abated PJV35 PJV Exhaust Ci/sec	Abated HOP31 HLW Exhaust Ci/sec
10028-17-8	Tritium	1.19E-07	2.55E-12	2.79E-09	2.61E-11	1.86E-08	1.50E-10	2.25E-08
10045-97-3	Cesium-137	1.00E-14	1.88E-16	1.56E-10	5.27E-14	3.97E-15	3.50E-12	6.91E-13
10098-97-2	Strontium-90	9.21E-14	3.01E-16	3.72E-12	4.68E-14	1.50E-13	4.77E-15	1.33E-13
10198-40-0	Cobalt-60	4.53E-23	1.45E-25	7.34E-17	8.42E-20	2.94E-18	1.03E-19	8.91E-20
13966-29-5	Uranium-234	5.23E-20	5.93E-21	4.23E-17	3.40E-19	5.01E-20	6.17E-20	3.40E-19
13967-48-1	Ruthenium-106	3.88E-23	1.12E-24	4.58E-25	3.85E-28	3.93E-27	3.86E-24	2.63E-25
13967-70-9	Cesium-134	1.44E-21	2.71E-23	4.05E-19	1.31E-22	1.04E-23	9.15E-21	1.62E-21
13968-55-3	Uranium-233	1.78E-19	2.02E-20	9.37E-17	1.20E-18	1.10E-19	1.39E-19	1.20E-18
13981-15-2	Curium-244	5.92E-18	6.72E-19	8.41E-17	1.55E-19	9.79E-20	1.17E-19	1.48E-19
13981-16-3	Plutonium-238	7.34E-19	8.31E-20	4.30E-16	4.20E-18	5.05E-19	6.26E-19	4.20E-18
13981-37-8	Nickel-63	1.73E-16	2.28E-18	1.42E-13	1.45E-16	1.42E-15	1.31E-16	2.73E-16
13982-10-0	Plutonium-242	5.89E-22	6.67E-23	4.29E-19	1.11E-21	4.97E-22	5.39E-22	1.07E-21
13982-63-3	Radium-226	1.04E-20	5.82E-22	7.84E-20	2.19E-23	3.72E-21	2.19E-21	1.21E-22
13982-70-2	Uranium-236	1.73E-21	1.96E-22	1.31E-18	9.46E-21	1.55E-21	1.87E-21	9.42E-21
13994-20-2	Neptunium-237	5.09E-19	5.76E-20	2.41E-16	3.21E-19	2.83E-19	3.38E-19	3.01E-19
14119-32-5	Plutonium-241	1.03E-17	1.16E-18	1.62E-15	1.65E-17	1.92E-18	2.38E-18	1.65E-17
14119-33-6	Plutonium-240	3.80E-18	4.30E-19	1.32E-15	1.41E-17	1.55E-18	1.93E-18	1.42E-17
14133-76-7	Technetium-99	3.78E-13	6.97E-15	4.48E-13	6.03E-17	2.11E-13	2.48E-14	8.70E-15
14158-29-3	Uranium-232	3.29E-21	3.74E-22	2.00E-18	1.44E-20	2.35E-21	2.90E-21	1.44E-20
14234-35-6	Antimony-125	3.12E-15	4.82E-18	9.43E-18	2.96E-21	1.50E-17	3.66E-21	9.34E-21
14331-85-2	Protactinium-231	7.37E-27	8.17E-28	2.73E-17	1.16E-20	3.17E-20	3.77E-20	9.09E-21
14336-70-0	Nickel-59	2.30E-18	3.02E-20	2.40E-15	2.30E-18	2.39E-17	2.21E-18	4.30E-18
14391-16-3	Europium-155	5.96E-24	6.61E-25	8.95E-17	4.70E-19	1.06E-19	1.29E-19	4.66E-19
14596-10-2	Americium-241	1.80E-16	1.52E-17	5.44E-14	4.16E-16	1.25E-16	1.20E-16	4.19E-16
14683-23-9	Europium-152	2.79E-24	3.09E-25	4.83E-16	7.35E-19	5.68E-19	6.79E-19	6.96E-19
14762-75-5	Carbon-14	1.13E-06	2.26E-13	8.05E-15	1.12E-18	5.74E-07	7.88E-15	9.23E-08
14952-40-0	Actinium-227	5.31E-20	6.03E-21	1.99E-17	1.20E-20	2.31E-20	2.74E-20	1.02E-20
14993-75-0	Americium-243	1.04E-19	8.81E-21	2.43E-17	1.79E-19	5.58E-20	5.28E-20	1.80E-19
15046-84-1	Iodine-129	1.64E-09	2.45E-18	3.92E-16	5.27E-20	9.41E-10	3.52E-16	4.89E-12
15046-84-1	Iodine-129(s)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
15117-48-3	Plutonium-239	1.63E-17	1.85E-18	6.36E-15	6.74E-17	7.47E-18	9.30E-18	6.75E-17
15117-96-1	Uranium-235	2.12E-21	2.40E-22	1.63E-18	1.28E-20	1.93E-21	2.37E-21	1.27E-20
15262-20-1	Radium-228	6.37E-19	3.56E-20	2.47E-18	1.96E-20	1.11E-19	6.52E-20	2.71E-20
15510-73-3	Curium-242	4.83E-18	5.48E-19	8.75E-17	1.38E-19	1.02E-19	1.22E-19	1.31E-19
15585-10-1	Europium-154	1.62E-23	1.79E-24	1.50E-15	7.15E-18	1.78E-18	2.16E-18	7.08E-18
15594-54-4	Thorium-229	3.70E-27	4.11E-28	1.22E-18	3.63E-21	1.43E-21	1.75E-21	2.11E-21
15715-94-3	Samarium-151	1.64E-20	1.82E-21	2.39E-12	5.08E-15	2.80E-15	3.35E-15	3.58E-15
15751-77-6	Zirconium-93	1.53E-22	4.03E-24	1.44E-14	4.75E-18	3.86E-17	9.39E-18	4.65E-18
15757-87-6	Curium-243	3.43E-19	3.90E-20	6.84E-18	1.20E-20	7.96E-21	9.60E-21	1.15E-20
15758-45-9	Selenium-79	7.95E-17	4.07E-17	1.00E-14	1.36E-18	4.96E-17	5.18E-16	4.71E-18
15832-50-5	Tin-126	1.94E-17	2.20E-18	9.50E-15	2.34E-18	1.10E-17	1.31E-17	1.44E-18
378253-44-2	Cadmium-113m	1.73E-16	3.58E-18	4.67E-15	1.17E-18	2.85E-17	3.86E-17	1.01E-17
378782-82-2	Niobium-93m	5.92E-23	6.57E-24	1.54E-14	5.09E-18	1.80E-17	2.12E-17	3.64E-18
7440-18-8	Ruthenium-103	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7440-29-1	Thorium-232	8.14E-27	9.03E-28	1.98E-18	1.48E-20	2.33E-21	2.90E-21	1.47E-20
7440-61-1R	Uranium-238	4.69E-20	5.33E-21	5.00E-17	3.68E-19	5.92E-20	7.28E-20	3.67E-19
Total Radionuclide COPCs		1.25E-06	2.78E-12	2.95E-09	2.62E-11	5.93E-07	1.54E-10	1.15E-07

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3 Study Bases

3.1 Estimation Tool

The emissions estimate is prepared using the Process Emissions model (24590-WTP-UIF-PE-18-0001) which is an approved software for use at WTP (this software is on the list of the approved Project Software Baseline). Process Emissions model is a level D, non-IHLW software (24590-WTP-PSRA-PE-18-0001) and the software design and implementation details are provided in the software life cycle document, 24590-WTP-SWLCD-PE-18-0001-02. This model provides a steady-state representation of standard set of plant configurations identified in Section 1.2.1.

Twelve Process Emissions model runs were performed for each DFLAW and Integrated WTP configurations to determine COPC emission rates and mass fractions in the streams of interest. Several model runs were needed to determine emission rates for 312 organic constituents (309 COPCs and 3 non-COPCs) using constituent-specific physical property data (such as molecular weight, vapor fraction, PIC generation, Henry's Law Constant) and mass in the feed. Refer to Section 7.5 of 24590-WTP-M4C-V20T-00001, *Emissions Estimate for DFLAW and Integrated WTP configurations* for details.

3.2 Methodology

Refer to sections 5 and 6 of the supporting engineering calculation, 24590-WTP-M4C-V20T-00001 for details on the methodology and assumptions used in developing the emissions estimate for DFLAW and integrated WTP flowsheet configurations.

The methodology used in 24590-WTP-M4C-V20T-00001 to estimate emission rates for organic, inorganic, and radionuclide COPCs is summarized in Table 3-1. Terms used in this table are defined below:

- Henry's Law: Method applied on vapor-liquid process that determines the partitioning of organic constituents into vapor and liquid phases. Refer to section 5.2.1.3 of 24590-WTP-M4C-V20T-00001 for details.
- Decontamination factor (DF): Value applied to incoming quantity of COPCs to predict removal by offgas treatment system. Refer to section 5.2.1.1 of 24590-WTP-M4C-V20T-00001 for details.
- Destruction and removal efficiency (DRE): Percentage of constituent quantity that is destroyed and (or) removed in a unit operation.
- Release Fraction: Value used for determining entrained mass rate of aerosols into PJM vent and equipment offgas streams.
- Combustion Reactions: Used to decompose incoming PIC quantity and a fraction of feed organic quantity (depending on the DF used) in melters and oxidizers. Refer to sections 5.2.3.5 and 5.2.3.7 of 24590-WTP-M4C-V20T-00001 for details.
- Minimum DRE of 99.99%: Permit condition that requires that a minimum destruction and removal efficiency of 99.99% is achieved for organic constituents present in the feed (non-PICs) in the LAW and HLW melter offgas systems. Refer to section 4.1 of 24590-WTP-M4C-V20T-00001 for details.

- PIC Generation: PIC quantity generated at the melters and oxidizers. It is determined based on PIC conversion factors applied to the total organic carbon in the melter feed. Refer to sections 5.2.3.5 and 5.2.3.7 of 24590-WTP-M4C-V20T-00001 for details.
- Entrainment: Coefficient applied to aqueous and solid phases in vessels for determining entrained mass rate in the vent stream. Refer to section 5.2.1.4 of 24590-WTP-M4C-V20T-00001 for details.
- Mass distribution ratio (MDR): For evaporators and condensers only, ratio applied on the quantity of in the aqueous phase for determining entrained mass rate in the evaporator overheads and condenser vents. Refer to section 5.2.1.1 of 24590-WTP-M4C-V20T-00001 for details.

Table 3-1 layout is described below:

- Table 3-1 is divided into five horizontal sections. The first four sections present the methodologies applied on COPCs at each offgas equipment in the four PT and VIT systems: LAW VIT offgas system, HLW VIT offgas system, EMF vessel vent system and Pretreatment vessel vent and PJM vent treatment systems. The fifth section presents the methodologies applied in the vessels, evaporators and condensers in all PT, VIT and EMF facilities.
- Table 3-1 is divided into three vertical sections for three different constituent types: organics, inorganics and radionuclides. These sections describe how each constituent type is handled in the corresponding unit operation (listed in the first column).
- Since organics are categorized as feed, PIC or both and tracked in four different phases (vapor, particle-bound, aqueous and solids), the 'Organics' section is further divided into four columns. The first column in the 'Organics' section presents the feed/PIC category. The next three columns describe how the feed/PIC organic COPCs in the vapor, particle-bound and aqueous/solid phases are handled in each unit operation (listed in the first column).
- Since inorganics include cations/anions and inorganic gases (such as HCl, NO, CO, etc.), the 'Inorganics' section is divided into two sections. These columns present methodologies applied on inorganics in the aqueous/solid and gaseous phases.
- The last column in Table 3-1 describes how radionuclides in both aqueous and solid phases are handled in the corresponding unit operation (listed in the first column).

The description of how the constituents are handled in the LAW VIT melter is provided below as an example:

- Organics (feed): Quantities in the vapor and particle-bound phases in the melter offgas are determined using a DF and vapor fraction (F_v). Combustion reactions are applied if the assumed DRE is non-zero (which indicates a non-unity DF).
- Organics (PIC): PIC quantities in the vapor and particle-bound phases in the melter offgas are determined using PIC generation and vapor fraction (F_v). The incoming PIC quantities in the aqueous/solid phases are decomposed using combustion reactions.
- Inorganics (aqueous/solid phases): The aqueous and solid phase quantities in the melter offgas are determined using DFs and chemical reactions.
- Inorganics (gases): The quantities of inorganics in the vapor phase in the melter offgas are a result of chemical reactions in the melter.
- Radionuclides (aqueous/solid phases): The aqueous and solid phase quantities in the melter offgas are determined using DFs.

The description of how the constituents are handled in the LAW VIT SBS is provided below:

- Organics (Feed/PIC): Same methodology is applied on both feed and PIC organic COPCs. The vapor phase quantity in the SBS offgas is determined by the application of Henry's law. The quantity in the particle bound phase in the SBS offgas is determined using the DF. The quantities in the aqueous/solid phases in the SBS offgas are determined by the release fraction.
- Inorganics (aqueous/solid phases): The aqueous and solid phase quantities in the SBS offgas are determined using DFs, release fraction and chemical reactions (if applicable).
- Inorganics (gases): The quantities of inorganics in the vapor phase in the SBS offgas are determined using DFs and chemical reactions (if applicable).
- Radionuclides (aqueous/solid phases): The aqueous and solid phase quantities in the SBS offgas are determined using DFs and release fraction.

Similarly, the methodology summary provided in Table 3-1 can be used to understand how each type of constituent is handled in different unit operations in the Process Emissions Model.

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Table 3-1 Methodology Summary for Organics, Inorganics and Radionuclide Constituents

	Organics				Inorganics			Radionuclides
Equipment/Unit	**Feed/PIC**	**Vapor Phase**	**Particle-Bound Phase**	**Aqueous/Solid Phases**	**Aqueous/Solid Phases**	**Gases (e.g., CO, HCl, SO_2, DMHg etc.)**	**Notes**	**Aqueous/Solid Phases**
LAW VIT Offgas System								
LAW Melter	Feed	DF & F_v	DF & F_v	Combustion Reaction (if applicable)	DF/Chemical Reactions	Chemical Reactions	Chemical reactions with some inorganics generate gases	DF
	PIC	PIC Generation & Fv	PIC Generation & Fv	Combustion Reaction				
LOP Submerged Bed Scrubber	Feed/PIC	Henry's Law	DF	Release fraction determines entrainment	DF & Release Fraction & Chemical Reaction (if applicable)	DF/Chemical Reactions (if applicable)		DF & Release Fraction
LOP Wet Electrostatic Precipitator	Feed/PIC	DF	DF	DF & Release Fraction	DF & Release Fraction & Chemical Reaction (if applicable)	DF/Chemical Reactions (if applicable)		DF & Release Fraction
LVP HEPA Filters	Feed/PIC	DF	DF	DF	DF	DF	Vapors pass through the HEPA filters. A DF of 1 is used	DF
LVP Carbon Bed Adsorber	Feed/PIC	N/A	N/A	N/A	DF	DF (if applicable)	Only some removal of mercury and iodine is considered	DF (if applicable)
LVP Oxidizer	Feed	DF (if necessary, adjusted to achieve a minimum DRE of 99.99% in the melter offgas system & Combustion Reaction	DF & Combustion Reaction	DF & Combustion Reaction	N/A	DF (if applicable)	Only a few gases such as CO and SO_2 are oxidized	N/A
	PIC	PIC Generation & Fv	PIC Generation & Fv	Combustion Reaction				
LVP Catalytic Reducer Bed	Feed/PIC	N/A	N/A	N/A	N/A	DF (if applicable)	Only NO_x is reduced to N_2	N/A
LVP Scrubber	Feed/PIC	DF	DF	DF & Release Fraction	DF & Release Fraction & Chemical Reaction (if applicable)	DF/Chemical Reactions (if applicable)	Only some removal of SO_x, acid gases, CO_2 and NO_2 is considered	DF & Release Fraction
EMF Vessel Vent System								
DEP HEPA Filters	Feed/PIC	DF	DF	DF	DF	DF	Vapors pass through the HEPA filters. A DF of 1 is used	DF
HLW VIT Offgas System								
HLW Melter	Feed	DF & F_v	DF & F_v	Combustion Reaction (if applicable)	DF/Chemical Reactions	Chemical Reactions	Chemical reactions with some inorganics generate gases	DF
	PIC	PIC Generation & Fv	PIC Generation & Fv	Combustion Reaction				

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	Organics				Inorganics			Radionuclides
Equipment/Unit	**Feed/PIC**	**Vapor Phase**	**Particle-Bound Phase**	**Aqueous/Solid Phases**	**Aqueous/Solid Phases**	**Gases (e.g., CO, HCl, SO_2, DMHg etc.)**	**Notes**	**Aqueous/Solid Phases**
HOP Submerged Bed Scrubber	Feed/PIC	Henry's Law	DF	Release fraction determines entrainment	DF & Release Fraction & Chemical Reaction (if applicable)	DF/Chemical Reactions (if applicable)		DF & Release Fraction
HOP Wet Electrostatic Precipitator	Feed/PIC	DF	DF	DF & Release Fraction	DF & Release Fraction & Chemical Reaction (if applicable)	DF/Chemical Reactions (if applicable)		DF & Release Fraction
HOP High Efficiency Mist Eliminator	Feed/PIC	DF	DF	DF & Release Fraction	DF & Release Fraction & Chemical Reaction (if applicable)	DF/Chemical Reactions (if applicable)		DF & Release Fraction
HOP HEPA Filters	Feed/PIC	DF	DF	DF	DF	DF	Vapors pass through the HEPA filters. A DF of 1 is used	DF
HOP Carbon Bed Adsorber	Feed/PIC	N/A	N/A	N/A	DF	DF (if applicable)	Only some removal of mercury and iodine is considered	DF (if applicable)
HOP Silver Mordenite Column	Feed/PIC	N/A	N/A	N/A	N/A	DF (if applicable)	Only some removal of iodine and halide gases is considered	N/A
HOP Oxidizer	Feed	DF (if necessary, adjusted to achieve a minimum DRE of 99.99% in the melter offgas system & Combustion Reaction	DF & Combustion Reaction	DF & Combustion Reaction	N/A	DF (if applicable)	Only a few gases such as CO and SO_2 are oxidized	N/A
	PIC	PIC Generation & Fv	PIC Generation & Fv	Combustion Reaction				
HOP Catalytic Reducer Bed	Feed/PIC	N/A	N/A	N/A	N/A	DF (if applicable)	Only NO_x is reduced to N_2	N/A
PT Vessel Vent System								
PVP Scrubber	Feed/PIC	Henry's Law	N/A	DF & Release Fraction	DF & Release Fraction & Chemical Reaction (if applicable)	DF/Chemical Reactions (if applicable)		DF & Release Fraction
PVP High Efficiency Mist Eliminator	Feed/PIC	DF	N/A	DF & Release Fraction	DF & Release Fraction & Chemical Reaction (if applicable)	DF/Chemical Reactions (if applicable)		DF & Release Fraction
PVP HEPA	Feed/PIC	DF	N/A	DF	DF	DF	Vapors pass through the HEPA filters. A DF of 1 is used	DF
PVP Oxidizer	Feed/PIC	DF & Combustion Reaction	N/A	DF & Combustion Reaction	N/A	N/A		N/A
PVP Carbon Bed Adsorber	Feed/PIC	DF	N/A	DF	DF (if applicable)	DF (if applicable)		DF (if applicable)
PJV Demister	Feed/PIC	DF	N/A	DF & Release Fraction	DF & Release Fraction & Chemical Reaction (if applicable)	DF/Chemical Reactions (if applicable)		DF & Release Fraction
PJV HEPA	Feed/PIC	DF	N/A	DF	DF	DF	Vapors pass through the HEPA filters. A DF of 1 is used	DF
Vessels, Evaporators and Condensers								

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	Organics				Inorganics			Radionuclides
Equipment/Unit	**Feed/PIC**	**Vapor Phase**	**Particle-Bound Phase**	**Aqueous/Solid Phases**	**Aqueous/Solid Phases**	**Gases (e.g., CO, HCl, SO_2, DMHg etc.)**	**Notes**	**Aqueous/Solid Phases**
Vessels	Feed/PIC	Henry's Law	N/A	Vessel Vent Entrainment/PJM Release Fraction (if applicable)	Vessel Vent Entrainment/ Pulse Jet Mixer Release Fraction. Chemical Reactions (if applicable)	DMHg formation	Precipitation and dissolution of oxalate, gibbsite and phosphate	Vessel Vent Entrainment/ Pulse Jet Mixer Release Fraction (if applicable)
Evaporator	Feed/PIC	Henry's Law	N/A	Entrainment (using MDRs)	Entrainment (using MDRs)	DMHg formation	Precipitation and dissolution of oxalate, gibbsite and phosphate	Entrainment (using MDRs)
Condenser	Feed/PIC	Henry's Law	N/A	Entrainment (using MDRs)	Entrainment (using MDRs)	N/A		Entrainment (using MDRs)

Notes:

DEP = DFLAW EMF process system

LOP = LAW primary offgas process system

LVP = LAW secondary offgas/vessel vent process system

PJM = pulse jet mixer

PJV = pulse jet ventilation system

PVP = pretreatment vessel vent process system

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4 Description of Alternatives/Solutions Considered

Not applicable. This engineering study is not a comparative study and does not provide any recommendation to support engineering design. Therefore, this section is not applicable. As discussed in Section 1, the objective of this study is to provide an emissions estimate for both DFLAW and integrated WTP flowsheet configurations.

5 Selection of Recommended Alternative/Solution

Not applicable. See Section 4 for details.

6 Sources (References)

6.1 Project Documents

24590-101-TSA-W000-0009-166-00001, Rev B, Final Report – Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants.

24590-WTP-M4C-V20T-00001, Rev B, Emissions Estimate for DFLAW and Integrated WTP Configurations.

24590-WTP-PSRA-PE-18-0001, Rev 0, Project Software Risk Assessment for EPCC – Process Emissions Model.

24590-WTP-RPT-ENV-10-001, Rev 0, *Constituents of Potential Concern for the WTP Air and Dangerous Waste Permits*.

24590-WTP-RPT-ENV-14-002, Rev 0, *Environmental Risk Assessment Work Plan for the Hanford Tank Waste Treatment and Immobilization Plant*.

24590-WTP-RPT-ENV-16-001, Rev 0, *Feed Vector Development in Support of WTP Environmental Risk Assessment Activities* (RPP-RPT-58656, Rev 0). Washington River Protection Solutions, Richland, WA.

24590-WTP-RPT-ENV-17-008, Rev 0, *Cell Emissions Estimate*.

24590-WTP-RPT-PE-11-010, Rev 0, *WTP Feed and Organic Generation Rates and Decontamination Factors for 2011-2012 Emissions Report*.

24590-WTP-RPT-PO-03-008, Rev 2, *Integrated Emissions Baseline Report for the Hanford Tank Waste Treatment and Immobilization Plant*.

24590-WTP-SWLCD-PE-18-0001-02, Rev 1, *Process Emissions Model Software Life Cycle Document*

24590-WTP-UIF-PE-18-0001, Rev 0, *Process Emissions Model*

6.2 Codes and Standards

None.

6.3 Other Documents

WA7890008967. *Dangerous Waste Portion of the Hanford Facility Resource Conservation and Recovery Act Permit for the Treatment, Storage, and Disposal of Dangerous Waste* (Hanford Facility RCRA Permit – Dangerous Waste Portion). Washington State Department of Ecology, Olympia, WA

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Figures

No table of figures entries found.

Acronyms, Executive Summary, etc.

CNP	cesium nitric acid recovery process system
CXP	cesium ion exchange process system
DFLAW	Direct Feed Low-Activity Waste
DWP	Dangerous Waste Permit
EPA	US Environmental Protection Agency
Ecology	Washington State Department of Ecology
FEP	waste feed evaporation process system
FRP	waste feed receipt process system
HCP	HLW concentrate receipt process system
HEPA	high-efficiency particulate air (filter)
HFP	HLW melter feed process system
HLP	HLW lag storage and feed blending process system
HLW	high-level waste
LAW	low-activity waste
LCP	LAW concentrate receipt process system
LFP	LAW melter feed process system
PIC	products of incomplete combustion
PT	Pretreatment Facility
PWD	plant wash and disposal system
RDP	spent resin collection and dewatering process system
RLD	radioactive liquid waste disposal system
SOCMI	synthetic organic chemical manufacturing industry
TCP	treated LAW concentrate storage process system
TLP	treated LAW evaporation process system
TOC	total organic carbon
UFP	ultrafiltration process system
VOC	volatile organic compound
WTP	Hanford Tank Waste Treatment and Immobilization Plant

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1 Introduction

The purpose of this report is to provide an estimate of the potential emission of volatile organic compounds (VOC) from ancillary equipment located within the Hanford Tank Waste Treatment and Immobilization Plant (WTP) process cells containing raw waste. The WTP will be operated in two processing configurations. For near-term operations, WTP will be operated in a Direct Feed Low-Activity Waste (DFLAW) operating configuration involving the LAW Facility, the EMF and the Lab. In the DFLAW operating configuration, the waste is pretreated within the Hanford tank farms to remove cesium and solids. The LAW Facility is where the low-activity fraction of the waste is solidified by vitrification. Liquid effluents generated in the LAW Facility are transferred and treated at the EMF. The EMF is not included in this estimate because no raw waste will be in the process cells.

The WTP will later be operated in the baseline WTP operating configuration when the PT Facility and the HLW Facility become operational. The PT Facility will both separate and pretreat the LAW and HLW, and manage recycle waste streams produced from the LAW and HLW waste treatment operation. Treated LAW and HLW will be transferred to the respective LAW and HLW Facilities for vitrification. The three production process facilities (i.e., PT, LAW, and HLW) are also supported by the BOF and Lab. The EMF does not support the baseline WTP operating configuration.

The WTP risk assessment, as described in 24590-WTP-RPT-ENV-14-002, *Environmental Risk Assessment Work Plan for the Hanford Tank Waste Treatment and Immobilization Plant*, requires emission estimates as inputs. According to the *Human Health Risk Assessment Protocol* (EPA 2005), one type of emission that may be associated with burning hazardous waste (in addition to stack emissions) may be fugitive emissions. Fugitive emissions "means emissions that could not reasonably pass through a stack, chimney, vent, or other functionally equivalent opening", as defined in WAC-173-400-030(39), *Definitions*.

The WTP process cells will be operated under negative pressure with respect to atmospheric pressure, and the air from the process cells will be released to the atmosphere through a stack or flue. Since the WTP will not have emissions that do not pass through a stack or flue, by definition, the fugitive emissions from the facility will be zero.

However, the WTP emissions will consist of vapor phase organics that are assumed to be derived from valves and other ancillary equipment with the potential to leak in WTP process cells. These vapor-phase organic emissions are analogous to fugitive emissions in that the vapor-phase will be unabated by the high efficiency particulate air (HEPA) filtration systems that control particulate emissions from process cells. Ecology requests that WTP estimate the potential emission of organic compounds that are not abated by the WTP offgas treatment systems[1].

In response to that request, this is an estimate of the potential unabated emission of organic compounds from the WTP process cells. This estimate is based upon the US Environmental Protection Agency (EPA) guidance documents.

2 Methodology

The emission estimate of vapor-phase organic compounds is made using the following process:

[1] There are three inorganic compounds (Dimethyl Mercury, Mercury, and Ammonia/Ammonium) and one radionuclide (Tritium) that are volatile and they are calculated through the same methodology as the organic compounds.

- Estimate the annual release of volatile organic material into the process cells from ancillary equipment for both the integrated and DFLAW configurations
  - Tritium is divided by the specific activity to be constant with units (g/s) of other compounds as it is the only volatile radionuclide
- Determine the weight fraction of individual organic compounds in the streams being evaluated
- Apportion the annual release of organic material to the individual organic compounds
- Apply cancellation abatement to the applicable organic compounds

2.1 Release Estimation

The following sections present the formula for estimating the release of organic compounds from ancillary equipment within process cells and describes adjustments to the formula based upon the design and operation of the WTP.

2.1.1 Release Estimate Formula

The estimated release of organic material from ancillary equipment is calculated using the EPA guidance document, *Protocol for Equipment Leak Emission Estimates* (EPA 1995). This guidance provides several different methods to determine releases. The guidance recommends using the method that best matches the type of process being evaluated and the data available on the process. Since the WTP is not in operation, actual release measurements are not available, thus average release factors, given in the guidance, are used for the calculation. The formula (given in the EPA guidance [EPA 1995] Section 2.3.1 and adapted for this estimate) for estimating releases using the average release factors is:

$$E_{HO}\left(\frac{kg}{yr}\right) = N \times R_{avg}\left(\frac{kg}{hr}\right) \times WF_s\left(\frac{mg}{kg}\right) \times \frac{1\ kg}{1000000\ mg} \times H\left(\frac{hr}{yr}\right)$$

Where:
E_{HO} = estimated annual release of organic compounds
N = ancillary equipment count by equipment type
R_{avg} = average release factor by equipment type
WF_S = weight fraction of organic material by waste stream
H = hours of operation

An explanation of each formula value is discussed in the following sections, and the estimations are presented in Appendix A, Table 1.

2.1.2 Count of Ancillary Equipment by Equipment Type (*N*)

The EPA guidance (EPA 1995) states that the following ancillary equipment types are sources of potential release:

- Valves
- Pump seals
- Compressor seals
- Pressure relief valves
- Connectors
- Agitator seals
- Open-ended lines

- Sampling connections

Only WTP equipment that has the potential to release and is applicable to the WTP Dangerous Waste Permit (WA7890008967, herein referred to as the DWP) is included in the ancillary equipment count. The sections below (Sections 2.1.2.1 through 2.1.2.8) discuss the potential to emit for each of these ancillary types as they pertain to the design and operation of the WTP, and concludes that only, valves and jumper connections have the potential to release. Section 2.1.2.9 describes how the equipment count is obtained for each facility.

2.1.2.1 Valves

Valves that contact the waste are included in the release estimate.

2.1.2.2 Pumps

Reverse flow diverter pumps are not considered in the estimation since the associated offgasses will be captured in process vessel ductwork, treated by the offgas treatment train, and released from the plant stack. The resultant estimated emissions are already included in calculation 24590-WTP-M4C-V20T-00001, *Emissions Estimate for DFLAW and Integrated WTP Configurations*

Pumps within the vessels have seals in the vapor space of the vessel, and the vessels will be under one to two inches of water gauge vacuum. The EPA guidance (EPA 1995) considers equipment under vacuum to be zero release.

Canned pumps are completely enclosed and do not have a shaft seal separating the waste from the environment (room/cell). It is assumed that there is no potential for release from these types of “canned pumps” that are fully encased.

The WTP will also use conventional, centrifugal pumps that contact the waste. Some of these pumps will be equipped with double mechanical seals with an inert barrier fluid are greater pressure than the waste. It is assumed that there is no potential for release from these types of pumps with a double mechanical seal.

2.1.2.3 Compressors

The design of the WTP does not include compressors that contact the waste.

2.1.2.4 Pressure relief valves

Pressure relief valves on the process vessels and tanks are not considered sources of release in this estimation since all of the process vessels and tanks that manage the Hanford tank waste will operate under one to two inches of water gauge vacuum. The EPA guidance (EPA 1995) considers equipment under vacuum to be zero release.

2.1.2.5 Connections

Welded connections are considered to be zero release in the EPA guidance (EPA 1995). Other types of connectors such as gasket flanged connections that contact the waste are included in this estimate.

2.1.2.6 Agitator seals

Most of the process vessels that are agitated will use pulse jet mixers located within the vessels being agitated. Emissions from pulse jet mixers were not included in this estimation since these offgases will be captured in the process vessel ductwork, treated by the offgas treatment train, and released from the plant stack. The resultant estimated emissions are already included in 24590-WTP-M4C-V20T-00001.

Certain vessels will employ mechanical agitators that do employ a seal. These seals will be in the vapor space of the vessel, and the vessels will be under one to two inches of water gauge vacuum. The EPA guidance (EPA 1995) considers equipment under vacuum to be zero release.

2.1.2.7 Open-ended lines

The design of the WTP does not include open-ended lines.

2.1.2.8 Sampling systems

Sampling systems in the WTP will be closed-loop and are considered in the EPA guidance (EPA 1995) to be zero emission.

2.1.2.9 Obtaining the Equipment Count

The counts of valves and jumper connections are obtained from the WTP Component Information System. Only equipment that are DWP-applicable based off of the critical systems list in Appendix 2 of the DWP (e.g., only equipment in direct contact with waste) are considered. The ancillary equipment counts are sorted by the waste streams listed in Section 2.1.4 and are assumed to include the following:

- The Pretreatment stream includes equipment from the cesium nitric acid recovery process system (CNP), the cesium ion exchange process system (CXP), the waste feed evaporation process system (FEP), the LAW waste feed receipt process system (LAW FRP), the HLW waste feed receipt process system (HLW FRP), the HLW lag storage and feed blending process system (HLP), the plant wash and disposal system (PWD), the spent resin collection and dewatering process system (RDP), the radioactive liquid waste disposal system (RLD), the treated LAW concentrate storage process system (TCP), the treated LAW evaporation process system (TLP), and the ultrafiltration process system (UFP). (CCN 293284, *Valves and Connectors for Hot Cell Emissions Calculation*)

- The LAW stream includes equipment from the LAW concentrate receipt process system (LCP), the LAW melter feed process system (LFP), and the RLD. (CCN 276646, *Law Facility-LCP, LFP, LMP, & RLD Valve and Component Connection Types*)

- The HLW stream includes equipment from the HLW concentrate receipt process system (HCP), the HLW melter feed process system (HFP), and the radioactive liquid waste disposal system (RLD). (CCN 296730)

Table 1 of Appendix A gives the ancillary equipment count by equipment type, *N*. Note that the equipment counts are divided by a factor of 0.85 to account for equipment that may not be incorporated into the final design of a facility.

2.1.3 Average Release Factors (R_{avg})

The EPA developed the average release factors (R_{avg}) through extensive measurements of actual processes in operation. This estimation uses average release factors developed for the synthetic organic chemical manufacturing industry (SOCMI) since some processes for WTP are similar to the processes used in SOCMI.

The SOCMI average release factors for valves are based upon the type of service. The EPA guidance (EPA 1995) defines the types of services as:

- Gas/vapor – material in a gaseous state at operating conditions
- Light liquid – material in a liquid state in which the sum of the concentration of individual constituents with a vapor pressure over 0.3 kilopascals at 20°C is greater than or equal to 20 weight percent
- Heavy liquid – not in a gas/vapor service or light liquid service

The release factor for heavy liquid service is used in this calculation since the total organic carbon (TOC) content of the Hanford waste is bounded at 10% by weight (Ecology 2012). As long as the TOC is under 20% by weight, the fluid is still considered to be heavy liquid service (EPA 2005).

The average release factors for connectors is the same regardless of the type of service. Table 1 in Appendix A shows the average release factors, R_{avg}, applicable to the WTP.

2.1.4 Weight Fraction of Organic Material

The EPA guidance (EPA 1995) states that the weight fraction (WF_s) must be determined for each waste stream under evaluation. The 18 waste streams are evaluated for this estimation of ancillary equipment releases under the baseline configuration[2]. These 18 waste streams[3] are grouped by facility as follows:

- **Pretreatment**
  - CNP
  - CXP
  - FEP
  - LAW FRP
  - HLW FRP
  - HLP
  - PWD
  - RDP
  - RLD
  - TCP
  - TLP
  - UFP
- **LAW**
  - LCP
  - LFP

[2] Note that the DFLAW configuration only has the 3 waste streams associated with LAW.
[3] The waste streams were taken from the critical systems list from Appendix 2 of the Dangerous Waste Permit. These are the systems that come in contact with the waste.

- RLD
- **HLW**
- HCP
- HFP
- RLD

Section 3 addresses the determination of the weight fraction of the individual organic compounds in each of the 18 evaluated streams. The individual weight fractions are summed for each of the evaluated streams and entered into Table 1 of Appendix A as the respective waste stream organic weight fraction, WF_s.

2.1.5 Hours of Operation (*H*)

The estimation uses 8760 hours of operation which represents continuous operation for a year. The operation hours used is conservative since the average operational availability of the WTP is approximately 71% as determined in 24590-LAW-RPT-ENG-01-001, *LAW Vitrification Capacity and Availability Study*. In addition, most of the transfer pipes will remain empty between transfers and will be flushed with water after transfer to prevent solids from settling in the line and to minimize corrosion.

2.1.6 Estimated Release of Organic Material (E_{HO})

Table 1 of Appendix A gives the estimated release of organic material E_{HO}, into the pretreatment process cells from the twelve pretreatment plant feed streams, as well as the three LAW streams and three HLW streams.

3 Weight Fraction of Individual Organic Compounds

The following sections discuss the determination of the weight fraction of each organic compound in each of the eighteen evaluated streams

3.1 Weight Fraction of Organic Compounds

The study 24590-WTP-M4C-V20T-00001, *Emissions Estimate for DFLAW and Integrated WTP Configurations*, estimates the mass flow rate of the organic compounds in the waste using a computer model. The model estimates the mass flow rate for each of the organic compounds in the twelve pretreatment systems, the three LAW systems, and the three HLW systems shown in Appendix A, Tables A-2 through A-19 . Tritium is converted from a mass flow rate in curies/year to gram/second by dividing by the specific activity from 10 Code of Federal Regulations 71 Appendix A. This allows the tritium WF_i to be in the same unit of measure as the organic compounds.

The formula given in the EPA guidance (EPA 1995) in Section 2.3.1 to estimate the release of organic compounds requires the organic concentration to be expressed as a weight fraction. The mass flow rates are converted to weight fractions using the respective density for the eighteen streams in regards to its correlating configuration. This estimate uses the density of the liquid phase of the waste stream being evaluated since the model apportions the organic compounds to the liquid phase.

Then the weight fraction is calculated using the following formula giving final units in milligram/kilogram:

$$WF_i = \frac{Q_m\left(\frac{g}{s}\right) * 1000\left(\frac{mg}{g}\right)}{Q_v\left(\frac{m^3}{hr}\right) * \left(\frac{1hr}{60\,min} * \frac{1min}{60\,sec}\right) * \rho\left(\frac{kg}{m^3}\right)}$$

Where:
WF_i = the weight fraction of the constituent *i*
Q_m = mass flow rate of the individual organic compounds
Q_v = volumetric flow rate of the valuated stream
ρ = density of the liquid phase of the evaluated stream

The individual weight fractions are summed to yield the waste stream organic weight fraction, WF_s (mg/kg) according to the following formula:

$$WF_s = \sum WF_i$$

Tables A-2 through A-13 of Appendix A shows the mass flow rate and conversion to a weight fraction for each of the organic compounds for the pretreatment streams (CNP, CXP, FEP, LAW FRP, HLW FRP, HLP, PWD, RDP, RLD, TCP, TLP, UFP). Tables A-14 through A-19 of Appendix A present the same information for the LAW (LCP, LFP, RLD) and HLW (HCP, HFP, RLD) streams respectively.

4 Estimated Release of Organic Compounds

The *Human Health Risk Assessment Protocol* (EPA 2005) presents a method to estimate the release of organic compounds by multiplying the weight ratio of each individual organic compound by the total release from the waste streams being evaluated. This method is used to estimate the individual organic compound released into the WTP process cells for each of the evaluated streams.

The weight ratio for each organic compound for each stream is determined by dividing the individual organic compound weight fraction by the total weight fraction of all organic compounds in the stream.

$$WR = \frac{WF}{WF_s}$$

The estimated release for the stream (ER_O, in gm/s) from Table 1 of Appendix A is multiplied by the individual organic compound weight ratios (*WR*, unitless) to determine the estimated release of each individual organic compound for each stream (R_{IO}, in gm/s). This estimation is made for the twelve pretreatment streams, the three LAW streams, and the three HLW streams. Tables 2-19 of Appendix A display the resulting estimated releases into the process cells.

$$R_{IO}\left(\frac{g}{s}\right) = ER_O\left(\frac{g}{s}\right) \times WR$$

Where:

$$ER_O\left(\frac{g}{s}\right) = E_{HO}\left(\frac{kg}{yr}\right) \times \frac{1000\ g}{1(kg)} \times \frac{1\ (yr)}{365\ (days)} \times \frac{1\ (day)}{24\ (hrs)} \times \frac{1\ (hr)}{60\ (min)} \times \frac{1\ (min)}{60(sec)}$$

Note: E_{HO} is defined in section 2.1.6.

5 Estimated Emission of Organic Compounds

This section discusses the estimation of emissions of organic compounds from the WTP process cells.

5.1 Unabated Organic Compound Emissions

Only a portion of the organic compound released into the process cells will result in unabated emissions. Organic compounds that are particle-bound or particulate will be abated by the HEPA filters. The study 24590-WTP-M4C-V20T-00001 separates the organic compounds into particulate-bound or particulate, and vapor phase. According to the study, HEPA filters will abate the particle-bound or particulate organic compounds at a decontamination factor of two hundred thousand. Therefore, particle-bound or particulate organic compounds are not considered as uncontrolled emissions in this estimate.

- **Pretreatment**
  - CNP
  - CXP
  - FEP
  - LAW FRP
  - HLW FRP
  - HLP
  - PWD
  - RDP
  - RLD
  - TCP
  - TLP
  - UFP
- **LAW**
  - LCP
  - LFP
  - RLD
- **HLW**
  - HCP
  - HFP
  - RLD

Tables 2-13 of Appendix A give the estimated emission of organic compounds from the pretreatment process cells by summing these stream releases. Tables 14-16 of Appendix A give the estimated emission of organic compounds from the LAW process cells, and Tables 17-19 of Appendix A give the estimated emission of organic compounds from the HLW process cells.

5.2 Potential Emissions Not Considered

The study 24590-WTP-RPT-ES-17-001 proposes that the temperature and conditions in the melters and thermal oxidation units are sufficient to generate products of incomplete combustion (PIC) that would be introduced into the offgas streams. The melter offgas containing the PICs will be treated by a melter submerged bed scrubber, which will recycle scrubber liquor back into the pretreatment process. However, the Emission Baseline Report (24590-WTP-RPT- PE-17-001) predicts that PICs recycles to the

pretreatment plant will be at concentrations orders-of-magnitude less than the constituent organic compounds. Thus, PICs are not included as emissions in this estimate.

6 Direct Feed Low-Activity Waste Emissions

The DFLAW configuration cell emissions are estimated using the same methodology as the integrated WTP configuration cell emissions. The difference is DFLAW emissions are estimated with a different feed vector and include only the LAW Facility process cells (LCP, LFP, RLD). Results for the LAW emission can be seen in Tables 1-4 in Appendix B.

7 References

7.1 Codes, Standards, or Others

10 CFR 71 Appendix A, *Determination of A_1 and A_2*

Ecology. 2012. *Hanford Facility Resource Conservation and Recovery Act (RCRA) Permit, Dangerous Waste Portion, Revision 8C, for the Treatment, Storage, and Disposal of Dangerous Waste, Part III, Operating Unit Group 10 (Waste Treatment and Immobilization Plant)*, WA7890008967. Washington State Department of Ecology, Olympia, WA.

EPA. 2005. *Human Health Risk Assessment Protocol*, EPA530-R-05-006. US Environmental Protection Agency, Research Park, NC.

EPA. 1995. *Protocol for Equipment Leak Emission Estimates*, EPA-453/R-95-017. US Environmental Protection Agency, Research Triangle Park, NC

WAC 173-400, *General Regulations for Air Pollution Sources*, as amended. Washington Administrative Code. Olympia, WA.

WAC-173-400-030, *Definitions*. Washington Administrative Code. Olympia, WA.

7.2 Project Documents

CCN 023430, meeting minutes, L. Bostic (WTP) to Distribution (WTP), ,, *Discuss Proposed Final Resolution of Remaining Open Comments on the Risk Assessment Work Plan.* 9 November 2001.

CCN 276646, memorandum, N. Schertz (WTP) to K. Henckel (WTP), *Law Facility-LCP, LFP, LMP, & RLD Valve and Component Connection Types*. 4 January 2017.

CCN 293284, email, S. Troilett (WTP) to K. Henckel (WTP), *Valves and Connectors for Hot Cell Emissions Calculation*. 28 December 2016.

CCN 296730, email, L. Leyland (WTP) to K. Henckel (WTP), *HLW Cell Emission Equipment Count*. 12 January 2017.

24590-LAW-RPT-ENG-01-001, Rev. 0, *LAW Vitrification Capacity and Availability Study*.

24590-WTP-M4C-V20T-00001, *Emissions Estimate for DFLAW and Integrated WTP Configurations*

24590-WTP-RPT-ENV-14-002, *Environmental Risk Assessment Work Plan for the Hanford Tank Waste Treatment and Immobilization Plant*.

24590-WTP-RPT-PO-03-008, *Integrated Emissions Baseline Report for the Hanford Tank Waste and Immobilization Plant*.

Appendix A

Full Emission Results

The *Protocol for Equipment Lead Emission Estimates* (EPA 1995) provides the following formula to calculate the estimated release of organic material from ancillary equipment.

$E_{HO} = N \times R_{avg} \times WF_S \times H$

where:

E_{HO}	= estimated annual release by equipment type, kg/year
N	= ancillary equipment count by equipment type; equipment count obtained from Component Information System (2017)
R_{avg}	= average release factor by equipment type, (kg/hour); *from Protocol for Equipment Leak Emission Estimates* (EPA 1995)
WF_S	= weight fraction of organic material = WFs from tables 2 through 19, multiplied by 1/(1000×1000) to convert from mg/kg to kg/kg
H	= Hours per year (8760 hr/yr)

$E_{RO} = E_{HO}$ (kg/yr) × 1000 g/kg / (365 d/yr × 24 hr/d × 60 min/hr × 60 s/min)

where:

E_{RO}	= waste stream organic release (g/s) by equipment type, thus;
$ER_{O\text{-}PTF}$	= sum of PT Facility feed stream estimated release = Sum ER_O by equipment type
$ER_{O\text{-}LAW}$	= sum of LAW Concentrate Stream estimated release = Sum ER_O by equipment type
$ER_{O\text{-}HLW}$	= sum of HLW feed stream = Sum ER_O by equipment type

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Table A-1 Estimate of the Release of Organic Compounds from Ancillary Equipment

Plant	System Descriptions	Valve Count *N*	Connector Count *N*	Valve Count *N*/85%	Connector Count *N*/85%	Valve R_{avg} (kg/hour)	Connector R_{avg} (kg/hour)	Waste Stream Organic Weight Fraction WF_S	Operating Hours *H* (hr/yr)	Estimated Valve Annual Release E_{HO} (kg/yr)	Estimated Connector Annual Release E_{HO} (kg/yr)	Estimated Valve Release ER_O (g/s)	Estimated Connector Release ER_O (g/s)	Sum of Stream Feed estimation releases (g/s)
PT	CNP	10	65	12	76	2.30E-04	1.83E-03	2.05E-06	8760	0.00	0.00	1.57E-09	7.91E-08	**8.07E-08**
	CXP	53	182	62	214	2.30E-04	1.83E-03	1.90E-04	8760	0.02	0.65	7.52E-07	2.06E-05	**2.14E-05**
	FEP	29	127	34	149	2.30E-04	1.83E-03	2.71E-04	8760	0.02	0.65	5.89E-07	2.05E-05	**2.11E-05**
	LAW FRP	25	107	29	126	2.30E-04	1.83E-03	5.87E-04	8760	0.03	1.19	1.09E-06	3.76E-05	**3.87E-05**
	HLW FRP	6	13	7	15	2.30E-04	1.83E-03	5.38E-04	8760	0.01	0.13	2.41E-07	4.10E-06	**4.35E-06**
	HLP	29	187	34	220	2.30E-04	1.83E-03	6.05E-04	8760	0.04	2.13	1.31E-06	6.76E-05	**6.90E-05**
	PWD	1	51	1	60	2.30E-04	1.83E-03	1.74E-04	8760	0.00	0.17	1.11E-08	5.30E-06	**5.31E-06**
	RDP	26	61	31	72	2.30E-04	1.83E-03	9.45E-10	8760	0.00	0.00	1.87E-12	3.46E-11	**3.65E-11**
	RLD	0	3	0	4	2.30E-04	1.83E-03	2.26E-04	8760	0.00	0.01	0.00E+00	4.59E-07	**4.59E-07**
	TCP	0	3	0	4	2.30E-04	1.83E-03	5.75E-04	8760	0.00	0.04	0.00E+00	1.17E-06	**1.17E-06**
	TLP	2	21	2	25	2.30E-04	1.83E-03	6.02E-04	8760	0.00	0.24	7.69E-08	7.65E-06	**7.73E-06**
	UFP	130	430	153	506	2.30E-04	1.83E-03	1.92E-04	8760	0.06	1.56	1.88E-06	4.95E-05	**5.13E-05**
											$ER_{O\text{-}PTF}$ =		**2.21E-04**	
LAW	LCP	1	73	1	86	2.30E-04	1.83E-03	1.082E-03	8760	0.00	1.49	6.91E-08	4.73E-05	**4.74E-05**
	LFP	12	114	14	134	2.30E-04	1.83E-03	5.173E-04	8760	0.01	1.11	4.63E-07	3.52E-05	**3.57E-05**
	RLD	0	6	0	7	2.30E-04	1.83E-03	1.188E-03	8760	0.00	0.13	0.00E+00	4.23E-06	**4.23E-06**
											$ER_{O\text{-}LAW}$ =		**8.73E-05**	
HLW	HCP	1	0	1	0	2.30E-04	1.83E-03	4.577E-04	8760	0.00	0.00	2.92E-08	0.00E+00	**2.92E-08**
	HFP	9	102	11	120	2.30E-04	1.83E-03	3.576E-04	8760	0.01	0.69	2.51E-07	2.18E-05	**2.21E-05**
	RLD	7	65	8	76	2.30E-04	1.83E-03	2.189E-04	8760	0.00	0.27	1.12E-07	8.46E-06	**8.57E-06**
											$ER_{O\text{-}HLW}$ =		**3.07E-05**	

The following indicates the stream properties for feed into the Pretreatment Facility from the CNP feed used to calculate the weight fraction:

$$WF = \frac{(Q_m * 1000)}{\left(Q_v * \frac{\rho}{60 * 60}\right)}$$

Where:

Q_m = compound mass flow rate (g/s)
Q_v = volumetric flow rate (m^3/hr) = 2.64E-03
ρ = density (kg/m^3) = 1324.953

A "-" symbol indicates no data are available for approximating the emissions rate (no data were available, or the corresponding values were below the emissions model tolerance).

Table A-2 Estimate of Organic Emission from the Pretreatment Feed (CNP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
100-02-7	p-Nitrophenol	4.10E-07	4.20E-01	2.05E-01	1.66E-08
100-21-0	Phthalic acid	1.68E-07	1.72E-01	8.39E-02	6.77E-09
100-25-4	1,4-Dinitrobenzene	4.92E-11	5.04E-05	2.46E-05	1.99E-12
10028-17-8	Tritium	2.88E-12	2.96E-06	1.44E-06	1.16E-13
100-40-3	4-Ethenylcyclohexene	9.59E-25	9.83E-19	4.80E-19	3.87E-26
100-41-4	Ethyl benzene	1.11E-25	1.13E-19	5.54E-20	4.47E-27
100-42-5	Styrene	1.80E-22	1.85E-16	9.01E-17	7.27E-24
100-44-7	Benzyl chloride	-	-	-	-
100-47-0	Benzonitrile	-	-	-	-
100-51-6	Benzyl alcohol	-	-	-	-
100-52-7	Benzaldehyde	-	-	-	-
10061-01-5	cis-1,3-Dichloropropene	2.43E-23	2.50E-17	1.22E-17	9.83E-25
10061-02-6	trans-1,3-Dichloropropene	2.88E-21	2.95E-15	1.44E-15	1.16E-22

Table A-2 Estimate of Organic Emission from the Pretreatment Feed (CNP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
101-55-3	4-Bromophenylphenyl ether	1.64E-13	1.68E-07	8.19E-08	6.61E-15
101-77-9	4,4-Methylenedianiline	-	-	-	-
103-33-3	Azobenzene	-	-	-	-
103-65-1	n-Propyl benzene (Isocumene)	-	-	-	-
104-51-8	n-Butylbenzene	-	-	-	-
104-76-7	2-Ethyl-1-hexanol	4.99E-12	5.11E-06	2.49E-06	2.01E-13
105-67-9	2,4-Dimethylphenol	1.85E-10	1.89E-04	9.23E-05	7.45E-12
10595-95-6	n-Nitrosomethylethylamine	1.15E-09	1.18E-03	5.74E-04	4.63E-11
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	-	-	-	-
106-44-5	p-Cresol (4-methyl phenol)	-	-	-	-
106-46-7	1,4-Dichlorobenzene	7.19E-21	7.37E-15	3.60E-15	2.90E-22
106-47-8	p-Chloroaniline	5.19E-10	5.31E-04	2.59E-04	2.09E-11
106-49-0	p-Toluidine	-	-	-	-
106-51-4	Quinone	-	-	-	-
106-88-7	1,2-Epoxybutane	2.51E-14	2.57E-08	1.25E-08	1.01E-15
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	-	-	-	-
106-93-4	Ethylene dibromide	1.42E-21	1.46E-15	7.11E-16	5.74E-23
106-99-0	1,3-Butadiene	-	-	-	-
107-02-8	Acrolein	4.95E-17	5.07E-11	2.48E-11	2.00E-18
107-05-1	3-Chloropropene	3.44E-26	3.52E-20	1.72E-20	1.39E-27
107-06-2	1,2-Dichloroethane	5.76E-20	5.90E-14	2.88E-14	2.32E-21
107-12-0	Propionitrile	8.32E-15	8.52E-09	4.16E-09	3.36E-16

Table A-2 Estimate of Organic Emission from the Pretreatment Feed (CNP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
107-13-1	Acrylonitrile	1.82E-15	1.87E-09	9.10E-10	7.35E-17
107-19-7	Propargyl alcohol	-	-	-	-
107-21-1	Ethylene glycol (1,2-ethanediol)	-	-	-	-
107-98-2	Propylene glycol monomethyl ether	-	-	-	-
108-05-4	Acetic acid vinyl ester	7.28E-16	7.46E-10	3.64E-10	2.94E-17
108-10-1	4-Methyl-2-pentanone	7.25E-18	7.43E-12	3.63E-12	2.93E-19
108-39-4	m-Cresol	3.70E-09	3.79E-03	1.85E-03	1.49E-10
108-60-1	bis (2-Chloroisopropyl)ether	-	-	-	-
108-67-8	1,3,5-Trimethylbenzene	-	-	-	-
108-86-1	Bromobenzene (Phenyl bromide)	-	-	-	-
108-87-2	Methylcyclohexane	-	-	-	-
108-88-3	Toluene	1.16E-24	1.19E-18	5.81E-19	4.69E-26
108-90-7	Chlorobenzene	2.61E-23	2.67E-17	1.30E-17	1.05E-24
108-94-1	Cyclohexanone	1.65E-12	1.69E-06	8.25E-07	6.66E-14
108-95-2	Phenol	7.43E-10	7.62E-04	3.72E-04	3.00E-11
109-74-0	n-Butanenitrile	9.91E-13	1.02E-06	4.96E-07	4.00E-14
109-75-1	3-Butenenitrile	-	-	-	-
109-77-3	Malononitrile	-	-	-	-
109-86-4	2-Methoxyethanol	-	-	-	-
109-99-9	Tetrahydrofuran	1.61E-16	1.65E-10	8.07E-11	6.51E-18
110-00-9	Furan	-	-	-	-
110-54-3	n-Hexane	-	-	-	-

Table A-2 Estimate of Organic Emission from the Pretreatment Feed (CNP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
110-59-8	Pentanenitrile	4.03E-13	4.13E-07	2.01E-07	1.63E-14
110-80-5	2-Ethoxyethanol	2.15E-08	2.21E-02	1.08E-02	8.69E-10
110-82-7	Cyclohexane	-	-	-	-
110-83-8	Cyclohexene	-	-	-	-
110-86-1	Pyridine	4.10E-13	4.20E-07	2.05E-07	1.66E-14
111-15-9	Ethylene glycol monoethyl ether acetate	-	-	-	-
111-44-4	bis(2-Chloroethyl)ether	1.49E-13	1.53E-07	7.46E-08	6.02E-15
111-65-9	n-Octane	-	-	-	-
111-76-2	2-Butoxyethanol	6.66E-10	6.82E-04	3.33E-04	2.69E-11
111-84-2	n-Nonane	-	-	-	-
111-91-1	bis(2-Chloroethoxy)methane	8.36E-12	8.57E-06	4.18E-06	3.38E-13
1120-21-4	Undecane	-	-	-	-
1120-71-4	1,3-Propane sultone	-	-	-	-
112-30-1	1-Decanol	-	-	-	-
112-31-2	Decanal	-	-	-	-
112-40-3	Dodecane	-	-	-	-
117-81-7	Bis(2-ethylhexyl) phthalate	5.15E-08	5.27E-02	2.57E-02	2.08E-09
117-84-0	Di-n-octylphthalate	3.59E-12	3.68E-06	1.80E-06	1.45E-13
118-74-1	Hexachlorobenzene	5.89E-21	6.04E-15	2.95E-15	2.38E-22
119-90-4	3,3'-Dimethoxybenzidine	-	-	-	-
120-12-7	Anthracene	5.73E-13	5.87E-07	2.86E-07	2.31E-14
120-82-1	1,2,4-Trichlorobenzene	8.05E-21	8.25E-15	4.03E-15	3.25E-22

Table A-2 Estimate of Organic Emission from the Pretreatment Feed (CNP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
120-83-2	2,4-Dichlorophenol	1.72E-18	1.76E-12	8.60E-13	6.94E-20
121-14-2	2,4-Dinitrotoluene	1.16E-07	1.19E-01	5.79E-02	4.67E-09
122-39-4	N,N-Diphenylamine	4.83E-13	4.95E-07	2.42E-07	1.95E-14
122-66-7	1,2-Diphenylhydrazine	-	-	-	-
123-33-1	Maleic hydrazide	-	-	-	-
123-38-6	Propionaldehyde	4.89E-16	5.01E-10	2.45E-10	1.97E-17
123-72-8	Butanal	1.06E-13	1.09E-07	5.32E-08	4.30E-15
123-91-1	1,4-Dioxan	4.63E-14	4.75E-08	2.32E-08	1.87E-15
124-18-5	Decane	-	-	-	-
124-38-9	Carbon dioxide	-	-	-	-
124-48-1	Chlorodibromomethane	1.85E-19	1.89E-13	9.24E-14	7.46E-21
126-73-8	Tributyl phosphate	1.16E-09	1.19E-03	5.80E-04	4.68E-11
126-98-7	2-Methyl-2-propenenitrile	3.09E-18	3.16E-12	1.54E-12	1.25E-19
127-18-4	1,1,2,2-Tetrachloroethene	-	-	-	-
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	4.06E-12	4.16E-06	2.03E-06	1.64E-13
129-00-0	Pyrene	1.99E-10	2.04E-04	9.97E-05	8.04E-12
131-11-3	Dimethyl Phthalate	2.09E-09	2.14E-03	1.05E-03	8.44E-11
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	-	-	-	-
132-64-9	Dibenzofuran	3.63E-17	3.72E-11	1.81E-11	1.46E-18
1330-20-7	Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations)	1.34E-22	1.37E-16	6.69E-17	5.40E-24
133-06-2	Captan	-	-	-	-
1336-36-3	Polychlorinated biphenyls (1254 Aroclor)	3.33E-14	3.41E-08	1.67E-08	1.35E-15

Table A-2 Estimate of Organic Emission from the Pretreatment Feed (CNP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
134-32-7	alpha-Naphthylamine	2.08E-08	2.13E-02	1.04E-02	8.39E-10
135-98-8	sec-Butylbenzene	-	-	-	-
141-78-6	Acetic acid ethyl ester	2.54E-18	2.60E-12	1.27E-12	1.03E-19
145-73-3	Endothall	-	-	-	-
156-59-2	cis-1,2-Dichloroethene	-	-	-	-
156-60-5	1,2-trans-Dichloroethene	6.45E-21	6.61E-15	3.23E-15	2.60E-22
1634-04-4	Methyl tert-butyl ether	3.48E-16	3.56E-10	1.74E-10	1.40E-17
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1.39E-22	1.42E-16	6.95E-17	5.61E-24
189-55-9	Dibenzo[a,i]pyrene	5.90E-08	6.05E-02	2.95E-02	2.38E-09
189-64-0	Dibenzo[a,h]pyrene	5.90E-08	6.05E-02	2.95E-02	2.38E-09
191-24-2	Benzo(g,h,i)perylene	1.00E-08	1.03E-02	5.03E-03	4.06E-10
191-30-0	Dibenzo(a,l)pyrene	5.90E-08	6.05E-02	2.95E-02	2.38E-09
192-65-4	Dibenzo[a,e]pyrene	5.90E-08	6.05E-02	2.95E-02	2.38E-09
192-97-2	Benzo(e)pyrene	-	-	-	-
193-39-5	Indeno(1,2,3-cd)pyrene	1.09E-09	1.12E-03	5.45E-04	4.40E-11
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	5.90E-21	6.05E-15	2.95E-15	2.38E-22
205-82-3	Benzo[j]fluoranthene	-	-	-	-
205-99-2	Benzo(b)fluoranthene	2.88E-12	2.95E-06	1.44E-06	1.16E-13
206-44-0	Fluoranthene	7.89E-11	8.08E-05	3.95E-05	3.18E-12
207-08-9	Benzo(k)fluoranthene	9.34E-10	9.57E-04	4.67E-04	3.77E-11
208-96-8	Acenaphthylene	1.09E-13	1.12E-07	5.46E-08	4.40E-15
218-01-9	Chrysene	1.25E-15	1.29E-09	6.27E-10	5.06E-17

Table A-2 Estimate of Organic Emission from the Pretreatment Feed (CNP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
224-42-0	Dibenz[a,j]acridine	9.08E-08	9.31E-02	4.54E-02	3.67E-09
2245-38-7	2,3,5-Trimethylnaphthalene	-	-	-	-
226-36-8	Dibenz[a,h]acridine	8.73E-08	8.95E-02	4.37E-02	3.52E-09
23950-58-5	Pronamide	-	-	-	-
27154-33-2	Trichlorofluoroethane	1.12E-20	1.15E-14	5.60E-15	4.52E-22
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	7.64E-24	7.83E-18	3.82E-18	3.08E-25
319-84-6	alpha-BHC	1.88E-15	1.93E-09	9.43E-10	7.61E-17
319-85-7	beta-BHC	2.73E-11	2.80E-05	1.37E-05	1.10E-12
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	2.94E-19	3.01E-13	1.47E-13	1.19E-20
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	-	-	-	-
3268-87-9	Octachlorodibenzo(p)dioxin	4.75E-19	4.87E-13	2.38E-13	1.92E-20
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	2.43E-22	2.49E-16	1.22E-16	9.82E-24
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	1.67E-20	1.71E-14	8.37E-15	6.75E-22
3697-24-3	5-Methylchrysene	1.05E-10	1.08E-04	5.26E-05	4.24E-12
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	2.18E-23	2.23E-17	1.09E-17	8.79E-25
39001-02-0	Octachlorodibenzofuran	1.39E-18	1.43E-12	6.97E-13	5.62E-20
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	6.24E-21	6.39E-15	3.12E-15	2.52E-22
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	2.82E-22	2.89E-16	1.41E-16	1.14E-23
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	1.64E-19	1.68E-13	8.22E-14	6.63E-21
4170-30-3	Crotonaldehyde (Propylene aldehyde)	9.43E-25	9.66E-19	4.72E-19	3.81E-26
41851-50-7	Chlorocyclopentadiene	-	-	-	-
460-19-5	Cyanogen (oxalonitrile)	-	-	-	-

Table A-2 Estimate of Organic Emission from the Pretreatment Feed (CNP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
4786-20-3	2-Butenenitrile	-	-	-	-
50-00-0	Formaldehyde	7.78E-09	7.97E-03	3.89E-03	3.14E-10
50-32-8	Benzo(a)pyrene	3.72E-11	3.82E-05	1.86E-05	1.50E-12
506-68-3	Cyanogen bromide (bromocyanide)	-	-	-	-
506-77-4	Cyanogen chloride	-	-	-	-
510-15-6	Chlorobenzilate	-	-	-	-
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	8.47E-21	8.69E-15	4.24E-15	3.42E-22
51-28-5	2,4-Dinitrophenol	9.94E-09	1.02E-02	4.97E-03	4.01E-10
51-79-6	Ethyl carbamate (urethane)	-	-	-	-
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	2.53E-22	2.59E-16	1.26E-16	1.02E-23
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	-	-	-	-
532-27-4	2-Chloroacetophenone	-	-	-	-
534-52-1	4,6-Dinitro-o-cresol	9.08E-10	9.30E-04	4.54E-04	3.67E-11
53-70-3	Dibenz[a,h]anthracene	8.39E-09	8.60E-03	4.20E-03	3.39E-10
5385-75-1	Dibenzo(a,e)fluoranthene	-	-	-	-
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	1.28E-23	1.31E-17	6.38E-18	5.15E-25
540-73-8	1,2-Dimethylhydrazine	-	-	-	-
540-84-1	2,2,4-Trimethylpentane	-	-	-	-
541-73-1	1,3-Dichlorobenzene	1.78E-22	1.82E-16	8.89E-17	7.18E-24
542-75-6	1,3-Dichloropropene	-	-	-	-
542-88-1	bis(Chloromethyl)ether	-	-	-	-
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	1.50E-21	1.54E-15	7.51E-16	6.06E-23

Table A-2 Estimate of Organic Emission from the Pretreatment Feed (CNP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
56-23-5	Carbon tetrachloride	-	-	-	-
56-49-5	3-Methylcholanthrene	1.15E-10	1.17E-04	5.73E-05	4.63E-12
56-55-3	Benzo(a)anthracene	3.25E-11	3.33E-05	1.62E-05	1.31E-12
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	2.25E-19	2.30E-13	1.12E-13	9.07E-21
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	6.71E-20	6.88E-14	3.36E-14	2.71E-21
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	1.10E-20	1.13E-14	5.51E-15	4.45E-22
57-24-9	Strychnine	-	-	-	-
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	8.88E-20	9.10E-14	4.44E-14	3.59E-21
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	2.82E-21	2.89E-15	1.41E-15	1.14E-22
57-74-9	Chlordane	-	-	-	-
581-42-0	2,6-Dimethylnaphthalene	-	-	-	-
584-84-9	2,4-Toluene diisocyanate	-	-	-	-
58-89-9	gamma-BHC (Lindane)	9.18E-15	9.41E-09	4.59E-09	3.71E-16
58-90-2	2,3,4,6-Tetrachlorophenol	4.56E-10	4.67E-04	2.28E-04	1.84E-11
589-38-8	3-Hexanone	7.58E-14	7.77E-08	3.79E-08	3.06E-15
591-50-4	Benzene, iodo-	-	-	-	-
591-78-6	2-Hexanone	3.16E-16	3.23E-10	1.58E-10	1.27E-17
593-60-2	Bromoethene (Vinyl bromide)	-	-	-	-
593-74-8	Dimethyl Mercury	-	-	-	-
59-50-7	4-Chloro-3-methylphenol	1.08E-09	1.10E-03	5.39E-04	4.35E-11
59-89-2	N-Nitrosomorpholine	3.31E-07	3.40E-01	1.66E-01	1.34E-08
60-11-7	Dimethyl aminoazobenzene	1.88E-19	1.93E-13	9.42E-14	7.61E-21

Table A-2 Estimate of Organic Emission from the Pretreatment Feed (CNP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
602-87-9	5-Nitroacenaphthene	1.45E-09	1.48E-03	7.23E-04	5.84E-11
60-29-7	Ethyl ether	2.56E-20	2.63E-14	1.28E-14	1.03E-21
60-35-5	Acetamide	1.15E-07	1.18E-01	5.74E-02	4.63E-09
606-20-2	2,6-Dinitrotoluene	4.53E-10	4.65E-04	2.27E-04	1.83E-11
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	2.00E-21	2.05E-15	1.00E-15	8.07E-23
608-93-5	Pentachlorobenzene	-	-	-	-
61626-71-9	Dichloropentadiene	-	-	-	-
621-64-7	N-Nitroso-di-n-propylamine	1.17E-09	1.20E-03	5.88E-04	4.74E-11
624-83-9	Methyl isocyanate	-	-	-	-
62-50-0	Ethyl methanesulfonate	-	-	-	-
62-53-3	Aniline	-	-	-	-
62-75-9	N-Nitroso-N,N-dimethylamine	8.33E-12	8.53E-06	4.17E-06	3.36E-13
628-73-9	Hexanenitrile	1.72E-13	1.76E-07	8.59E-08	6.93E-15
630-20-6	1,1,1,2-Tetrachloroethane	5.12E-18	5.25E-12	2.56E-12	2.07E-19
64-18-6	Formic acid (methanoic acid)	-	-	-	-
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	2.20E-18	2.26E-12	1.10E-12	8.90E-20
65-85-0	Benzoic acid	-	-	-	-
67-56-1	Methyl alcohol	2.46E-10	2.52E-04	1.23E-04	9.92E-12
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	4.67E-21	4.79E-15	2.34E-15	1.89E-22
67-63-0	2-Propyl alcohol	5.64E-14	5.78E-08	2.82E-08	2.28E-15
67-64-1	2-Propanone (Acetone)	1.22E-13	1.25E-07	6.08E-08	4.91E-15
67-66-3	Chloroform	2.61E-23	2.68E-17	1.31E-17	1.06E-24

Table A-2 Estimate of Organic Emission from the Pretreatment Feed (CNP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
67-72-1	Hexachloroethane	1.98E-20	2.03E-14	9.90E-15	7.99E-22
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	8.41E-22	8.62E-16	4.21E-16	3.40E-23
70-30-4	Hexachlorophene	-	-	-	-
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	4.94E-21	5.06E-15	2.47E-15	1.99E-22
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	2.39E-21	2.45E-15	1.20E-15	9.66E-23
71-36-3	n-Butyl alcohol	1.42E-12	1.45E-06	7.08E-07	5.72E-14
71-43-2	Benzene	2.41E-24	2.47E-18	1.21E-18	9.74E-26
71-55-6	1,1,1-Trichloroethane	-	-	-	-
72-43-5	Methoxychlor	-	-	-	-
72-55-9	4,4-DDE	1.64E-11	1.68E-05	8.21E-06	6.62E-13
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	1.17E-21	1.20E-15	5.84E-16	4.71E-23
7439-97-6	Mercury	-	-	-	-
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	4.51E-23	4.62E-17	2.26E-17	1.82E-24
74-83-9	Bromomethane	1.17E-24	1.20E-18	5.83E-19	4.71E-26
74-87-3	Chloromethane	2.29E-25	2.34E-19	1.14E-19	9.24E-27
74-88-4	Iodomethane	2.31E-24	2.37E-18	1.16E-18	9.33E-26
74-95-3	Methylene bromide	-	-	-	-
74-97-5	Bromochloromethane	-	-	-	-
75-00-3	Chloroethane	8.00E-26	8.20E-20	4.00E-20	3.23E-27
75-01-4	1-Chloroethene	-	-	-	-
75-02-5	Fluoroethene (vinyl fluoride)	-	-	-	-
75-05-8	Acetonitrile	1.23E-12	1.26E-06	6.16E-07	4.97E-14

Table A-2 Estimate of Organic Emission from the Pretreatment Feed (CNP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
75-07-0	Acetaldehyde	4.02E-13	4.12E-07	2.01E-07	1.62E-14
75-09-2	Dichloromethane (Methylene Chloride)	2.75E-20	2.82E-14	1.38E-14	1.11E-21
75-15-0	Carbon disulfide	-	-	-	-
75-21-8	Ethylene oxide (Oxirane)	1.01E-16	1.03E-10	5.04E-11	4.07E-18
75-25-2	Bromoform	-	-	-	-
75-27-4	Bromodichloromethane	5.80E-17	5.94E-11	2.90E-11	2.34E-18
75-29-6	2-Chloropropane	-	-	-	-
75-34-3	1,1-Dichloroethane	2.59E-25	2.66E-19	1.30E-19	1.05E-26
75-35-4	1,1-Dichloroethene	-	-	-	-
75-44-5	Phosgene (hydrogen phosphide)	-	-	-	-
75-45-6	Chlorodifluoromethane	-	-	-	-
75-50-3	Trimethylamine	1.58E-13	1.62E-07	7.92E-08	6.39E-15
75-69-4	Trichlorofluoromethane	-	-	-	-
75-71-8	Dichlorodifluoromethane	-	-	-	-
76-01-7	Pentachloroethane	-	-	-	-
76-13-1	1,2,2-Trichlorotrifluoroethane	-	-	-	-
764-41-0	1,4-Dichloro-2-butene	-	-	-	-
76-44-8	Heptachlor	-	-	-	-
765-34-4	Glycidylaldehyde	-	-	-	-
7664-41-7	Ammonia/Ammonium	1.91E-07	1.96E-01	9.56E-02	7.72E-09
77-47-4	Hexachlorocyclopentadiene	-	-	-	-
77-78-1	Dimethyl sulfate	-	-	-	-

Table A-2 Estimate of Organic Emission from the Pretreatment Feed (CNP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
78-83-1	2-Methylpropyl alcohol	6.86E-10	7.03E-04	3.43E-04	2.77E-11
78-87-5	1,2-Dichloropropane	5.73E-24	5.87E-18	2.86E-18	2.31E-25
78-93-3	2-Butanone	1.58E-14	1.62E-08	7.92E-09	6.39E-16
79-00-5	1,1,2-Trichloroethane	7.35E-22	7.53E-16	3.67E-16	2.97E-23
79-01-6	1,1,2-Trichloroethylene	2.91E-26	2.98E-20	1.46E-20	1.18E-27
79-10-7	2-Propenoic acid	1.07E-08	1.10E-02	5.35E-03	4.32E-10
79-34-5	1,1,2,2-Tetrachloroethane	3.15E-20	3.23E-14	1.57E-14	1.27E-21
79-46-9	2-Nitropropane	2.30E-16	2.36E-10	1.15E-10	9.31E-18
80-62-6	Methyl methacrylate	-	-	-	-
822-06-0	Hexamethylene-1,5-diisocyanate	-	-	-	-
823-40-5	Toluene-2,6-diamine	-	-	-	-
82-68-8	Pentachloronitrobenzene (PCNB)	5.89E-18	6.04E-12	2.95E-12	2.38E-19
832-69-9	1-Methylphenanthrene	-	-	-	-
83-32-9	Acenaphthene	1.82E-13	1.87E-07	9.10E-08	7.35E-15
84-66-2	Diethyl phthalate	6.60E-09	6.77E-03	3.30E-03	2.67E-10
84-74-2	Di-n-butylphthalate	1.70E-08	1.74E-02	8.51E-03	6.87E-10
85-01-8	Phenanthrene	7.65E-12	7.84E-06	3.83E-06	3.09E-13
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	-	-	-	-
85-68-7	Butylbenzylphthalate	8.66E-09	8.87E-03	4.33E-03	3.50E-10
86-73-7	Fluorene	6.02E-13	6.17E-07	3.01E-07	2.43E-14
87-61-6	1,2,3-Trichlorobenzene	-	-	-	-
87-68-3	Hexachlorobutadiene	2.99E-23	3.07E-17	1.50E-17	1.21E-24

Table A-2 Estimate of Organic Emission from the Pretreatment Feed (CNP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
87-86-5	Pentachlorophenol	4.62E-10	4.74E-04	2.31E-04	1.87E-11
88-06-2	2,4,6-Trichlorophenol	1.81E-10	1.86E-04	9.08E-05	7.33E-12
88-74-4	o-Nitroaniline (2-nitroaniline)	2.81E-09	2.88E-03	1.40E-03	1.13E-10
88-75-5	2-Nitrophenol	1.34E-10	1.38E-04	6.72E-05	5.42E-12
90-04-0	o-Anisidine	-	-	-	-
90-12-0	1-Methylnaphthalene	-	-	-	-
91-20-3	Naphthalene	2.56E-15	2.62E-09	1.28E-09	1.03E-16
91-22-5	Quinoline	-	-	-	-
91-57-6	2-Methylnaphthalene	6.36E-17	6.51E-11	3.18E-11	2.57E-18
91-58-7	2-Chloronaphthalene	3.29E-15	3.37E-09	1.65E-09	1.33E-16
91-94-1	3,3'-Dichlorobenzidine	5.49E-08	5.62E-02	2.74E-02	2.22E-09
924-16-3	N-Nitroso-di-n-Buetylamine	-	-	-	-
92-52-4	1,1`-Biphenyl	8.91E-18	9.14E-12	4.46E-12	3.60E-19
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	-	-	-	-
94-75-7	2,4-D	-	-	-	-
95-48-7	o-Cresol	3.30E-09	3.38E-03	1.65E-03	1.33E-10
95-49-8	o-Chlorotoluene	-	-	-	-
95-50-1	1,2-Dichlorobenzene	2.92E-20	3.00E-14	1.46E-14	1.18E-21
95-53-4	o-Toluidine	-	-	-	-
95-57-8	2-Chlorophenol	5.40E-15	5.53E-09	2.70E-09	2.18E-16
95-63-6	1,2,4-Trimethyl benzene	-	-	-	-
95-94-3	1,2,4,5-Tetrachlorobenzene	-	-	-	-

Table A-2 Estimate of Organic Emission from the Pretreatment Feed (CNP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction WF (mg/kg)	Weight Ratio WR (unitless)	Individual Organic Release R_{IO} (g/s)
95-95-4	2,4,5-Trichlorophenol	4.46E-10	4.57E-04	2.23E-04	1.80E-11
96-12-8	1,2-Dibromo-3-chloropropane	-	-	-	-
96-18-4	1,2,3-Trichloropropane	-	-	-	-
96-45-7	Ethylene thiourea	-	-	-	-
97-63-2	Ethyl methacrylate	-	-	-	-
98-01-1	Furfural	-	-	-	-
98-06-6	tert-Butyl benzene	-	-	-	-
98-07-7	Benzotrichloride	-	-	-	-
98-82-8	Cumene	-	-	-	-
98-83-9	Methyl styrene (mixed isomers)	-	-	-	-
98-86-2	Acetophenone	8.43E-14	8.64E-08	4.22E-08	3.40E-15
98-95-3	Nitrobenzene	1.15E-13	1.18E-07	5.77E-08	4.66E-15
99-35-4	1,3,5-Trinitrobenzene	-	-	-	-
99-65-0	1,3-Dinitrobenzene	-	-	-	-
99-87-6	p-Cymene	-	-	-	-
			Weight Fraction Sum = WF_s =	2.05E+00	
				Weight Ratio Sum = WR_s =	1.00E+00
					Feed Stream Sum = 8.07E-08

The following indicates the stream properties for feed into the Pretreatment Facility from the CXP feed used to calculate the weight fraction:

$$WF = \frac{(Q_m * 1000)}{\left(Q_v * \frac{\rho}{60 * 60}\right)}$$

Where:

Q_m = compound mass flow rate (g/s)
Q_v = volumetric flow rate (m^3/hr) = 1.21
ρ = density (kg/m^3) = 1242.992

A "-" symbol indicates no data are available for approximating the emissions rate (no data were available, or the corresponding values were below the emissions model tolerance).

Table A-3 Estimate of Organic Emission from the Pretreatment Feed (CXP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
100-02-7	p-Nitrophenol	5.03E-03	1.20E+01	6.32E-02	1.35E-06
100-21-0	Phthalic acid	2.03E-03	4.86E+00	2.56E-02	5.48E-07
100-25-4	1,4-Dinitrobenzene	6.34E-06	1.51E-02	7.97E-05	1.70E-09
10028-17-8	Tritium	1.63E-07	3.90E-04	2.05E-06	4.40E-11
100-40-3	4-Ethenylcyclohexene	1.34E-16	3.20E-13	1.69E-15	3.61E-20
100-41-4	Ethyl benzene	1.52E-17	3.62E-14	1.91E-16	4.09E-21
100-42-5	Styrene	8.93E-13	2.13E-09	1.12E-11	2.40E-16
100-44-7	Benzyl chloride	-	-	-	-
100-47-0	Benzonitrile	-	-	-	-
100-51-6	Benzyl alcohol	-	-	-	-
100-52-7	Benzaldehyde	-	-	-	-

Table A-3 Estimate of Organic Emission from the Pretreatment Feed (CXP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
10061-01-5	cis-1,3-Dichloropropene	3.20E-15	7.64E-12	4.02E-14	8.61E-19
10061-02-6	trans-1,3-Dichloropropene	3.32E-13	7.94E-10	4.18E-12	8.95E-17
101-55-3	4-Bromophenylphenyl ether	6.07E-06	1.45E-02	7.63E-05	1.63E-09
101-77-9	4,4-Methylenedianiline	-	-	-	-
103-33-3	Azobenzene	-	-	-	-
103-65-1	n-Propyl benzene (Isocumene)	-	-	-	-
104-51-8	n-Butylbenzene	-	-	-	-
104-76-7	2-Ethyl-1-hexanol	7.26E-05	1.73E-01	9.13E-04	1.95E-08
105-67-9	2,4-Dimethylphenol	1.86E-04	4.44E-01	2.34E-03	5.01E-08
10595-95-6	n-Nitrosomethylethylamine	7.70E-04	1.84E+00	9.68E-03	2.07E-07
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	-	-	-	-
106-44-5	p-Cresol (4-methyl phenol)	-	-	-	-
106-46-7	1,4-Dichlorobenzene	1.47E-12	3.52E-09	1.86E-11	3.97E-16
106-47-8	p-Chloroaniline	2.93E-04	6.99E-01	3.68E-03	7.88E-08
106-49-0	p-Toluidine	-	-	-	-
106-51-4	Quinone	-	-	-	-
106-88-7	1,2-Epoxybutane	1.70E-06	4.06E-03	2.14E-05	4.58E-10
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	-	-	-	-
106-93-4	Ethylene dibromide	1.59E-13	3.80E-10	2.00E-12	4.29E-17
106-99-0	1,3-Butadiene	5.09E-21	1.21E-17	6.40E-20	1.37E-24
107-02-8	Acrolein	2.64E-09	6.29E-06	3.32E-08	7.09E-13
107-05-1	3-Chloropropene	4.75E-18	1.13E-14	5.97E-17	1.28E-21

Table A-3 Estimate of Organic Emission from the Pretreatment Feed (CXP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
107-06-2	1,2-Dichloroethane	8.00E-11	1.91E-07	1.01E-09	2.15E-14
107-12-0	Propionitrile	1.69E-07	4.02E-04	2.12E-06	4.54E-11
107-13-1	Acrylonitrile	2.22E-07	5.30E-04	2.79E-06	5.98E-11
107-19-7	Propargyl alcohol	-	-	-	-
107-21-1	Ethylene glycol (1,2-ethanediol)	-	-	-	-
107-98-2	Propylene glycol monomethyl ether	-	-	-	-
108-05-4	Acetic acid vinyl ester	7.47E-08	1.78E-04	9.40E-07	2.01E-11
108-10-1	4-Methyl-2-pentanone	4.26E-10	1.02E-06	5.35E-09	1.15E-13
108-39-4	m-Cresol	1.49E-03	3.56E+00	1.87E-02	4.01E-07
108-60-1	bis (2-Chloroisopropyl)ether	-	-	-	-
108-67-8	1,3,5-Trimethylbenzene	-	-	-	-
108-86-1	Bromobenzene (Phenyl bromide)	-	-	-	-
108-87-2	Methylcyclohexane	9.82E-26	2.34E-22	1.23E-24	2.64E-29
108-88-3	Toluene	1.06E-14	2.52E-11	1.33E-13	2.85E-18
108-90-7	Chlorobenzene	1.95E-13	4.67E-10	2.46E-12	5.26E-17
108-94-1	Cyclohexanone	7.60E-06	1.82E-02	9.57E-05	2.05E-09
108-95-2	Phenol	1.45E-04	3.45E-01	1.82E-03	3.90E-08
109-74-0	n-Butanenitrile	2.77E-05	6.61E-02	3.48E-04	7.45E-09
109-75-1	3-Butenenitrile	-	-	-	-
109-77-3	Malononitrile	-	-	-	-
109-86-4	2-Methoxyethanol	-	-	-	-
109-99-9	Tetrahydrofuran	5.98E-09	1.43E-05	7.52E-08	1.61E-12

Table A-3 Estimate of Organic Emission from the Pretreatment Feed (CXP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
110-00-9	Furan	-	-	-	-
110-54-3	n-Hexane	-	-	-	-
110-59-8	Pentanenitrile	1.47E-05	3.50E-02	1.85E-04	3.95E-09
110-80-5	2-Ethoxyethanol	4.78E-03	1.14E+01	6.01E-02	1.29E-06
110-82-7	Cyclohexane	1.63E-23	3.90E-20	2.05E-22	4.40E-27
110-83-8	Cyclohexene	6.00E-21	1.43E-17	7.54E-20	1.61E-24
110-86-1	Pyridine	1.86E-06	4.43E-03	2.33E-05	4.99E-10
111-15-9	Ethylene glycol monoethyl ether acetate	-	-	-	-
111-44-4	bis(2-Chloroethyl)ether	2.15E-06	5.14E-03	2.71E-05	5.80E-10
111-65-9	n-Octane	-	-	-	-
111-76-2	2-Butoxyethanol	4.97E-04	1.19E+00	6.25E-03	1.34E-07
111-84-2	n-Nonane	-	-	-	-
111-91-1	bis(2-Chloroethoxy)methane	1.75E-05	4.18E-02	2.20E-04	4.72E-09
1120-21-4	Undecane	-	-	-	-
1120-71-4	1,3-Propane sultone	-	-	-	-
112-30-1	1-Decanol	-	-	-	-
112-31-2	Decanal	-	-	-	-
112-40-3	Dodecane	-	-	-	-
117-81-7	Bis(2-ethylhexyl) phthalate	2.24E-03	5.34E+00	2.81E-02	6.02E-07
117-84-0	Di-n-octylphthalate	7.17E-05	1.71E-01	9.01E-04	1.93E-08
118-74-1	Hexachlorobenzene	7.64E-12	1.82E-08	9.60E-11	2.05E-15
119-90-4	3,3'-Dimethoxybenzidine	-	-	-	-

Table A-3 Estimate of Organic Emission from the Pretreatment Feed (CXP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
120-12-7	Anthracene	1.37E-05	3.28E-02	1.73E-04	3.69E-09
120-82-1	1,2,4-Trichlorobenzene	9.99E-13	2.38E-09	1.26E-11	2.69E-16
120-83-2	2,4-Dichlorophenol	2.24E-10	5.35E-07	2.82E-09	6.03E-14
121-14-2	2,4-Dinitrotoluene	4.75E-03	1.13E+01	5.97E-02	1.28E-06
122-39-4	N,N-Diphenylamine	4.37E-07	1.04E-03	5.50E-06	1.18E-10
122-66-7	1,2-Diphenylhydrazine	-	-	-	-
123-33-1	Maleic hydrazide	-	-	-	-
123-38-6	Propionaldehyde	1.82E-08	4.34E-05	2.29E-07	4.89E-12
123-72-8	Butanal	5.51E-06	1.31E-02	6.92E-05	1.48E-09
123-91-1	1,4-Dioxan	1.09E-07	2.59E-04	1.37E-06	2.92E-11
124-18-5	Decane	-	-	-	-
124-38-9	Carbon dioxide	-	-	-	-
124-48-1	Chlorodibromomethane	2.00E-10	4.77E-07	2.51E-09	5.38E-14
126-73-8	Tributyl phosphate	5.42E-04	1.29E+00	6.81E-03	1.46E-07
126-98-7	2-Methyl-2-propenenitrile	2.45E-10	5.84E-07	3.08E-09	6.59E-14
127-18-4	1,1,2,2-Tetrachloroethene	1.80E-19	4.30E-16	2.27E-18	4.85E-23
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	5.74E-06	1.37E-02	7.22E-05	1.55E-09
129-00-0	Pyrene	6.61E-04	1.58E+00	8.31E-03	1.78E-07
131-11-3	Dimethyl Phthalate	9.45E-05	2.26E-01	1.19E-03	2.54E-08
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	-	-	-	-
132-64-9	Dibenzofuran	6.90E-09	1.65E-05	8.67E-08	1.86E-12

Table A-3 Estimate of Organic Emission from the Pretreatment Feed (CXP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
1330-20-7	Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations)	5.40E-14	1.29E-10	6.79E-13	1.45E-17
133-06-2	Captan	-	-	-	-
1336-36-3	Polychlorinated biphenyls (1254 Aroclor)	2.33E-06	5.55E-03	2.93E-05	6.26E-10
134-32-7	alpha-Naphthylamine	9.72E-04	2.32E+00	1.22E-02	2.62E-07
135-98-8	sec-Butylbenzene	-	-	-	-
141-78-6	Acetic acid ethyl ester	1.45E-10	3.46E-07	1.83E-09	3.91E-14
145-73-3	Endothall	-	-	-	-
156-59-2	cis-1,2-Dichloroethene	-	-	-	-
156-60-5	1,2-trans-Dichloroethene	8.88E-13	2.12E-09	1.12E-11	2.39E-16
1634-04-4	Methyl tert-butyl ether	3.70E-08	8.83E-05	4.65E-07	9.96E-12
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	2.61E-15	6.23E-12	3.28E-14	7.03E-19
189-55-9	Dibenzo[a,i]pyrene	9.74E-04	2.33E+00	1.23E-02	2.62E-07
189-64-0	Dibenzo[a,h]pyrene	9.74E-04	2.33E+00	1.23E-02	2.62E-07
191-24-2	Benzo(g,h,i)perylene	9.72E-04	2.32E+00	1.22E-02	2.61E-07
191-30-0	Dibenzo(a,l)pyrene	9.74E-04	2.33E+00	1.23E-02	2.62E-07
192-65-4	Dibenzo[a,e]pyrene	9.74E-04	2.33E+00	1.23E-02	2.62E-07
192-97-2	Benzo(e)pyrene	-	-	-	-
193-39-5	Indeno(1,2,3-cd)pyrene	4.77E-04	1.14E+00	6.00E-03	1.28E-07
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	2.31E-14	5.51E-11	2.91E-13	6.22E-18
205-82-3	Benzo[j]fluoranthene	-	-	-	-
205-99-2	Benzo(b)fluoranthene	1.19E-05	2.85E-02	1.50E-04	3.21E-09

Table A-3 Estimate of Organic Emission from the Pretreatment Feed (CXP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
206-44-0	Fluoranthene	4.80E-04	1.15E+00	6.03E-03	1.29E-07
207-08-9	Benzo(k)fluoranthene	2.16E-04	5.16E-01	2.72E-03	5.82E-08
208-96-8	Acenaphthylene	4.00E-06	9.54E-03	5.02E-05	1.08E-09
218-01-9	Chrysene	8.07E-08	1.93E-04	1.01E-06	2.17E-11
224-42-0	Dibenz[a,j]acridine	1.16E-03	2.76E+00	1.45E-02	3.11E-07
2245-38-7	2,3,5-Trimethylnaphthalene	-	-	-	-
226-36-8	Dibenz[a,h]acridine	1.11E-03	2.65E+00	1.40E-02	2.99E-07
23950-58-5	Pronamide	-	-	-	-
27154-33-2	Trichlorofluoroethane	8.90E-13	2.12E-09	1.12E-11	2.40E-16
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	1.99E-15	4.75E-12	2.50E-14	5.36E-19
319-84-6	alpha-BHC	7.65E-09	1.83E-05	9.62E-08	2.06E-12
319-85-7	beta-BHC	6.80E-06	1.62E-02	8.56E-05	1.83E-09
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	1.24E-12	2.96E-09	1.56E-11	3.33E-16
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	1.39E-17	3.33E-14	1.75E-16	3.75E-21
3268-87-9	Octachlorodibenzo(p)dioxin	1.05E-12	2.51E-09	1.32E-11	2.83E-16
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	1.33E-14	3.18E-11	1.67E-13	3.58E-18
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	9.39E-14	2.24E-10	1.18E-12	2.53E-17
3697-24-3	5-Methylchrysene	2.03E-04	4.85E-01	2.56E-03	5.47E-08
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	2.72E-15	6.49E-12	3.42E-14	7.32E-19
39001-02-0	Octachlorodibenzofuran	7.55E-13	1.80E-09	9.49E-12	2.03E-16
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	2.83E-14	6.75E-11	3.56E-13	7.61E-18
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	1.07E-14	2.55E-11	1.35E-13	2.88E-18

Table A-3 Estimate of Organic Emission from the Pretreatment Feed (CXP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	2.15E-13	5.13E-10	2.70E-12	5.78E-17
4170-30-3	Crotonaldehyde (Propylene aldehyde)	1.30E-16	3.10E-13	1.63E-15	3.50E-20
41851-50-7	Chlorocyclopentadiene	-	-	-	-
460-19-5	Cyanogen (oxalonitrile)	-	-	-	-
4786-20-3	2-Butenenitrile	-	-	-	-
50-00-0	Formaldehyde	1.26E-03	3.01E+00	1.58E-02	3.39E-07
50-32-8	Benzo(a)pyrene	3.55E-05	8.46E-02	4.46E-04	9.54E-09
506-68-3	Cyanogen bromide (bromocyanide)	-	-	-	-
506-77-4	Cyanogen chloride	-	-	-	-
510-15-6	Chlorobenzilate	-	-	-	-
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	5.89E-14	1.41E-10	7.41E-13	1.58E-17
51-28-5	2,4-Dinitrophenol	1.53E-03	3.66E+00	1.93E-02	4.12E-07
51-79-6	Ethyl carbamate (urethane)	-	-	-	-
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	1.38E-14	3.30E-11	1.74E-13	3.72E-18
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	-	-	-	-
532-27-4	2-Chloroacetophenone	-	-	-	-
534-52-1	4,6-Dinitro-o-cresol	4.37E-04	1.04E+00	5.50E-03	1.18E-07
53-70-3	Dibenz[a,h]anthracene	1.32E-04	3.16E-01	1.67E-03	3.56E-08
5385-75-1	Dibenzo(a,e)fluoranthene	-	-	-	-
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	1.20E-13	2.87E-10	1.51E-12	3.23E-17
540-73-8	1,2-Dimethylhydrazine	-	-	-	-
540-84-1	2,2,4-Trimethylpentane	-	-	-	-

Table A-3 Estimate of Organic Emission from the Pretreatment Feed (CXP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
541-73-1	1,3-Dichlorobenzene	2.35E-14	5.62E-11	2.96E-13	6.34E-18
542-75-6	1,3-Dichloropropene	-	-	-	-
542-88-1	bis(Chloromethyl)ether	-	-	-	-
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	1.04E-14	2.49E-11	1.31E-13	2.81E-18
56-23-5	Carbon tetrachloride	2.54E-18	6.07E-15	3.20E-17	6.84E-22
56-49-5	3-Methylcholanthrene	2.09E-04	4.99E-01	2.63E-03	5.63E-08
56-55-3	Benzo(a)anthracene	3.28E-05	7.84E-02	4.13E-04	8.83E-09
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	1.23E-13	2.93E-10	1.55E-12	3.31E-17
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	1.04E-13	2.47E-10	1.30E-12	2.79E-17
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	3.37E-14	8.05E-11	4.24E-13	9.07E-18
57-24-9	Strychnine	-	-	-	-
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	3.83E-13	9.15E-10	4.82E-12	1.03E-16
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	1.87E-14	4.47E-11	2.36E-13	5.04E-18
57-74-9	Chlordane	-	-	-	-
581-42-0	2,6-Dimethylnaphthalene	-	-	-	-
584-84-9	2,4-Toluene diisocyanate	-	-	-	-
58-89-9	gamma-BHC (Lindane)	1.64E-08	3.92E-05	2.07E-07	4.42E-12
58-90-2	2,3,4,6-Tetrachlorophenol	6.89E-04	1.64E+00	8.67E-03	1.85E-07
589-38-8	3-Hexanone	4.14E-06	9.89E-03	5.21E-05	1.12E-09
591-50-4	Benzene, iodo-	-	-	-	-
591-78-6	2-Hexanone	1.41E-08	3.37E-05	1.77E-07	3.79E-12
593-60-2	Bromoethene (Vinyl bromide)	-	-	-	-

Table A-3 Estimate of Organic Emission from the Pretreatment Feed (CXP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
593-74-8	Dimethyl Mercury	2.53E-09	6.03E-06	3.18E-08	6.80E-13
59-50-7	4-Chloro-3-methylphenol	1.24E-03	2.97E+00	1.57E-02	3.35E-07
59-89-2	N-Nitrosomorpholine	7.70E-03	1.84E+01	9.68E-02	2.07E-06
60-11-7	Dimethyl aminoazobenzene	-	-	-	-
602-87-9	5-Nitroacenaphthene	5.33E-04	1.27E+00	6.70E-03	1.43E-07
60-29-7	Ethyl ether	3.12E-12	7.46E-09	3.93E-11	8.41E-16
60-35-5	Acetamide	1.65E-03	3.94E+00	2.07E-02	4.44E-07
606-20-2	2,6-Dinitrotoluene	1.16E-04	2.76E-01	1.45E-03	3.11E-08
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	1.02E-14	2.44E-11	1.29E-13	2.75E-18
608-93-5	Pentachlorobenzene	-	-	-	-
61626-71-9	Dichloropentadiene	-	-	-	-
621-64-7	N-Nitroso-di-n-propylamine	1.24E-03	2.97E+00	1.56E-02	3.35E-07
624-83-9	Methyl isocyanate	-	-	-	-
62-50-0	Ethyl methanesulfonate	-	-	-	-
62-53-3	Aniline	-	-	-	-
62-75-9	N-Nitroso-N,N-dimethylamine	7.09E-06	1.69E-02	8.92E-05	1.91E-09
628-73-9	Hexanenitrile	7.77E-06	1.85E-02	9.77E-05	2.09E-09
630-20-6	1,1,1,2-Tetrachloroethane	6.69E-10	1.60E-06	8.41E-09	1.80E-13
64-18-6	Formic acid (methanoic acid)	-	-	-	-
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	3.12E-11	7.44E-08	3.92E-10	8.39E-15
65-85-0	Benzoic acid	-	-	-	-
67-56-1	Methyl alcohol	5.44E-04	1.30E+00	6.84E-03	1.46E-07

Table A-3 Estimate of Organic Emission from the Pretreatment Feed (CXP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	3.23E-14	7.71E-11	4.06E-13	8.69E-18
67-63-0	2-Propyl alcohol	2.32E-07	5.53E-04	2.91E-06	6.24E-11
67-64-1	2-Propanone (Acetone)	4.13E-06	9.85E-03	5.19E-05	1.11E-09
67-66-3	Chloroform	1.95E-13	4.67E-10	2.46E-12	5.26E-17
67-72-1	Hexachloroethane	2.65E-12	6.33E-09	3.34E-11	7.14E-16
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	3.21E-14	7.66E-11	4.04E-13	8.64E-18
70-30-4	Hexachlorophene	-	-	-	-
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	6.53E-14	1.56E-10	8.21E-13	1.76E-17
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	2.39E-14	5.72E-11	3.01E-13	6.45E-18
71-36-3	n-Butyl alcohol	6.38E-06	1.52E-02	8.02E-05	1.72E-09
71-43-2	Benzene	2.46E-14	5.87E-11	3.09E-13	6.62E-18
71-55-6	1,1,1-Trichloroethane	2.42E-19	5.77E-16	3.04E-18	6.51E-23
72-43-5	Methoxychlor	-	-	-	-
72-55-9	4,4-DDE	1.33E-04	3.17E-01	1.67E-03	3.58E-08
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	6.01E-15	1.43E-11	7.56E-14	1.62E-18
7439-97-6	Mercury	-	-	-	-
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	3.48E-15	8.30E-12	4.38E-14	9.36E-19
74-83-9	Bromomethane	1.41E-14	3.37E-11	1.78E-13	3.80E-18
74-87-3	Chloromethane	2.30E-15	5.50E-12	2.90E-14	6.20E-19
74-88-4	Iodomethane	3.21E-14	7.67E-11	4.04E-13	8.65E-18
74-95-3	Methylene bromide	-	-	-	-
74-97-5	Bromochloromethane	-	-	-	-

Table A-3 Estimate of Organic Emission from the Pretreatment Feed (CXP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
75-00-3	Chloroethane	1.10E-17	2.62E-14	1.38E-16	2.96E-21
75-01-4	1-Chloroethene	5.28E-20	1.26E-16	6.64E-19	1.42E-23
75-02-5	Fluoroethene (vinyl fluoride)	1.90E-18	4.53E-15	2.39E-17	5.11E-22
75-05-8	Acetonitrile	4.16E-05	9.93E-02	5.23E-04	1.12E-08
75-07-0	Acetaldehyde	1.58E-05	3.78E-02	1.99E-04	4.26E-09
75-09-2	Dichloromethane (Methylene Chloride)	6.19E-11	1.48E-07	7.78E-10	1.67E-14
75-15-0	Carbon disulfide	1.19E-18	2.84E-15	1.50E-17	3.20E-22
75-21-8	Ethylene oxide (Oxirane)	6.11E-09	1.46E-05	7.69E-08	1.65E-12
75-25-2	Bromoform	-	-	-	-
75-27-4	Bromodichloromethane	7.30E-09	1.74E-05	9.18E-08	1.96E-12
75-29-6	2-Chloropropane	-	-	-	-
75-34-3	1,1-Dichloroethane	3.52E-17	8.41E-14	4.43E-16	9.49E-21
75-35-4	1,1-Dichloroethene	3.95E-20	9.42E-17	4.96E-19	1.06E-23
75-44-5	Phosgene (hydrogen phosphide)	-	-	-	-
75-45-6	Chlorodifluoromethane	1.05E-20	2.50E-17	1.32E-19	2.82E-24
75-50-3	Trimethylamine	7.65E-06	1.83E-02	9.62E-05	2.06E-09
75-69-4	Trichlorofluoromethane	1.18E-22	2.81E-19	1.48E-21	3.17E-26
75-71-8	Dichlorodifluoromethane	2.23E-25	5.31E-22	2.80E-24	5.99E-29
76-01-7	Pentachloroethane	-	-	-	-
76-13-1	1,2,2-Trichlorotrifluoroethane	-	-	-	-
764-41-0	1,4-Dichloro-2-butene	-	-	-	-
76-44-8	Heptachlor	-	-	-	-

Table A-3 Estimate of Organic Emission from the Pretreatment Feed (CXP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
765-34-4	Glycidylaldehyde	-	-	-	-
7664-41-7	Ammonia/Ammonium	3.22E-03	7.69E+00	4.05E-02	8.67E-07
77-47-4	Hexachlorocyclopentadiene	1.58E-17	3.78E-14	1.99E-16	4.26E-21
77-78-1	Dimethyl sulfate	-	-	-	-
78-83-1	2-Methylpropyl alcohol	3.46E-03	8.27E+00	4.36E-02	9.32E-07
78-87-5	1,2-Dichloropropane	7.54E-16	1.80E-12	9.48E-15	2.03E-19
78-93-3	2-Butanone	8.69E-07	2.07E-03	1.09E-05	2.34E-10
79-00-5	1,1,2-Trichloroethane	8.56E-14	2.04E-10	1.08E-12	2.30E-17
79-01-6	1,1,2-Trichloroethylene	1.17E-15	2.78E-12	1.47E-14	3.14E-19
79-10-7	2-Propenoic acid	1.89E-03	4.52E+00	2.38E-02	5.10E-07
79-34-5	1,1,2,2-Tetrachloroethane	2.84E-12	6.78E-09	3.57E-11	7.65E-16
79-46-9	2-Nitropropane	1.22E-08	2.91E-05	1.54E-07	3.29E-12
80-62-6	Methyl methacrylate	-	-	-	-
822-06-0	Hexamethylene-1,5-diisocyanate	-	-	-	-
823-40-5	Toluene-2,6-diamine	-	-	-	-
82-68-8	Pentachloronitrobenzene (PCNB)	3.91E-10	9.34E-07	4.92E-09	1.05E-13
832-69-9	1-Methylphenanthrene	-	-	-	-
83-32-9	Acenaphthene	8.20E-06	1.96E-02	1.03E-04	2.21E-09
84-66-2	Diethyl phthalate	1.02E-03	2.43E+00	1.28E-02	2.74E-07
84-74-2	Di-n-butylphthalate	1.02E-02	2.44E+01	1.28E-01	2.75E-06
85-01-8	Phenanthrene	6.86E-05	1.64E-01	8.62E-04	1.85E-08
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	-	-	-	-

Table A-3 Estimate of Organic Emission from the Pretreatment Feed (CXP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
85-68-7	Butylbenzylphthalate	3.73E-03	8.92E+00	4.70E-02	1.01E-06
86-73-7	Fluorene	1.43E-05	3.41E-02	1.79E-04	3.84E-09
87-61-6	1,2,3-Trichlorobenzene	-	-	-	-
87-68-3	Hexachlorobutadiene	4.11E-15	9.80E-12	5.16E-14	1.10E-18
87-86-5	Pentachlorophenol	9.07E-06	2.16E-02	1.14E-04	2.44E-09
88-06-2	2,4,6-Trichlorophenol	7.17E-04	1.71E+00	9.01E-03	1.93E-07
88-74-4	o-Nitroaniline (2-nitroaniline)	1.30E-04	3.10E-01	1.64E-03	3.50E-08
88-75-5	2-Nitrophenol	6.58E-04	1.57E+00	8.27E-03	1.77E-07
90-04-0	o-Anisidine	-	-	-	-
90-12-0	1-Methylnaphthalene	-	-	-	-
91-20-3	Naphthalene	2.98E-07	7.11E-04	3.75E-06	8.02E-11
91-22-5	Quinoline	-	-	-	-
91-57-6	2-Methylnaphthalene	4.36E-08	1.04E-04	5.48E-07	1.17E-11
91-58-7	2-Chloronaphthalene	2.88E-07	6.88E-04	3.62E-06	7.75E-11
91-94-1	3,3'-Dichlorobenzidine	7.37E-04	1.76E+00	9.27E-03	1.98E-07
924-16-3	N-Nitroso-di-n-Buetylamine	-	-	-	-
92-52-4	1,1`-Biphenyl	7.75E-10	1.85E-06	9.75E-09	2.09E-13
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	-	-	-	-
94-75-7	2,4-D	-	-	-	-
95-48-7	o-Cresol	1.84E-03	4.40E+00	2.32E-02	4.96E-07
95-49-8	o-Chlorotoluene	-	-	-	-
95-50-1	1,2-Dichlorobenzene	3.74E-12	8.92E-09	4.70E-11	1.01E-15

Table A-3 Estimate of Organic Emission from the Pretreatment Feed (CXP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction WF (mg/kg)	Weight Ratio WR (unitless)	Individual Organic Release R_{IO} (g/s)
95-53-4	o-Toluidine	-	-	-	-
95-57-8	2-Chlorophenol	5.11E-07	1.22E-03	6.43E-06	1.38E-10
95-63-6	1,2,4-Trimethyl benzene	-	-	-	-
95-94-3	1,2,4,5-Tetrachlorobenzene	-	-	-	-
95-95-4	2,4,5-Trichlorophenol	9.36E-04	2.24E+00	1.18E-02	2.52E-07
96-12-8	1,2-Dibromo-3-chloropropane	-	-	-	-
96-18-4	1,2,3-Trichloropropane	-	-	-	-
96-45-7	Ethylene thiourea	-	-	-	-
97-63-2	Ethyl methacrylate	-	-	-	-
98-01-1	Furfural	-	-	-	-
98-06-6	tert-Butyl benzene	-	-	-	-
98-07-7	Benzotrichloride	-	-	-	-
98-82-8	Cumene	1.04E-23	2.47E-20	1.30E-22	2.79E-27
98-83-9	Methyl styrene (mixed isomers)	-	-	-	-
98-86-2	Acetophenone	4.74E-07	1.13E-03	5.97E-06	1.28E-10
98-95-3	Nitrobenzene	1.99E-06	4.76E-03	2.51E-05	5.37E-10
99-35-4	1,3,5-Trinitrobenzene	-	-	-	-
99-65-0	1,3-Dinitrobenzene	-	-	-	-
99-87-6	p-Cymene	-	-	-	-
			Weight Fraction Sum = WF_s =	1.90E+02	
				Weight Ratio Sum = WR_s =	1.00E+00
					Feed Stream Sum = 2.14E-05

The following indicates the stream properties for feed into the Pretreatment Facility from the FEP feed used to calculate the weight fraction:

$$WF = \frac{(Q_m * 1000)}{\left(Q_v * \frac{\rho}{60 * 60}\right)}$$

Where:

Q_m = compound mass flow rate (g/s)
Q_v = volumetric flow rate (m^3/hr) = 1.13
ρ = density (kg/m^3) = 1325

A "-" symbol indicates no data are available for approximating the emissions rate (no data were available, or the corresponding values were below the emissions model tolerance).

Table A-4 Estimate of Organic Emission from the Pretreatment Feed (FEP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
100-02-7	p-Nitrophenol	1.92E-03	4.62E+00	1.70E-02	3.60E-07
100-21-0	Phthalic acid	7.34E-04	1.76E+00	6.50E-03	1.37E-07
100-25-4	1,4-Dinitrobenzene	1.46E-06	3.50E-03	1.29E-05	2.72E-10
10028-17-8	Tritium	1.60E-07	3.85E-04	1.42E-06	3.00E-11
100-40-3	4-Ethenylcyclohexene	4.78E-04	1.15E+00	4.23E-03	8.94E-08
100-41-4	Ethyl benzene	1.30E-08	3.13E-05	1.16E-07	2.44E-12
100-42-5	Styrene	6.25E-09	1.50E-05	5.54E-08	1.17E-12
100-44-7	Benzyl chloride	-	-	-	-
100-47-0	Benzonitrile	-	-	-	-
100-51-6	Benzyl alcohol	-	-	-	-
100-52-7	Benzaldehyde	-	-	-	-
10061-01-5	cis-1,3-Dichloropropene	2.31E-08	5.54E-05	2.04E-07	4.31E-12
10061-02-6	trans-1,3-Dichloropropene	2.41E-08	5.78E-05	2.13E-07	4.50E-12

Table A-4 Estimate of Organic Emission from the Pretreatment Feed (FEP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
101-55-3	4-Bromophenylphenyl ether	7.34E-04	1.76E+00	6.50E-03	1.37E-07
101-77-9	4,4-Methylenedianiline	-	-	-	-
103-33-3	Azobenzene	-	-	-	-
103-65-1	n-Propyl benzene (Isocumene)	-	-	-	-
104-51-8	n-Butylbenzene	-	-	-	-
104-76-7	2-Ethyl-1-hexanol	5.76E-04	1.38E+00	5.10E-03	1.08E-07
105-67-9	2,4-Dimethylphenol	-	-	-	-
10595-95-6	n-Nitrosomethylethylamine	1.04E-03	2.49E+00	9.20E-03	1.94E-07
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	-	-	-	-
106-44-5	p-Cresol (4-methyl phenol)	-	-	-	-
106-46-7	1,4-Dichlorobenzene	3.96E-06	9.50E-03	3.51E-05	7.40E-10
106-47-8	p-Chloroaniline	-	-	-	-
106-49-0	p-Toluidine	-	-	-	-
106-51-4	Quinone	-	-	-	-
106-88-7	1,2-Epoxybutane	6.37E-04	1.53E+00	5.64E-03	1.19E-07
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	-	-	-	-
106-93-4	Ethylene dibromide	6.25E-09	1.50E-05	5.53E-08	1.17E-12
106-99-0	1,3-Butadiene	2.10E-07	5.03E-04	1.86E-06	3.92E-11
107-02-8	Acrolein	3.39E-07	8.14E-04	3.00E-06	6.34E-11
107-05-1	3-Chloropropene	2.31E-08	5.54E-05	2.04E-07	4.31E-12
107-06-2	1,2-Dichloroethane	7.31E-09	1.75E-05	6.47E-08	1.37E-12
107-12-0	Propionitrile	2.12E-06	5.08E-03	1.87E-05	3.96E-10

Table A-4 Estimate of Organic Emission from the Pretreatment Feed (FEP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
107-13-1	Acrylonitrile	2.31E-07	5.54E-04	2.04E-06	4.31E-11
107-19-7	Propargyl alcohol	-	-	-	-
107-21-1	Ethylene glycol (1,2-ethanediol)	-	-	-	-
107-98-2	Propylene glycol monomethyl ether	-	-	-	-
108-05-4	Acetic acid vinyl ester	7.61E-04	1.83E+00	6.74E-03	1.42E-07
108-10-1	4-Methyl-2-pentanone	8.12E-08	1.95E-04	7.19E-07	1.52E-11
108-39-4	m-Cresol	1.68E-03	4.03E+00	1.49E-02	3.14E-07
108-60-1	bis (2-Chloroisopropyl)ether	-	-	-	-
108-67-8	1,3,5-Trimethylbenzene	-	-	-	-
108-86-1	Bromobenzene (Phenyl bromide)	-	-	-	-
108-87-2	Methylcyclohexane	2.66E-08	6.37E-05	2.35E-07	4.97E-12
108-88-3	Toluene	3.26E-08	7.82E-05	2.88E-07	6.09E-12
108-90-7	Chlorobenzene	7.52E-09	1.81E-05	6.66E-08	1.41E-12
108-94-1	Cyclohexanone	2.25E-05	5.41E-02	2.00E-04	4.21E-09
108-95-2	Phenol	5.23E-06	1.26E-02	4.63E-05	9.78E-10
109-74-0	n-Butanenitrile	6.11E-04	1.47E+00	5.41E-03	1.14E-07
109-75-1	3-Butenenitrile	-	-	-	-
109-77-3	Malononitrile	-	-	-	-
109-86-4	2-Methoxyethanol	-	-	-	-
109-99-9	Tetrahydrofuran	2.51E-07	6.03E-04	2.22E-06	4.70E-11
110-00-9	Furan	-	-	-	-
110-54-3	n-Hexane	1.22E-06	2.92E-03	1.08E-05	2.28E-10

Table A-4 Estimate of Organic Emission from the Pretreatment Feed (FEP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
110-59-8	Pentanenitrile	5.88E-04	1.41E+00	5.20E-03	1.10E-07
110-80-5	2-Ethoxyethanol	4.41E-03	1.06E+01	3.91E-02	8.26E-07
110-82-7	Cyclohexane	2.31E-08	5.54E-05	2.04E-07	4.31E-12
110-83-8	Cyclohexene	2.31E-08	5.54E-05	2.04E-07	4.31E-12
110-86-1	Pyridine	5.44E-06	1.30E-02	4.81E-05	1.02E-09
111-15-9	Ethylene glycol monoethyl ether acetate	-	-	-	-
111-44-4	bis(2-Chloroethyl)ether	-	-	-	-
111-65-9	n-Octane	2.78E-07	6.68E-04	2.46E-06	5.20E-11
111-76-2	2-Butoxyethanol	6.96E-04	1.67E+00	6.17E-03	1.30E-07
111-84-2	n-Nonane	1.86E-07	4.48E-04	1.65E-06	3.49E-11
111-91-1	bis(2-Chloroethoxy)methane	-	-	-	-
1120-21-4	Undecane	-	-	-	-
1120-71-4	1,3-Propane sultone	-	-	-	-
112-30-1	1-Decanol	-	-	-	-
112-31-2	Decanal	-	-	-	-
112-40-3	Dodecane	-	-	-	-
117-81-7	Bis(2-ethylhexyl) phthalate	5.75E-04	1.38E+00	5.09E-03	1.08E-07
117-84-0	Di-n-octylphthalate	2.52E-03	6.04E+00	2.23E-02	4.71E-07
118-74-1	Hexachlorobenzene	1.31E-08	3.14E-05	1.16E-07	2.45E-12
119-90-4	3,3'-Dimethoxybenzidine	-	-	-	-
120-12-7	Anthracene	4.50E-04	1.08E+00	3.99E-03	8.42E-08
120-82-1	1,2,4-Trichlorobenzene	4.63E-07	1.11E-03	4.10E-06	8.65E-11

Table A-4 Estimate of Organic Emission from the Pretreatment Feed (FEP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
120-83-2	2,4-Dichlorophenol	9.60E-04	2.31E+00	8.51E-03	1.80E-07
121-14-2	2,4-Dinitrotoluene	2.22E-03	5.32E+00	1.96E-02	4.15E-07
122-39-4	N,N-Diphenylamine	6.99E-07	1.68E-03	6.19E-06	1.31E-10
122-66-7	1,2-Diphenylhydrazine	-	-	-	-
123-33-1	Maleic hydrazide	-	-	-	-
123-38-6	Propionaldehyde	7.68E-07	1.84E-03	6.81E-06	1.44E-10
123-72-8	Butanal	6.37E-04	1.53E+00	5.64E-03	1.19E-07
123-91-1	1,4-Dioxan	2.31E-07	5.54E-04	2.04E-06	4.31E-11
124-18-5	Decane	-	-	-	-
124-38-9	Carbon dioxide	-	-	-	-
124-48-1	Chlorodibromomethane	-	-	-	-
126-73-8	Tributyl phosphate	6.58E-04	1.58E+00	5.83E-03	1.23E-07
126-98-7	2-Methyl-2-propenenitrile	2.31E-07	5.54E-04	2.04E-06	4.31E-11
127-18-4	1,1,2,2-Tetrachloroethene	7.60E-09	1.82E-05	6.73E-08	1.42E-12
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	1.10E-05	2.65E-02	9.78E-05	2.06E-09
129-00-0	Pyrene	2.18E-03	5.24E+00	1.93E-02	4.08E-07
131-11-3	Dimethyl Phthalate	-	-	-	-
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	-	-	-	-
132-64-9	Dibenzofuran	-	-	-	-
1330-20-7	Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations)	2.23E-06	5.35E-03	1.97E-05	4.17E-10
133-06-2	Captan	-	-	-	-
1336-36-3	Polychlorinated biphenyls (1254 Aroclor)	1.01E-03	2.43E+00	8.98E-03	1.90E-07

Table A-4 Estimate of Organic Emission from the Pretreatment Feed (FEP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
134-32-7	alpha-Naphthylamine	5.06E-04	1.22E+00	4.48E-03	9.47E-08
135-98-8	sec-Butylbenzene	-	-	-	-
141-78-6	Acetic acid ethyl ester	2.46E-08	5.91E-05	2.18E-07	4.61E-12
145-73-3	Endothall	-	-	-	-
156-59-2	cis-1,2-Dichloroethene	-	-	-	-
156-60-5	1,2-trans-Dichloroethene	1.71E-03	4.11E+00	1.52E-02	3.20E-07
1634-04-4	Methyl tert-butyl ether	6.23E-04	1.50E+00	5.52E-03	1.17E-07
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	-	-	-	-
189-55-9	Dibenzo[a,i]pyrene	4.45E-04	1.07E+00	3.94E-03	8.33E-08
189-64-0	Dibenzo[a,h]pyrene	4.45E-04	1.07E+00	3.94E-03	8.33E-08
191-24-2	Benzo(g,h,i)perylene	4.44E-04	1.07E+00	3.93E-03	8.30E-08
191-30-0	Dibenzo(a,l)pyrene	4.45E-04	1.07E+00	3.94E-03	8.33E-08
192-65-4	Dibenzo[a,e]pyrene	4.45E-04	1.07E+00	3.94E-03	8.33E-08
192-97-2	Benzo(e)pyrene	-	-	-	-
193-39-5	Indeno(1,2,3-cd)pyrene	4.44E-04	1.07E+00	3.93E-03	8.30E-08
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	-	-	-	-
205-82-3	Benzo[j]fluoranthene	-	-	-	-
205-99-2	Benzo(b)fluoranthene	-	-	-	-
206-44-0	Fluoranthene	2.19E-03	5.26E+00	1.94E-02	4.10E-07
207-08-9	Benzo(k)fluoranthene	-	-	-	-
208-96-8	Acenaphthylene	4.48E-04	1.08E+00	3.97E-03	8.39E-08
218-01-9	Chrysene	-	-	-	-

Table A-4 Estimate of Organic Emission from the Pretreatment Feed (FEP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
224-42-0	Dibenz[a,j]acridine	4.70E-04	1.13E+00	4.16E-03	8.79E-08
2245-38-7	2,3,5-Trimethylnaphthalene	-	-	-	-
226-36-8	Dibenz[a,h]acridine	4.70E-04	1.13E+00	4.16E-03	8.79E-08
23950-58-5	Pronamide	-	-	-	-
27154-33-2	Trichlorofluoroethane	2.68E-03	6.42E+00	2.37E-02	5.00E-07
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	-	-	-	-
319-84-6	alpha-BHC	2.58E-08	6.19E-05	2.29E-07	4.83E-12
319-85-7	beta-BHC	3.51E-08	8.41E-05	3.10E-07	6.56E-12
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	-	-	-	-
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	-	-	-	-
3268-87-9	Octachlorodibenzo(p)dioxin	-	-	-	-
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	-	-	-	-
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	-	-	-	-
3697-24-3	5-Methylchrysene	4.51E-04	1.08E+00	3.99E-03	8.43E-08
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	-	-	-	-
39001-02-0	Octachlorodibenzofuran	-	-	-	-
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	-	-	-	-
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	-	-	-	-
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	-	-	-	-
4170-30-3	Crotonaldehyde (Propylene aldehyde)	3.15E-07	7.56E-04	2.79E-06	5.89E-11
41851-50-7	Chlorocyclopentadiene	-	-	-	-
460-19-5	Cyanogen (oxalonitrile)	-	-	-	-

Table A-4 Estimate of Organic Emission from the Pretreatment Feed (FEP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
4786-20-3	2-Butenenitrile	-	-	-	-
50-00-0	Formaldehyde	1.06E-03	2.55E+00	9.40E-03	1.99E-07
50-32-8	Benzo(a)pyrene	9.12E-07	2.19E-03	8.08E-06	1.71E-10
506-68-3	Cyanogen bromide (bromocyanide)	-	-	-	-
506-77-4	Cyanogen chloride	-	-	-	-
510-15-6	Chlorobenzilate	-	-	-	-
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	-	-	-	-
51-28-5	2,4-Dinitrophenol	-	-	-	-
51-79-6	Ethyl carbamate (urethane)	-	-	-	-
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	-	-	-	-
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	-	-	-	-
532-27-4	2-Chloroacetophenone	-	-	-	-
534-52-1	4,6-Dinitro-o-cresol	-	-	-	-
53-70-3	Dibenz[a,h]anthracene	1.05E-06	2.52E-03	9.31E-06	1.97E-10
5385-75-1	Dibenzo(a,e)fluoranthene	-	-	-	-
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	-	-	-	-
540-73-8	1,2-Dimethylhydrazine	-	-	-	-
540-84-1	2,2,4-Trimethylpentane	-	-	-	-
541-73-1	1,3-Dichlorobenzene	3.03E-07	7.27E-04	2.68E-06	5.67E-11
542-75-6	1,3-Dichloropropene	-	-	-	-
542-88-1	bis(Chloromethyl)ether	-	-	-	-
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	-	-	-	-

Table A-4 Estimate of Organic Emission from the Pretreatment Feed (FEP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
56-23-5	Carbon tetrachloride	1.19E-08	2.86E-05	1.06E-07	2.23E-12
56-49-5	3-Methylcholanthrene	4.52E-04	1.08E+00	4.00E-03	8.45E-08
56-55-3	Benzo(a)anthracene	-	-	-	-
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	-	-	-	-
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	-	-	-	-
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	-	-	-	-
57-24-9	Strychnine	-	-	-	-
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	-	-	-	-
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	-	-	-	-
57-74-9	Chlordane	-	-	-	-
581-42-0	2,6-Dimethylnaphthalene	-	-	-	-
584-84-9	2,4-Toluene diisocyanate	-	-	-	-
58-89-9	gamma-BHC (Lindane)	3.49E-08	8.38E-05	3.09E-07	6.53E-12
58-90-2	2,3,4,6-Tetrachlorophenol	1.37E-03	3.28E+00	1.21E-02	2.56E-07
589-38-8	3-Hexanone	5.90E-04	1.42E+00	5.23E-03	1.10E-07
591-50-4	Benzene, iodo-	-	-	-	-
591-78-6	2-Hexanone	9.97E-07	2.39E-03	8.83E-06	1.87E-10
593-60-2	Bromoethene (Vinyl bromide)	-	-	-	-
593-74-8	Dimethyl Mercury	1.55E-10	3.73E-07	1.38E-09	2.90E-14
59-50-7	4-Chloro-3-methylphenol	2.03E-03	4.86E+00	1.79E-02	3.79E-07
59-89-2	N-Nitrosomorpholine	4.47E-03	1.07E+01	3.96E-02	8.36E-07
60-11-7	Dimethyl aminoazobenzene	-	-	-	-

Table A-4 Estimate of Organic Emission from the Pretreatment Feed (FEP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
602-87-9	5-Nitroacenaphthene	5.87E-04	1.41E+00	5.20E-03	1.10E-07
60-29-7	Ethyl ether	8.66E-07	2.08E-03	7.67E-06	1.62E-10
60-35-5	Acetamide	1.04E-03	2.51E+00	9.25E-03	1.95E-07
606-20-2	2,6-Dinitrotoluene	-	-	-	-
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	-	-	-	-
608-93-5	Pentachlorobenzene	-	-	-	-
61626-71-9	Dichloropentadiene	-	-	-	-
621-64-7	N-Nitroso-di-n-propylamine	1.96E-03	4.71E+00	1.74E-02	3.67E-07
624-83-9	Methyl isocyanate	-	-	-	-
62-50-0	Ethyl methanesulfonate	-	-	-	-
62-53-3	Aniline	-	-	-	-
62-75-9	N-Nitroso-N,N-dimethylamine	1.04E-05	2.49E-02	9.19E-05	1.94E-09
628-73-9	Hexanenitrile	5.72E-04	1.37E+00	5.07E-03	1.07E-07
630-20-6	1,1,1,2-Tetrachloroethane	2.97E-03	7.12E+00	2.63E-02	5.55E-07
64-18-6	Formic acid (methanoic acid)	-	-	-	-
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	-	-	-	-
65-85-0	Benzoic acid	-	-	-	-
67-56-1	Methyl alcohol	1.13E-03	2.72E+00	1.00E-02	2.12E-07
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	-	-	-	-
67-63-0	2-Propyl alcohol	6.43E-07	1.54E-03	5.70E-06	1.20E-10
67-64-1	2-Propanone (Acetone)	1.09E-05	2.63E-02	9.69E-05	2.05E-09
67-66-3	Chloroform	7.81E-09	1.88E-05	6.92E-08	1.46E-12

Table A-4 Estimate of Organic Emission from the Pretreatment Feed (FEP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
67-72-1	Hexachloroethane	9.22E-05	2.21E-01	8.17E-04	1.72E-08
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	-	-	-	-
70-30-4	Hexachlorophene	-	-	-	-
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	-	-	-	-
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	-	-	-	-
71-36-3	n-Butyl alcohol	1.86E-05	4.47E-02	1.65E-04	3.48E-09
71-43-2	Benzene	1.97E-08	4.74E-05	1.75E-07	3.69E-12
71-55-6	1,1,1-Trichloroethane	7.72E-09	1.85E-05	6.84E-08	1.44E-12
72-43-5	Methoxychlor	-	-	-	-
72-55-9	4,4-DDE	8.03E-04	1.93E+00	7.11E-03	1.50E-07
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	-	-	-	-
7439-97-6	Mercury	-	-	-	-
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	-	-	-	-
74-83-9	Bromomethane	1.56E-08	3.74E-05	1.38E-07	2.92E-12
74-87-3	Chloromethane	3.11E-08	7.46E-05	2.75E-07	5.81E-12
74-88-4	Iodomethane	-	-	-	-
74-95-3	Methylene bromide	-	-	-	-
74-97-5	Bromochloromethane	-	-	-	-
75-00-3	Chloroethane	1.56E-08	3.74E-05	1.38E-07	2.92E-12
75-01-4	1-Chloroethene	1.58E-08	3.80E-05	1.40E-07	2.96E-12
75-02-5	Fluoroethene (vinyl fluoride)	8.14E-04	1.95E+00	7.21E-03	1.52E-07
75-05-8	Acetonitrile	5.69E-06	1.37E-02	5.04E-05	1.06E-09

Table A-4 Estimate of Organic Emission from the Pretreatment Feed (FEP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
75-07-0	Acetaldehyde	7.79E-04	1.87E+00	6.90E-03	1.46E-07
75-09-2	Dichloromethane (Methylene Chloride)	4.62E-06	1.11E-02	4.09E-05	8.65E-10
75-15-0	Carbon disulfide	-	-	-	-
75-21-8	Ethylene oxide (Oxirane)	1.34E-06	3.23E-03	1.19E-05	2.51E-10
75-25-2	Bromoform	-	-	-	-
75-27-4	Bromodichloromethane	5.79E-03	1.39E+01	5.13E-02	1.08E-06
75-29-6	2-Chloropropane	-	-	-	-
75-34-3	1,1-Dichloroethane	6.25E-09	1.50E-05	5.54E-08	1.17E-12
75-35-4	1,1-Dichloroethene	9.83E-09	2.36E-05	8.70E-08	1.84E-12
75-44-5	Phosgene (hydrogen phosphide)	-	-	-	-
75-45-6	Chlorodifluoromethane	2.31E-08	5.54E-05	2.04E-07	4.31E-12
75-50-3	Trimethylamine	6.97E-04	1.67E+00	6.17E-03	1.30E-07
75-69-4	Trichlorofluoromethane	1.90E-08	4.56E-05	1.68E-07	3.55E-12
75-71-8	Dichlorodifluoromethane	1.93E-08	4.64E-05	1.71E-07	3.62E-12
76-01-7	Pentachloroethane	-	-	-	-
76-13-1	1,2,2-Trichlorotrifluoroethane	1.91E-08	4.59E-05	1.69E-07	3.57E-12
764-41-0	1,4-Dichloro-2-butene	-	-	-	-
76-44-8	Heptachlor	1.80E-08	4.31E-05	1.59E-07	3.36E-12
765-34-4	Glycidylaldehyde	-	-	-	-
7664-41-7	Ammonia/Ammonium	-	-	-	-
77-47-4	Hexachlorocyclopentadiene	-	-	-	-
77-78-1	Dimethyl sulfate	-	-	-	-

Table A-4 Estimate of Organic Emission from the Pretreatment Feed (FEP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
78-83-1	2-Methylpropyl alcohol	1.08E-02	2.60E+01	9.60E-02	2.03E-06
78-87-5	1,2-Dichloropropane	6.25E-09	1.50E-05	5.54E-08	1.17E-12
78-93-3	2-Butanone	2.50E-06	6.00E-03	2.21E-05	4.67E-10
79-00-5	1,1,2-Trichloroethane	7.32E-09	1.76E-05	6.49E-08	1.37E-12
79-01-6	1,1,2-Trichloroethylene	8.32E-09	2.00E-05	7.37E-08	1.56E-12
79-10-7	2-Propenoic acid	1.63E-03	3.91E+00	1.44E-02	3.04E-07
79-34-5	1,1,2,2-Tetrachloroethane	7.33E-09	1.76E-05	6.49E-08	1.37E-12
79-46-9	2-Nitropropane	1.54E-06	3.70E-03	1.37E-05	2.89E-10
80-62-6	Methyl methacrylate	-	-	-	-
822-06-0	Hexamethylene-1,5-diisocyanate	-	-	-	-
823-40-5	Toluene-2,6-diamine	-	-	-	-
82-68-8	Pentachloronitrobenzene (PCNB)	1.46E-06	3.50E-03	1.29E-05	2.72E-10
832-69-9	1-Methylphenanthrene	-	-	-	-
83-32-9	Acenaphthene	2.21E-03	5.31E+00	1.96E-02	4.13E-07
84-66-2	Diethyl phthalate	6.55E-04	1.57E+00	5.80E-03	1.22E-07
84-74-2	Di-n-butylphthalate	1.34E-02	3.21E+01	1.18E-01	2.50E-06
85-01-8	Phenanthrene	4.50E-04	1.08E+00	3.99E-03	8.42E-08
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	-	-	-	-
85-68-7	Butylbenzylphthalate	4.30E-03	1.03E+01	3.81E-02	8.04E-07
86-73-7	Fluorene	4.52E-04	1.09E+00	4.00E-03	8.45E-08
87-61-6	1,2,3-Trichlorobenzene	-	-	-	-
87-68-3	Hexachlorobutadiene	3.96E-06	9.50E-03	3.51E-05	7.41E-10

Table A-4 Estimate of Organic Emission from the Pretreatment Feed (FEP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
87-86-5	Pentachlorophenol	3.81E-06	9.15E-03	3.38E-05	7.13E-10
88-06-2	2,4,6-Trichlorophenol	1.95E-03	4.67E+00	1.72E-02	3.64E-07
88-74-4	o-Nitroaniline (2-nitroaniline)	-	-	-	-
88-75-5	2-Nitrophenol	1.97E-03	4.73E+00	1.74E-02	3.68E-07
90-04-0	o-Anisidine	-	-	-	-
90-12-0	1-Methylnaphthalene	-	-	-	-
91-20-3	Naphthalene	2.07E-03	4.96E+00	1.83E-02	3.87E-07
91-22-5	Quinoline	-	-	-	-
91-57-6	2-Methylnaphthalene	-	-	-	-
91-58-7	2-Chloronaphthalene	5.75E-04	1.38E+00	5.09E-03	1.08E-07
91-94-1	3,3'-Dichlorobenzidine	-	-	-	-
924-16-3	N-Nitroso-di-n-Buetylamine	-	-	-	-
92-52-4	1,1`-Biphenyl	1.46E-06	3.50E-03	1.29E-05	2.72E-10
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	-	-	-	-
94-75-7	2,4-D	-	-	-	-
95-48-7	o-Cresol	2.33E-03	5.59E+00	2.06E-02	4.35E-07
95-49-8	o-Chlorotoluene	-	-	-	-
95-50-1	1,2-Dichlorobenzene	6.03E-06	1.45E-02	5.34E-05	1.13E-09
95-53-4	o-Toluidine	-	-	-	-
95-57-8	2-Chlorophenol	2.09E-03	5.03E+00	1.86E-02	3.92E-07
95-63-6	1,2,4-Trimethyl benzene	-	-	-	-
95-94-3	1,2,4,5-Tetrachlorobenzene	-	-	-	-

Table A-4 Estimate of Organic Emission from the Pretreatment Feed (FEP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction WF (mg/kg)	Weight Ratio WR (unitless)	Individual Organic Release R_{IO} (g/s)
95-95-4	2,4,5-Trichlorophenol	1.90E-03	4.56E+00	1.68E-02	3.56E-07
96-12-8	1,2-Dibromo-3-chloropropane	-	-	-	-
96-18-4	1,2,3-Trichloropropane	-	-	-	-
96-45-7	Ethylene thiourea	-	-	-	-
97-63-2	Ethyl methacrylate	-	-	-	-
98-01-1	Furfural	-	-	-	-
98-06-6	tert-Butyl benzene	-	-	-	-
98-07-7	Benzotrichloride	-	-	-	-
98-82-8	Cumene	4.71E-04	1.13E+00	4.17E-03	8.80E-08
98-83-9	Methyl styrene (mixed isomers)	-	-	-	-
98-86-2	Acetophenone	1.46E-06	3.50E-03	1.29E-05	2.72E-10
98-95-3	Nitrobenzene	5.09E-06	1.22E-02	4.51E-05	9.52E-10
99-35-4	1,3,5-Trinitrobenzene	-	-	-	-
99-65-0	1,3-Dinitrobenzene	-	-	-	-
99-87-6	p-Cymene	-	-	-	-
		Weight Fraction Sum = WF_s =	2.69E+02		
			Weight Ratio Sum = WR_s =	1.00E+00	
				Feed Stream Sum =	2.10E-05

The following indicates the stream properties for feed into the Pretreatment Facility from the LAW FRP feed used to calculate the weight fraction:

$$WF = \frac{(Q_m * 1000)}{\left(Q_v * \frac{\rho}{60 * 60}\right)}$$

Where:

Q_m = compound mass flow rate (g/s)
Q_v = volumetric flow rate (m^3/hr) = 5.28E-01
ρ = density (kg/m^3) = 1309.644

A "-" symbol indicates no data are available for approximating the emissions rate (no data were available, or the corresponding values were below the emissions model tolerance).

Table A-5 Estimate of Organic Emission from the Pretreatment Feed (LAW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
100-02-7	p-Nitrophenol	1.92E-03	1.00E+01	1.70E-02	6.59E-07
100-21-0	Phthalic acid	7.34E-04	3.82E+00	6.50E-03	2.52E-07
100-25-4	1,4-Dinitrobenzene	1.46E-06	7.58E-03	1.29E-05	4.99E-10
10028-17-8	Tritium	1.60E-07	8.33E-04	1.42E-06	5.49E-11
100-40-3	4-Ethenylcyclohexene	4.78E-04	2.49E+00	4.23E-03	1.64E-07
100-41-4	Ethyl benzene	1.30E-08	6.79E-05	1.16E-07	4.47E-12
100-42-5	Styrene	6.25E-09	3.25E-05	5.54E-08	2.14E-12
100-44-7	Benzyl chloride	-	-	-	-
100-47-0	Benzonitrile	-	-	-	-
100-51-6	Benzyl alcohol	-	-	-	-

Table A-5 Estimate of Organic Emission from the Pretreatment Feed (LAW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
100-52-7	Benzaldehyde	-	-	-	-
10061-01-5	cis-1,3-Dichloropropene	2.31E-08	1.20E-04	2.04E-07	7.91E-12
10061-02-6	trans-1,3-Dichloropropene	2.41E-08	1.25E-04	2.13E-07	8.26E-12
101-55-3	4-Bromophenylphenyl ether	7.34E-04	3.82E+00	6.50E-03	2.52E-07
101-77-9	4,4-Methylenedianiline	-	-	-	-
103-33-3	Azobenzene	-	-	-	-
103-65-1	n-Propyl benzene (Isocumene)	-	-	-	-
104-51-8	n-Butylbenzene	-	-	-	-
104-76-7	2-Ethyl-1-hexanol	5.76E-04	2.99E+00	5.10E-03	1.97E-07
105-67-9	2,4-Dimethylphenol	-	-	-	-
10595-95-6	n-Nitrosomethylethylamine	1.04E-03	5.40E+00	9.20E-03	3.56E-07
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	-	-	-	-
106-44-5	p-Cresol (4-methyl phenol)	-	-	-	-
106-46-7	1,4-Dichlorobenzene	3.96E-06	2.06E-02	3.51E-05	1.36E-09
106-47-8	p-Chloroaniline	-	-	-	-
106-49-0	p-Toluidine	-	-	-	-
106-51-4	Quinone	-	-	-	-
106-88-7	1,2-Epoxybutane	6.37E-04	3.32E+00	5.64E-03	2.19E-07
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	-	-	-	-
106-93-4	Ethylene dibromide	6.25E-09	3.25E-05	5.53E-08	2.14E-12
106-99-0	1,3-Butadiene	2.10E-07	1.09E-03	1.86E-06	7.19E-11
107-02-8	Acrolein	3.39E-07	1.76E-03	3.00E-06	1.16E-10

Table A-5 Estimate of Organic Emission from the Pretreatment Feed (LAW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
107-05-1	3-Chloropropene	2.31E-08	1.20E-04	2.04E-07	7.91E-12
107-06-2	1,2-Dichloroethane	7.31E-09	3.80E-05	6.47E-08	2.51E-12
107-12-0	Propionitrile	2.12E-06	1.10E-02	1.87E-05	7.25E-10
107-13-1	Acrylonitrile	2.31E-07	1.20E-03	2.04E-06	7.91E-11
107-19-7	Propargyl alcohol	-	-	-	-
107-21-1	Ethylene glycol (1,2-ethanediol)	-	-	-	-
107-98-2	Propylene glycol monomethyl ether	-	-	-	-
108-05-4	Acetic acid vinyl ester	7.61E-04	3.96E+00	6.74E-03	2.61E-07
108-10-1	4-Methyl-2-pentanone	8.12E-08	4.23E-04	7.19E-07	2.78E-11
108-39-4	m-Cresol	1.68E-03	8.72E+00	1.49E-02	5.75E-07
108-60-1	bis (2-Chloroisopropyl)ether	-	-	-	-
108-67-8	1,3,5-Trimethylbenzene	-	-	-	-
108-86-1	Bromobenzene (Phenyl bromide)	-	-	-	-
108-87-2	Methylcyclohexane	2.66E-08	1.38E-04	2.35E-07	9.10E-12
108-88-3	Toluene	3.26E-08	1.69E-04	2.88E-07	1.12E-11
108-90-7	Chlorobenzene	7.52E-09	3.91E-05	6.66E-08	2.58E-12
108-94-1	Cyclohexanone	2.25E-05	1.17E-01	2.00E-04	7.73E-09
108-95-2	Phenol	5.23E-06	2.72E-02	4.63E-05	1.79E-09
109-74-0	n-Butanenitrile	6.11E-04	3.18E+00	5.41E-03	2.09E-07
109-75-1	3-Butenenitrile	-	-	-	-
109-77-3	Malononitrile	-	-	-	-
109-86-4	2-Methoxyethanol	-	-	-	-

Table A-5 Estimate of Organic Emission from the Pretreatment Feed (LAW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
109-99-9	Tetrahydrofuran	2.51E-07	1.31E-03	2.22E-06	8.61E-11
110-00-9	Furan	-	-	-	-
110-54-3	n-Hexane	1.22E-06	6.33E-03	1.08E-05	4.17E-10
110-59-8	Pentanenitrile	5.88E-04	3.06E+00	5.20E-03	2.01E-07
110-80-5	2-Ethoxyethanol	4.41E-03	2.30E+01	3.91E-02	1.51E-06
110-82-7	Cyclohexane	2.31E-08	1.20E-04	2.04E-07	7.91E-12
110-83-8	Cyclohexene	2.31E-08	1.20E-04	2.04E-07	7.91E-12
110-86-1	Pyridine	5.44E-06	2.83E-02	4.81E-05	1.86E-09
111-15-9	Ethylene glycol monoethyl ether acetate	-	-	-	-
111-44-4	bis(2-Chloroethyl)ether	-	-	-	-
111-65-9	n-Octane	2.78E-07	1.45E-03	2.46E-06	9.54E-11
111-76-2	2-Butoxyethanol	6.96E-04	3.62E+00	6.17E-03	2.39E-07
111-84-2	n-Nonane	1.86E-07	9.70E-04	1.65E-06	6.39E-11
111-91-1	bis(2-Chloroethoxy)methane	-	-	-	-
1120-21-4	Undecane	-	-	-	-
1120-71-4	1,3-Propane sultone	-	-	-	-
112-30-1	1-Decanol	-	-	-	-
112-31-2	Decanal	-	-	-	-
112-40-3	Dodecane	-	-	-	-
117-81-7	Bis(2-ethylhexyl) phthalate	5.75E-04	2.99E+00	5.09E-03	1.97E-07
117-84-0	Di-n-octylphthalate	2.52E-03	1.31E+01	2.23E-02	8.63E-07
118-74-1	Hexachlorobenzene	1.31E-08	6.81E-05	1.16E-07	4.49E-12

Table A-5 Estimate of Organic Emission from the Pretreatment Feed (LAW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
119-90-4	3,3'-Dimethoxybenzidine	-	-	-	-
120-12-7	Anthracene	4.50E-04	2.34E+00	3.99E-03	1.54E-07
120-82-1	1,2,4-Trichlorobenzene	4.63E-07	2.41E-03	4.10E-06	1.59E-10
120-83-2	2,4-Dichlorophenol	9.60E-04	5.00E+00	8.51E-03	3.29E-07
121-14-2	2,4-Dinitrotoluene	2.22E-03	1.15E+01	1.96E-02	7.60E-07
122-39-4	N,N-Diphenylamine	6.99E-07	3.64E-03	6.19E-06	2.40E-10
122-66-7	1,2-Diphenylhydrazine	-	-	-	-
123-33-1	Maleic hydrazide	-	-	-	-
123-38-6	Propionaldehyde	7.68E-07	4.00E-03	6.81E-06	2.63E-10
123-72-8	Butanal	6.37E-04	3.32E+00	5.64E-03	2.19E-07
123-91-1	1,4-Dioxan	2.31E-07	1.20E-03	2.04E-06	7.91E-11
124-18-5	Decane	-	-	-	-
124-38-9	Carbon dioxide	-	-	-	-
124-48-1	Chlorodibromomethane	-	-	-	-
126-73-8	Tributyl phosphate	6.58E-04	3.42E+00	5.83E-03	2.26E-07
126-98-7	2-Methyl-2-propenenitrile	2.31E-07	1.20E-03	2.04E-06	7.91E-11
127-18-4	1,1,2,2-Tetrachloroethene	7.60E-09	3.95E-05	6.73E-08	2.61E-12
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	1.10E-05	5.74E-02	9.78E-05	3.79E-09
129-00-0	Pyrene	2.18E-03	1.14E+01	1.93E-02	7.49E-07
131-11-3	Dimethyl Phthalate	-	-	-	-
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	-	-	-	-
132-64-9	Dibenzofuran	-	-	-	-

Table A-5 Estimate of Organic Emission from the Pretreatment Feed (LAW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
1330-20-7	Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations)	2.23E-06	1.16E-02	1.97E-05	7.64E-10
133-06-2	Captan	-	-	-	-
1336-36-3	Polychlorinated biphenyls (1254 Aroclor)	1.01E-03	5.27E+00	8.98E-03	3.48E-07
134-32-7	alpha-Naphthylamine	5.06E-04	2.63E+00	4.48E-03	1.74E-07
135-98-8	sec-Butylbenzene	-	-	-	-
141-78-6	Acetic acid ethyl ester	2.46E-08	1.28E-04	2.18E-07	8.45E-12
145-73-3	Endothall	-	-	-	-
156-59-2	cis-1,2-Dichloroethene	-	-	-	-
156-60-5	1,2-trans-Dichloroethene	1.71E-03	8.91E+00	1.52E-02	5.87E-07
1634-04-4	Methyl tert-butyl ether	6.23E-04	3.24E+00	5.52E-03	2.14E-07
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	-	-	-	-
189-55-9	Dibenzo[a,i]pyrene	4.45E-04	2.32E+00	3.94E-03	1.53E-07
189-64-0	Dibenzo[a,h]pyrene	4.45E-04	2.32E+00	3.94E-03	1.53E-07
191-24-2	Benzo(g,h,i)perylene	4.44E-04	2.31E+00	3.93E-03	1.52E-07
191-30-0	Dibenzo(a,l)pyrene	4.45E-04	2.32E+00	3.94E-03	1.53E-07
192-65-4	Dibenzo[a,e]pyrene	4.45E-04	2.32E+00	3.94E-03	1.53E-07
192-97-2	Benzo(e)pyrene	-	-	-	-
193-39-5	Indeno(1,2,3-cd)pyrene	4.44E-04	2.31E+00	3.93E-03	1.52E-07
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	-	-	-	-
205-82-3	Benzo[j]fluoranthene	-	-	-	-
205-99-2	Benzo(b)fluoranthene	-	-	-	-

Table A-5 Estimate of Organic Emission from the Pretreatment Feed (LAW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
206-44-0	Fluoranthene	2.19E-03	1.14E+01	1.94E-02	7.51E-07
207-08-9	Benzo(k)fluoranthene	-	-	-	-
208-96-8	Acenaphthylene	4.48E-04	2.33E+00	3.97E-03	1.54E-07
218-01-9	Chrysene	-	-	-	-
224-42-0	Dibenz[a,j]acridine	4.70E-04	2.45E+00	4.16E-03	1.61E-07
2245-38-7	2,3,5-Trimethylnaphthalene	-	-	-	-
226-36-8	Dibenz[a,h]acridine	4.70E-04	2.45E+00	4.16E-03	1.61E-07
23950-58-5	Pronamide	-	-	-	-
27154-33-2	Trichlorofluoroethane	2.68E-03	1.39E+01	2.37E-02	9.17E-07
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	-	-	-	-
319-84-6	alpha-BHC	2.58E-08	1.34E-04	2.29E-07	8.85E-12
319-85-7	beta-BHC	3.51E-08	1.82E-04	3.10E-07	1.20E-11
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	-	-	-	-
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	-	-	-	-
3268-87-9	Octachlorodibenzo(p)dioxin	-	-	-	-
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	-	-	-	-
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	-	-	-	-
3697-24-3	5-Methylchrysene	4.51E-04	2.35E+00	3.99E-03	1.55E-07
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	-	-	-	-
39001-02-0	Octachlorodibenzofuran	-	-	-	-
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	-	-	-	-
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	-	-	-	-

Table A-5 Estimate of Organic Emission from the Pretreatment Feed (LAW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	-	-	-	-
4170-30-3	Crotonaldehyde (Propylene aldehyde)	3.15E-07	1.64E-03	2.79E-06	1.08E-10
41851-50-7	Chlorocyclopentadiene	-	-	-	-
460-19-5	Cyanogen (oxalonitrile)	-	-	-	-
4786-20-3	2-Butenenitrile	-	-	-	-
50-00-0	Formaldehyde	1.06E-03	5.52E+00	9.40E-03	3.64E-07
50-32-8	Benzo(a)pyrene	9.12E-07	4.75E-03	8.08E-06	3.13E-10
506-68-3	Cyanogen bromide (bromocyanide)	-	-	-	-
506-77-4	Cyanogen chloride	-	-	-	-
510-15-6	Chlorobenzilate	-	-	-	-
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	-	-	-	-
51-28-5	2,4-Dinitrophenol	-	-	-	-
51-79-6	Ethyl carbamate (urethane)	-	-	-	-
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	-	-	-	-
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	-	-	-	-
532-27-4	2-Chloroacetophenone	-	-	-	-
534-52-1	4,6-Dinitro-o-cresol	-	-	-	-
53-70-3	Dibenz[a,h]anthracene	1.05E-06	5.47E-03	9.31E-06	3.60E-10
5385-75-1	Dibenzo(a,e)fluoranthene	-	-	-	-
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	-	-	-	-
540-73-8	1,2-Dimethylhydrazine	-	-	-	-
540-84-1	2,2,4-Trimethylpentane	-	-	-	-

Table A-5 Estimate of Organic Emission from the Pretreatment Feed (LAW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
541-73-1	1,3-Dichlorobenzene	3.03E-07	1.58E-03	2.68E-06	1.04E-10
542-75-6	1,3-Dichloropropene	-	-	-	-
542-88-1	bis(Chloromethyl)ether	-	-	-	-
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	-	-	-	-
56-23-5	Carbon tetrachloride	1.19E-08	6.21E-05	1.06E-07	4.09E-12
56-49-5	3-Methylcholanthrene	4.52E-04	2.35E+00	4.00E-03	1.55E-07
56-55-3	Benzo(a)anthracene	-	-	-	-
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	-	-	-	-
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	-	-	-	-
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	-	-	-	-
57-24-9	Strychnine	-	-	-	-
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	-	-	-	-
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	-	-	-	-
57-74-9	Chlordane	-	-	-	-
581-42-0	2,6-Dimethylnaphthalene	-	-	-	-
584-84-9	2,4-Toluene diisocyanate	-	-	-	-
58-89-9	gamma-BHC (Lindane)	3.49E-08	1.82E-04	3.09E-07	1.20E-11
58-90-2	2,3,4,6-Tetrachlorophenol	1.37E-03	7.11E+00	1.21E-02	4.68E-07
589-38-8	3-Hexanone	5.90E-04	3.07E+00	5.23E-03	2.02E-07
591-50-4	Benzene, iodo-	-	-	-	-
591-78-6	2-Hexanone	9.97E-07	5.19E-03	8.83E-06	3.42E-10
593-60-2	Bromoethene (Vinyl bromide)	-	-	-	-

Table A-5 Estimate of Organic Emission from the Pretreatment Feed (LAW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
593-74-8	Dimethyl Mercury	1.55E-10	8.08E-07	1.38E-09	5.32E-14
59-50-7	4-Chloro-3-methylphenol	2.03E-03	1.05E+01	1.79E-02	6.94E-07
59-89-2	N-Nitrosomorpholine	4.47E-03	2.33E+01	3.96E-02	1.53E-06
60-11-7	Dimethyl aminoazobenzene	-	-	-	-
602-87-9	5-Nitroacenaphthene	5.87E-04	3.05E+00	5.20E-03	2.01E-07
60-29-7	Ethyl ether	8.66E-07	4.51E-03	7.67E-06	2.97E-10
60-35-5	Acetamide	1.04E-03	5.43E+00	9.25E-03	3.58E-07
606-20-2	2,6-Dinitrotoluene	-	-	-	-
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	-	-	-	-
608-93-5	Pentachlorobenzene	-	-	-	-
61626-71-9	Dichloropentadiene	-	-	-	-
621-64-7	N-Nitroso-di-n-propylamine	1.96E-03	1.02E+01	1.74E-02	6.73E-07
624-83-9	Methyl isocyanate	-	-	-	-
62-50-0	Ethyl methanesulfonate	-	-	-	-
62-53-3	Aniline	-	-	-	-
62-75-9	N-Nitroso-N,N-dimethylamine	1.04E-05	5.40E-02	9.19E-05	3.56E-09
628-73-9	Hexanenitrile	5.72E-04	2.98E+00	5.07E-03	1.96E-07
630-20-6	1,1,1,2-Tetrachloroethane	2.97E-03	1.54E+01	2.63E-02	1.02E-06
64-18-6	Formic acid (methanoic acid)	-	-	-	-
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	-	-	-	-
65-85-0	Benzoic acid	-	-	-	-
67-56-1	Methyl alcohol	1.13E-03	5.89E+00	1.00E-02	3.88E-07

Table A-5 Estimate of Organic Emission from the Pretreatment Feed (LAW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	-	-	-	-
67-63-0	2-Propyl alcohol	6.43E-07	3.35E-03	5.70E-06	2.21E-10
67-64-1	2-Propanone (Acetone)	1.09E-05	5.69E-02	9.69E-05	3.75E-09
67-66-3	Chloroform	7.81E-09	4.06E-05	6.92E-08	2.68E-12
67-72-1	Hexachloroethane	9.22E-05	4.80E-01	8.17E-04	3.16E-08
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	-	-	-	-
70-30-4	Hexachlorophene	-	-	-	-
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	-	-	-	-
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	-	-	-	-
71-36-3	n-Butyl alcohol	1.86E-05	9.69E-02	1.65E-04	6.39E-09
71-43-2	Benzene	1.97E-08	1.03E-04	1.75E-07	6.76E-12
71-55-6	1,1,1-Trichloroethane	7.72E-09	4.02E-05	6.84E-08	2.65E-12
72-43-5	Methoxychlor	-	-	-	-
72-55-9	4,4-DDE	8.03E-04	4.18E+00	7.11E-03	2.75E-07
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	-	-	-	-
7439-97-6	Mercury	-	-	-	-
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	-	-	-	-
74-83-9	Bromomethane	1.56E-08	8.11E-05	1.38E-07	5.35E-12
74-87-3	Chloromethane	3.11E-08	1.62E-04	2.75E-07	1.06E-11
74-88-4	Iodomethane	-	-	-	-
74-95-3	Methylene bromide	-	-	-	-
74-97-5	Bromochloromethane	-	-	-	-

Table A-5 Estimate of Organic Emission from the Pretreatment Feed (LAW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
75-00-3	Chloroethane	1.56E-08	8.11E-05	1.38E-07	5.35E-12
75-01-4	1-Chloroethene	1.58E-08	8.23E-05	1.40E-07	5.43E-12
75-02-5	Fluoroethene (vinyl fluoride)	8.14E-04	4.23E+00	7.21E-03	2.79E-07
75-05-8	Acetonitrile	5.69E-06	2.96E-02	5.04E-05	1.95E-09
75-07-0	Acetaldehyde	7.79E-04	4.05E+00	6.90E-03	2.67E-07
75-09-2	Dichloromethane (Methylene Chloride)	4.62E-06	2.40E-02	4.09E-05	1.58E-09
75-15-0	Carbon disulfide	-	-	-	-
75-21-8	Ethylene oxide (Oxirane)	1.34E-06	6.99E-03	1.19E-05	4.61E-10
75-25-2	Bromoform	-	-	-	-
75-27-4	Bromodichloromethane	5.79E-03	3.01E+01	5.13E-02	1.99E-06
75-29-6	2-Chloropropane	-	-	-	-
75-34-3	1,1-Dichloroethane	6.25E-09	3.25E-05	5.54E-08	2.14E-12
75-35-4	1,1-Dichloroethene	9.83E-09	5.11E-05	8.70E-08	3.37E-12
75-44-5	Phosgene (hydrogen phosphide)	-	-	-	-
75-45-6	Chlorodifluoromethane	2.31E-08	1.20E-04	2.04E-07	7.91E-12
75-50-3	Trimethylamine	6.97E-04	3.62E+00	6.17E-03	2.39E-07
75-69-4	Trichlorofluoromethane	1.90E-08	9.88E-05	1.68E-07	6.51E-12
75-71-8	Dichlorodifluoromethane	1.93E-08	1.01E-04	1.71E-07	6.63E-12
76-01-7	Pentachloroethane	-	-	-	-
76-13-1	1,2,2-Trichlorotrifluoroethane	1.91E-08	9.94E-05	1.69E-07	6.55E-12
764-41-0	1,4-Dichloro-2-butene	-	-	-	-
76-44-8	Heptachlor	1.80E-08	9.34E-05	1.59E-07	6.16E-12

Table A-5 Estimate of Organic Emission from the Pretreatment Feed (LAW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
765-34-4	Glycidylaldehyde	-	-	-	-
7664-41-7	Ammonia/Ammonium	-	-	-	-
77-47-4	Hexachlorocyclopentadiene	-	-	-	-
77-78-1	Dimethyl sulfate	-	-	-	-
78-83-1	2-Methylpropyl alcohol	1.08E-02	5.64E+01	9.60E-02	3.72E-06
78-87-5	1,2-Dichloropropane	6.25E-09	3.25E-05	5.54E-08	2.14E-12
78-93-3	2-Butanone	2.50E-06	1.30E-02	2.21E-05	8.57E-10
79-00-5	1,1,2-Trichloroethane	7.32E-09	3.81E-05	6.49E-08	2.51E-12
79-01-6	1,1,2-Trichloroethylene	8.32E-09	4.33E-05	7.37E-08	2.85E-12
79-10-7	2-Propenoic acid	1.63E-03	8.46E+00	1.44E-02	5.58E-07
79-34-5	1,1,2,2-Tetrachloroethane	7.33E-09	3.81E-05	6.49E-08	2.51E-12
79-46-9	2-Nitropropane	1.54E-06	8.03E-03	1.37E-05	5.29E-10
80-62-6	Methyl methacrylate	-	-	-	-
822-06-0	Hexamethylene-1,5-diisocyanate	-	-	-	-
823-40-5	Toluene-2,6-diamine	-	-	-	-
82-68-8	Pentachloronitrobenzene (PCNB)	1.46E-06	7.58E-03	1.29E-05	4.99E-10
832-69-9	1-Methylphenanthrene	-	-	-	-
83-32-9	Acenaphthene	2.21E-03	1.15E+01	1.96E-02	7.58E-07
84-66-2	Diethyl phthalate	6.55E-04	3.41E+00	5.80E-03	2.24E-07
84-74-2	Di-n-butylphthalate	1.34E-02	6.96E+01	1.18E-01	4.59E-06
85-01-8	Phenanthrene	4.50E-04	2.34E+00	3.99E-03	1.54E-07
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	-	-	-	-

Table A-5 Estimate of Organic Emission from the Pretreatment Feed (LAW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
85-68-7	Butylbenzylphthalate	4.30E-03	2.24E+01	3.81E-02	1.47E-06
86-73-7	Fluorene	4.52E-04	2.35E+00	4.00E-03	1.55E-07
87-61-6	1,2,3-Trichlorobenzene	-	-	-	-
87-68-3	Hexachlorobutadiene	3.96E-06	2.06E-02	3.51E-05	1.36E-09
87-86-5	Pentachlorophenol	3.81E-06	1.98E-02	3.38E-05	1.31E-09
88-06-2	2,4,6-Trichlorophenol	1.95E-03	1.01E+01	1.72E-02	6.67E-07
88-74-4	o-Nitroaniline (2-nitroaniline)	-	-	-	-
88-75-5	2-Nitrophenol	1.97E-03	1.02E+01	1.74E-02	6.75E-07
90-04-0	o-Anisidine	-	-	-	-
90-12-0	1-Methylnaphthalene	-	-	-	-
91-20-3	Naphthalene	2.07E-03	1.08E+01	1.83E-02	7.09E-07
91-22-5	Quinoline	-	-	-	-
91-57-6	2-Methylnaphthalene	-	-	-	-
91-58-7	2-Chloronaphthalene	5.75E-04	2.99E+00	5.09E-03	1.97E-07
91-94-1	3,3'-Dichlorobenzidine	-	-	-	-
924-16-3	N-Nitroso-di-n-Buetylamine	-	-	-	-
92-52-4	1,1`-Biphenyl	1.46E-06	7.58E-03	1.29E-05	4.99E-10
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	-	-	-	-
94-75-7	2,4-D	-	-	-	-
95-48-7	o-Cresol	2.33E-03	1.21E+01	2.06E-02	7.98E-07
95-49-8	o-Chlorotoluene	-	-	-	-
95-50-1	1,2-Dichlorobenzene	6.03E-06	3.14E-02	5.34E-05	2.07E-09

Table A-5 Estimate of Organic Emission from the Pretreatment Feed (LAW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction WF (mg/kg)	Weight Ratio WR (unitless)	Individual Organic Release R_{IO} (g/s)
95-53-4	o-Toluidine	-	-	-	-
95-57-8	2-Chlorophenol	2.09E-03	1.09E+01	1.86E-02	7.18E-07
95-63-6	1,2,4-Trimethyl benzene	-	-	-	-
95-94-3	1,2,4,5-Tetrachlorobenzene	-	-	-	-
95-95-4	2,4,5-Trichlorophenol	1.90E-03	9.89E+00	1.68E-02	6.52E-07
96-12-8	1,2-Dibromo-3-chloropropane	-	-	-	-
96-18-4	1,2,3-Trichloropropane	-	-	-	-
96-45-7	Ethylene thiourea	-	-	-	-
97-63-2	Ethyl methacrylate	-	-	-	-
98-01-1	Furfural	-	-	-	-
98-06-6	tert-Butyl benzene	-	-	-	-
98-07-7	Benzotrichloride	-	-	-	-
98-82-8	Cumene	4.71E-04	2.45E+00	4.17E-03	1.61E-07
98-83-9	Methyl styrene (mixed isomers)	-	-	-	-
98-86-2	Acetophenone	1.46E-06	7.58E-03	1.29E-05	4.99E-10
98-95-3	Nitrobenzene	5.09E-06	2.65E-02	4.51E-05	1.75E-09
99-35-4	1,3,5-Trinitrobenzene	-	-	-	-
99-65-0	1,3-Dinitrobenzene	-	-	-	-
99-87-6	p-Cymene	-	-	-	-
			Weight Fraction Sum = WF_s =	5.84E+02	
				Weight Ratio Sum = WR_s =	1.00E+00
					Feed Stream Sum = 3.85E-05

The following indicates the stream properties for feed into the Pretreatment Facility from the HLW FRP feed used to calculate the weight fraction:

$$WF = \frac{(Q_m * 1000)}{\left(Q_v * \frac{\rho}{60 * 60}\right)}$$

Where:

Q_m = compound mass flow rate (g/s)
Q_v = volumetric flow rate (m^3/hr) = 5.90E-01
ρ = density (kg/m^3) = 1279.012

A "-" symbol indicates no data are available for approximating the emissions rate (no data were available, or the corresponding values were below the emissions model tolerance).

Table A-6 Estimate of Organic Emission from the Pretreatment Feed (HLW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
100-02-7	p-Nitrophenol	1.92E-03	9.17E+00	1.70E-02	7.40E-08
100-21-0	Phthalic acid	7.34E-04	3.50E+00	6.50E-03	2.83E-08
100-25-4	1,4-Dinitrobenzene	1.46E-06	6.95E-03	1.29E-05	5.61E-11
10028-17-8	Tritium	1.60E-07	7.64E-04	1.42E-06	6.17E-12
100-40-3	4-Ethenylcyclohexene	4.78E-04	2.28E+00	4.23E-03	1.84E-08
100-41-4	Ethyl benzene	1.30E-08	6.22E-05	1.16E-07	5.02E-13
100-42-5	Styrene	6.25E-09	2.98E-05	5.54E-08	2.41E-13
100-44-7	Benzyl chloride	-	-	-	-
100-47-0	Benzonitrile	-	-	-	-
100-51-6	Benzyl alcohol	-	-	-	-
100-52-7	Benzaldehyde	-	-	-	-

Table A-6 Estimate of Organic Emission from the Pretreatment Feed (HLW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
10061-01-5	cis-1,3-Dichloropropene	2.31E-08	1.10E-04	2.04E-07	8.88E-13
10061-02-6	trans-1,3-Dichloropropene	2.41E-08	1.15E-04	2.13E-07	9.27E-13
101-55-3	4-Bromophenylphenyl ether	7.34E-04	3.50E+00	6.50E-03	2.82E-08
101-77-9	4,4-Methylenedianiline	-	-	-	-
103-33-3	Azobenzene	-	-	-	-
103-65-1	n-Propyl benzene (Isocumene)	-	-	-	-
104-51-8	n-Butylbenzene	-	-	-	-
104-76-7	2-Ethyl-1-hexanol	5.76E-04	2.74E+00	5.10E-03	2.22E-08
105-67-9	2,4-Dimethylphenol	-	-	-	-
10595-95-6	n-Nitrosomethylethylamine	1.04E-03	4.95E+00	9.20E-03	4.00E-08
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	-	-	-	-
106-44-5	p-Cresol (4-methyl phenol)	-	-	-	-
106-46-7	1,4-Dichlorobenzene	3.96E-06	1.89E-02	3.51E-05	1.52E-10
106-47-8	p-Chloroaniline	-	-	-	-
106-49-0	p-Toluidine	-	-	-	-
106-51-4	Quinone	-	-	-	-
106-88-7	1,2-Epoxybutane	6.37E-04	3.04E+00	5.64E-03	2.45E-08
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	-	-	-	-
106-93-4	Ethylene dibromide	6.25E-09	2.98E-05	5.53E-08	2.41E-13
106-99-0	1,3-Butadiene	2.10E-07	1.00E-03	1.86E-06	8.07E-12
107-02-8	Acrolein	3.39E-07	1.62E-03	3.00E-06	1.30E-11
107-05-1	3-Chloropropene	2.31E-08	1.10E-04	2.04E-07	8.88E-13

Table A-6 Estimate of Organic Emission from the Pretreatment Feed (HLW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
107-06-2	1,2-Dichloroethane	7.31E-09	3.48E-05	6.47E-08	2.81E-13
107-12-0	Propionitrile	2.12E-06	1.01E-02	1.87E-05	8.14E-11
107-13-1	Acrylonitrile	2.31E-07	1.10E-03	2.04E-06	8.88E-12
107-19-7	Propargyl alcohol	-	-	-	-
107-21-1	Ethylene glycol (1,2-ethanediol)	-	-	-	-
107-98-2	Propylene glycol monomethyl ether	-	-	-	-
108-05-4	Acetic acid vinyl ester	7.61E-04	3.63E+00	6.74E-03	2.93E-08
108-10-1	4-Methyl-2-pentanone	8.12E-08	3.87E-04	7.19E-07	3.13E-12
108-39-4	m-Cresol	1.68E-03	8.00E+00	1.49E-02	6.45E-08
108-60-1	bis (2-Chloroisopropyl)ether	-	-	-	-
108-67-8	1,3,5-Trimethylbenzene	-	-	-	-
108-86-1	Bromobenzene (Phenyl bromide)	-	-	-	-
108-87-2	Methylcyclohexane	2.66E-08	1.27E-04	2.35E-07	1.02E-12
108-88-3	Toluene	3.26E-08	1.55E-04	2.88E-07	1.25E-12
108-90-7	Chlorobenzene	7.52E-09	3.59E-05	6.66E-08	2.89E-13
108-94-1	Cyclohexanone	2.25E-05	1.07E-01	2.00E-04	8.67E-10
108-95-2	Phenol	5.23E-06	2.49E-02	4.63E-05	2.01E-10
109-74-0	n-Butanenitrile	6.11E-04	2.91E+00	5.41E-03	2.35E-08
109-75-1	3-Butenenitrile	-	-	-	-
109-77-3	Malononitrile	-	-	-	-
109-86-4	2-Methoxyethanol	-	-	-	-
109-99-9	Tetrahydrofuran	2.51E-07	1.20E-03	2.22E-06	9.66E-12

Table A-6 Estimate of Organic Emission from the Pretreatment Feed (HLW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
110-00-9	Furan	-	-	-	-
110-54-3	n-Hexane	1.22E-06	5.80E-03	1.08E-05	4.68E-11
110-59-8	Pentanenitrile	5.88E-04	2.80E+00	5.20E-03	2.26E-08
110-80-5	2-Ethoxyethanol	4.41E-03	2.10E+01	3.91E-02	1.70E-07
110-82-7	Cyclohexane	2.31E-08	1.10E-04	2.04E-07	8.88E-13
110-83-8	Cyclohexene	2.31E-08	1.10E-04	2.04E-07	8.88E-13
110-86-1	Pyridine	5.44E-06	2.59E-02	4.81E-05	2.09E-10
111-15-9	Ethylene glycol monoethyl ether acetate	-	-	-	-
111-44-4	bis(2-Chloroethyl)ether	-	-	-	-
111-65-9	n-Octane	2.78E-07	1.33E-03	2.46E-06	1.07E-11
111-76-2	2-Butoxyethanol	6.96E-04	3.32E+00	6.17E-03	2.68E-08
111-84-2	n-Nonane	1.86E-07	8.89E-04	1.65E-06	7.18E-12
111-91-1	bis(2-Chloroethoxy)methane	-	-	-	-
1120-21-4	Undecane	-	-	-	-
1120-71-4	1,3-Propane sultone	-	-	-	-
112-30-1	1-Decanol	-	-	-	-
112-31-2	Decanal	-	-	-	-
112-40-3	Dodecane	-	-	-	-
117-81-7	Bis(2-ethylhexyl) phthalate	5.75E-04	2.74E+00	5.09E-03	2.21E-08
117-84-0	Di-n-octylphthalate	2.52E-03	1.20E+01	2.23E-02	9.69E-08
118-74-1	Hexachlorobenzene	1.31E-08	6.24E-05	1.16E-07	5.04E-13
119-90-4	3,3'-Dimethoxybenzidine	-	-	-	-

Table A-6 Estimate of Organic Emission from the Pretreatment Feed (HLW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
120-12-7	Anthracene	4.50E-04	2.15E+00	3.99E-03	1.73E-08
120-82-1	1,2,4-Trichlorobenzene	4.63E-07	2.21E-03	4.10E-06	1.78E-11
120-83-2	2,4-Dichlorophenol	9.60E-04	4.58E+00	8.51E-03	3.70E-08
121-14-2	2,4-Dinitrotoluene	2.22E-03	1.06E+01	1.96E-02	8.54E-08
122-39-4	N,N-Diphenylamine	6.99E-07	3.33E-03	6.19E-06	2.69E-11
122-66-7	1,2-Diphenylhydrazine	-	-	-	-
123-33-1	Maleic hydrazide	-	-	-	-
123-38-6	Propionaldehyde	7.68E-07	3.66E-03	6.81E-06	2.96E-11
123-72-8	Butanal	6.37E-04	3.04E+00	5.64E-03	2.45E-08
123-91-1	1,4-Dioxan	2.31E-07	1.10E-03	2.04E-06	8.88E-12
124-18-5	Decane	-	-	-	-
124-38-9	Carbon dioxide	-	-	-	-
124-48-1	Chlorodibromomethane	-	-	-	-
126-73-8	Tributyl phosphate	6.58E-04	3.14E+00	5.83E-03	2.53E-08
126-98-7	2-Methyl-2-propenenitrile	2.31E-07	1.10E-03	2.04E-06	8.88E-12
127-18-4	1,1,2,2-Tetrachloroethene	7.60E-09	3.62E-05	6.73E-08	2.93E-13
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	1.10E-05	5.26E-02	9.78E-05	4.25E-10
129-00-0	Pyrene	2.18E-03	1.04E+01	1.93E-02	8.40E-08
131-11-3	Dimethyl Phthalate	-	-	-	-
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	-	-	-	-
132-64-9	Dibenzofuran	-	-	-	-
1330-20-7	Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations)	2.23E-06	1.06E-02	1.97E-05	8.58E-11

Table A-6 Estimate of Organic Emission from the Pretreatment Feed (HLW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
133-06-2	Captan	-	-	-	-
1336-36-3	Polychlorinated biphenyls (1254 Aroclor)	1.01E-03	4.83E+00	8.98E-03	3.90E-08
134-32-7	alpha-Naphthylamine	5.06E-04	2.41E+00	4.48E-03	1.95E-08
135-98-8	sec-Butylbenzene	-	-	-	-
141-78-6	Acetic acid ethyl ester	2.46E-08	1.17E-04	2.18E-07	9.48E-13
145-73-3	Endothall	-	-	-	-
156-59-2	cis-1,2-Dichloroethene	-	-	-	-
156-60-5	1,2-trans-Dichloroethene	1.71E-03	8.17E+00	1.52E-02	6.59E-08
1634-04-4	Methyl tert-butyl ether	6.23E-04	2.97E+00	5.52E-03	2.40E-08
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	-	-	-	-
189-55-9	Dibenzo[a,i]pyrene	4.45E-04	2.12E+00	3.94E-03	1.71E-08
189-64-0	Dibenzo[a,h]pyrene	4.45E-04	2.12E+00	3.94E-03	1.71E-08
191-24-2	Benzo(g,h,i)perylene	4.44E-04	2.12E+00	3.93E-03	1.71E-08
191-30-0	Dibenzo(a,l)pyrene	4.45E-04	2.12E+00	3.94E-03	1.71E-08
192-65-4	Dibenzo[a,e]pyrene	4.45E-04	2.12E+00	3.94E-03	1.71E-08
192-97-2	Benzo(e)pyrene	-	-	-	-
193-39-5	Indeno(1,2,3-cd)pyrene	4.44E-04	2.12E+00	3.93E-03	1.71E-08
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	-	-	-	-
205-82-3	Benzo[j]fluoranthene	-	-	-	-
205-99-2	Benzo(b)fluoranthene	-	-	-	-
206-44-0	Fluoranthene	2.19E-03	1.04E+01	1.94E-02	8.43E-08
207-08-9	Benzo(k)fluoranthene	-	-	-	-

Table A-6 Estimate of Organic Emission from the Pretreatment Feed (HLW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
208-96-8	Acenaphthylene	4.48E-04	2.14E+00	3.97E-03	1.73E-08
218-01-9	Chrysene	-	-	-	-
224-42-0	Dibenz[a,j]acridine	4.70E-04	2.24E+00	4.16E-03	1.81E-08
2245-38-7	2,3,5-Trimethylnaphthalene	-	-	-	-
226-36-8	Dibenz[a,h]acridine	4.70E-04	2.24E+00	4.16E-03	1.81E-08
23950-58-5	Pronamide	-	-	-	-
27154-33-2	Trichlorofluoroethane	2.68E-03	1.28E+01	2.37E-02	1.03E-07
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	-	-	-	-
319-84-6	alpha-BHC	2.58E-08	1.23E-04	2.29E-07	9.93E-13
319-85-7	beta-BHC	3.51E-08	1.67E-04	3.10E-07	1.35E-12
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	-	-	-	-
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	-	-	-	-
3268-87-9	Octachlorodibenzo(p)dioxin	-	-	-	-
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	-	-	-	-
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	-	-	-	-
3697-24-3	5-Methylchrysene	4.51E-04	2.15E+00	3.99E-03	1.74E-08
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	-	-	-	-
39001-02-0	Octachlorodibenzofuran	-	-	-	-
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	-	-	-	-
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	-	-	-	-
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	-	-	-	-
4170-30-3	Crotonaldehyde (Propylene aldehyde)	3.15E-07	1.50E-03	2.79E-06	1.21E-11

Table A-6 Estimate of Organic Emission from the Pretreatment Feed (HLW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
41851-50-7	Chlorocyclopentadiene	-	-	-	-
460-19-5	Cyanogen (oxalonitrile)	-	-	-	-
4786-20-3	2-Butenenitrile	-	-	-	-
50-00-0	Formaldehyde	1.06E-03	5.06E+00	9.40E-03	4.09E-08
50-32-8	Benzo(a)pyrene	9.12E-07	4.35E-03	8.08E-06	3.51E-11
506-68-3	Cyanogen bromide (bromocyanide)	-	-	-	-
506-77-4	Cyanogen chloride	-	-	-	-
510-15-6	Chlorobenzilate	-	-	-	-
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	-	-	-	-
51-28-5	2,4-Dinitrophenol	-	-	-	-
51-79-6	Ethyl carbamate (urethane)	-	-	-	-
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	-	-	-	-
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	-	-	-	-
532-27-4	2-Chloroacetophenone	-	-	-	-
534-52-1	4,6-Dinitro-o-cresol	-	-	-	-
53-70-3	Dibenz[a,h]anthracene	1.05E-06	5.01E-03	9.31E-06	4.04E-11
5385-75-1	Dibenzo(a,e)fluoranthene	-	-	-	-
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	-	-	-	-
540-73-8	1,2-Dimethylhydrazine	-	-	-	-
540-84-1	2,2,4-Trimethylpentane	-	-	-	-
541-73-1	1,3-Dichlorobenzene	3.03E-07	1.44E-03	2.68E-06	1.17E-11
542-75-6	1,3-Dichloropropene	-	-	-	-

Table A-6 Estimate of Organic Emission from the Pretreatment Feed (HLW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
542-88-1	bis(Chloromethyl)ether	-	-	-	-
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	-	-	-	-
56-23-5	Carbon tetrachloride	1.19E-08	5.69E-05	1.06E-07	4.59E-13
56-49-5	3-Methylcholanthrene	4.52E-04	2.15E+00	4.00E-03	1.74E-08
56-55-3	Benzo(a)anthracene	-	-	-	-
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	-	-	-	-
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	-	-	-	-
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	-	-	-	-
57-24-9	Strychnine	-	-	-	-
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	-	-	-	-
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	-	-	-	-
57-74-9	Chlordane	-	-	-	-
581-42-0	2,6-Dimethylnaphthalene	-	-	-	-
584-84-9	2,4-Toluene diisocyanate	-	-	-	-
58-89-9	gamma-BHC (Lindane)	3.49E-08	1.66E-04	3.09E-07	1.34E-12
58-90-2	2,3,4,6-Tetrachlorophenol	1.37E-03	6.51E+00	1.21E-02	5.26E-08
589-38-8	3-Hexanone	5.90E-04	2.81E+00	5.23E-03	2.27E-08
591-50-4	Benzene, iodo-	-	-	-	-
591-78-6	2-Hexanone	9.97E-07	4.76E-03	8.83E-06	3.84E-11
593-60-2	Bromoethene (Vinyl bromide)	-	-	-	-
593-74-8	Dimethyl Mercury	1.55E-10	7.40E-07	1.38E-09	5.98E-15
59-50-7	4-Chloro-3-methylphenol	2.03E-03	9.66E+00	1.79E-02	7.80E-08

Table A-6 Estimate of Organic Emission from the Pretreatment Feed (HLW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
59-89-2	N-Nitrosomorpholine	4.47E-03	2.13E+01	3.96E-02	1.72E-07
60-11-7	Dimethyl aminoazobenzene	-	-	-	-
602-87-9	5-Nitroacenaphthene	5.87E-04	2.80E+00	5.20E-03	2.26E-08
60-29-7	Ethyl ether	8.66E-07	4.13E-03	7.67E-06	3.33E-11
60-35-5	Acetamide	1.04E-03	4.98E+00	9.25E-03	4.02E-08
606-20-2	2,6-Dinitrotoluene	-	-	-	-
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	-	-	-	-
608-93-5	Pentachlorobenzene	-	-	-	-
61626-71-9	Dichloropentadiene	-	-	-	-
621-64-7	N-Nitroso-di-n-propylamine	1.96E-03	9.36E+00	1.74E-02	7.55E-08
624-83-9	Methyl isocyanate	-	-	-	-
62-50-0	Ethyl methanesulfonate	-	-	-	-
62-53-3	Aniline	-	-	-	-
62-75-9	N-Nitroso-N,N-dimethylamine	1.04E-05	4.95E-02	9.19E-05	3.99E-10
628-73-9	Hexanenitrile	5.72E-04	2.73E+00	5.07E-03	2.20E-08
630-20-6	1,1,1,2-Tetrachloroethane	2.97E-03	1.41E+01	2.63E-02	1.14E-07
64-18-6	Formic acid (methanoic acid)	-	-	-	-
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	-	-	-	-
65-85-0	Benzoic acid	-	-	-	-
67-56-1	Methyl alcohol	1.13E-03	5.40E+00	1.00E-02	4.36E-08
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	-	-	-	-
67-63-0	2-Propyl alcohol	6.43E-07	3.07E-03	5.70E-06	2.48E-11

Table A-6 Estimate of Organic Emission from the Pretreatment Feed (HLW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
67-64-1	2-Propanone (Acetone)	1.09E-05	5.22E-02	9.69E-05	4.21E-10
67-66-3	Chloroform	7.81E-09	3.72E-05	6.92E-08	3.01E-13
67-72-1	Hexachloroethane	9.22E-05	4.40E-01	8.17E-04	3.55E-09
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	-	-	-	-
70-30-4	Hexachlorophene	-	-	-	-
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	-	-	-	-
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	-	-	-	-
71-36-3	n-Butyl alcohol	1.86E-05	8.88E-02	1.65E-04	7.17E-10
71-43-2	Benzene	1.97E-08	9.41E-05	1.75E-07	7.59E-13
71-55-6	1,1,1-Trichloroethane	7.72E-09	3.68E-05	6.84E-08	2.97E-13
72-43-5	Methoxychlor	-	-	-	-
72-55-9	4,4-DDE	8.03E-04	3.83E+00	7.11E-03	3.09E-08
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	-	-	-	-
7439-97-6	Mercury	-	-	-	-
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	-	-	-	-
74-83-9	Bromomethane	1.56E-08	7.43E-05	1.38E-07	6.00E-13
74-87-3	Chloromethane	3.11E-08	1.48E-04	2.75E-07	1.20E-12
74-88-4	Iodomethane	-	-	-	-
74-95-3	Methylene bromide	-	-	-	-
74-97-5	Bromochloromethane	-	-	-	-
75-00-3	Chloroethane	1.56E-08	7.43E-05	1.38E-07	6.00E-13
75-01-4	1-Chloroethene	1.58E-08	7.55E-05	1.40E-07	6.09E-13

Table A-6 Estimate of Organic Emission from the Pretreatment Feed (HLW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
75-02-5	Fluoroethene (vinyl fluoride)	8.14E-04	3.88E+00	7.21E-03	3.13E-08
75-05-8	Acetonitrile	5.69E-06	2.71E-02	5.04E-05	2.19E-10
75-07-0	Acetaldehyde	7.79E-04	3.71E+00	6.90E-03	3.00E-08
75-09-2	Dichloromethane (Methylene Chloride)	4.62E-06	2.20E-02	4.09E-05	1.78E-10
75-15-0	Carbon disulfide	-	-	-	-
75-21-8	Ethylene oxide (Oxirane)	1.34E-06	6.41E-03	1.19E-05	5.17E-11
75-25-2	Bromoform	-	-	-	-
75-27-4	Bromodichloromethane	5.79E-03	2.76E+01	5.13E-02	2.23E-07
75-29-6	2-Chloropropane	-	-	-	-
75-34-3	1,1-Dichloroethane	6.25E-09	2.98E-05	5.54E-08	2.41E-13
75-35-4	1,1-Dichloroethene	9.83E-09	4.69E-05	8.70E-08	3.78E-13
75-44-5	Phosgene (hydrogen phosphide)	-	-	-	-
75-45-6	Chlorodifluoromethane	2.31E-08	1.10E-04	2.04E-07	8.88E-13
75-50-3	Trimethylamine	6.97E-04	3.32E+00	6.17E-03	2.68E-08
75-69-4	Trichlorofluoromethane	1.90E-08	9.05E-05	1.68E-07	7.31E-13
75-71-8	Dichlorodifluoromethane	1.93E-08	9.22E-05	1.71E-07	7.44E-13
76-01-7	Pentachloroethane	-	-	-	-
76-13-1	1,2,2-Trichlorotrifluoroethane	1.91E-08	9.11E-05	1.69E-07	7.35E-13
764-41-0	1,4-Dichloro-2-butene	-	-	-	-
76-44-8	Heptachlor	1.80E-08	8.56E-05	1.59E-07	6.91E-13
765-34-4	Glycidylaldehyde	-	-	-	-
7664-41-7	Ammonia/Ammonium	-	-	-	-

Table A-6 Estimate of Organic Emission from the Pretreatment Feed (HLW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
77-47-4	Hexachlorocyclopentadiene	-	-	-	-
77-78-1	Dimethyl sulfate	-	-	-	-
78-83-1	2-Methylpropyl alcohol	1.08E-02	5.17E+01	9.60E-02	4.17E-07
78-87-5	1,2-Dichloropropane	6.25E-09	2.98E-05	5.54E-08	2.41E-13
78-93-3	2-Butanone	2.50E-06	1.19E-02	2.21E-05	9.62E-11
79-00-5	1,1,2-Trichloroethane	7.32E-09	3.49E-05	6.49E-08	2.82E-13
79-01-6	1,1,2-Trichloroethylene	8.32E-09	3.97E-05	7.37E-08	3.20E-13
79-10-7	2-Propenoic acid	1.63E-03	7.76E+00	1.44E-02	6.26E-08
79-34-5	1,1,2,2-Tetrachloroethane	7.33E-09	3.49E-05	6.49E-08	2.82E-13
79-46-9	2-Nitropropane	1.54E-06	7.36E-03	1.37E-05	5.94E-11
80-62-6	Methyl methacrylate	-	-	-	-
822-06-0	Hexamethylene-1,5-diisocyanate	-	-	-	-
823-40-5	Toluene-2,6-diamine	-	-	-	-
82-68-8	Pentachloronitrobenzene (PCNB)	1.46E-06	6.95E-03	1.29E-05	5.61E-11
832-69-9	1-Methylphenanthrene	-	-	-	-
83-32-9	Acenaphthene	2.21E-03	1.05E+01	1.96E-02	8.51E-08
84-66-2	Diethyl phthalate	6.55E-04	3.12E+00	5.80E-03	2.52E-08
84-74-2	Di-n-butylphthalate	1.34E-02	6.38E+01	1.18E-01	5.15E-07
85-01-8	Phenanthrene	4.50E-04	2.15E+00	3.99E-03	1.73E-08
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	-	-	-	-
85-68-7	Butylbenzylphthalate	4.30E-03	2.05E+01	3.81E-02	1.65E-07
86-73-7	Fluorene	4.52E-04	2.16E+00	4.00E-03	1.74E-08

Table A-6 Estimate of Organic Emission from the Pretreatment Feed (HLW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
87-61-6	1,2,3-Trichlorobenzene	-	-	-	-
87-68-3	Hexachlorobutadiene	3.96E-06	1.89E-02	3.51E-05	1.52E-10
87-86-5	Pentachlorophenol	3.81E-06	1.82E-02	3.38E-05	1.47E-10
88-06-2	2,4,6-Trichlorophenol	1.95E-03	9.28E+00	1.72E-02	7.49E-08
88-74-4	o-Nitroaniline (2-nitroaniline)	-	-	-	-
88-75-5	2-Nitrophenol	1.97E-03	9.39E+00	1.74E-02	7.58E-08
90-04-0	o-Anisidine	-	-	-	-
90-12-0	1-Methylnaphthalene	-	-	-	-
91-20-3	Naphthalene	2.07E-03	9.85E+00	1.83E-02	7.95E-08
91-22-5	Quinoline	-	-	-	-
91-57-6	2-Methylnaphthalene	-	-	-	-
91-58-7	2-Chloronaphthalene	5.75E-04	2.74E+00	5.09E-03	2.21E-08
91-94-1	3,3'-Dichlorobenzidine	-	-	-	-
924-16-3	N-Nitroso-di-n-Buetylamine	-	-	-	-
92-52-4	1,1`-Biphenyl	1.46E-06	6.95E-03	1.29E-05	5.61E-11
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	-	-	-	-
94-75-7	2,4-D	-	-	-	-
95-48-7	o-Cresol	2.33E-03	1.11E+01	2.06E-02	8.96E-08
95-49-8	o-Chlorotoluene	-	-	-	-
95-50-1	1,2-Dichlorobenzene	6.03E-06	2.88E-02	5.34E-05	2.32E-10
95-53-4	o-Toluidine	-	-	-	-
95-57-8	2-Chlorophenol	2.09E-03	9.99E+00	1.86E-02	8.06E-08

Table A-6 Estimate of Organic Emission from the Pretreatment Feed (HLW FRP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction WF (mg/kg)	Weight Ratio WR (unitless)	Individual Organic Release R_{IO} (g/s)
95-63-6	1,2,4-Trimethyl benzene	-	-	-	-
95-94-3	1,2,4,5-Tetrachlorobenzene	-	-	-	-
95-95-4	2,4,5-Trichlorophenol	1.90E-03	9.06E+00	1.68E-02	7.32E-08
96-12-8	1,2-Dibromo-3-chloropropane	-	-	-	-
96-18-4	1,2,3-Trichloropropane	-	-	-	-
96-45-7	Ethylene thiourea	-	-	-	-
97-63-2	Ethyl methacrylate	-	-	-	-
98-01-1	Furfural	-	-	-	-
98-06-6	tert-Butyl benzene	-	-	-	-
98-07-7	Benzotrichloride	-	-	-	-
98-82-8	Cumene	4.71E-04	2.24E+00	4.17E-03	1.81E-08
98-83-9	Methyl styrene (mixed isomers)	-	-	-	-
98-86-2	Acetophenone	1.46E-06	6.95E-03	1.29E-05	5.61E-11
98-95-3	Nitrobenzene	5.09E-06	2.43E-02	4.51E-05	1.96E-10
99-35-4	1,3,5-Trinitrobenzene	-	-	-	-
99-65-0	1,3-Dinitrobenzene	-	-	-	-
99-87-6	p-Cymene	-	-	-	-
			Weight Fraction Sum = WF_s =	5.35E+02	
				Weight Ratio Sum = WR_s =	1.00E+00
					Feed Stream Sum = 4.32E-06

The following indicates the stream properties for feed into the Pretreatment Facility from the HLW FRP feed used to calculate the weight fraction:

$$WF = \frac{(Q_m * 1000)}{\left(Q_v * \frac{\rho}{60 * 60}\right)}$$

Where:

Q_m = compound mass flow rate (g/s)
Q_v = volumetric flow rate (m^3/hr) = 5.44E-01
ρ = density (kg/m^3) = 1310.38

A "-" symbol indicates no data are available for approximating the emissions rate (no data were available, or the corresponding values were below the emissions model tolerance).

Table A-7 Estimate of Organic Emission from the Pretreatment Feed (HLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
100-02-7	p-Nitrophenol	2.88E-03	1.46E+01	2.41E-02	1.66E-06
100-21-0	Phthalic acid	1.20E-03	6.04E+00	9.98E-03	6.88E-07
100-25-4	1,4-Dinitrobenzene	5.24E-06	2.65E-02	4.39E-05	3.02E-09
10028-17-8	Tritium	8.46E-08	4.28E-04	7.10E-07	4.88E-11
100-40-3	4-Ethenylcyclohexene	2.66E-04	1.35E+00	2.23E-03	1.53E-07
100-41-4	Ethyl benzene	7.27E-09	3.67E-05	6.07E-08	4.19E-12
100-42-5	Styrene	3.49E-09	1.76E-05	2.91E-08	2.01E-12
100-44-7	Benzyl chloride	-	-	-	-
100-47-0	Benzonitrile	-	-	-	-
100-51-6	Benzyl alcohol	-	-	-	-

Table A-7 Estimate of Organic Emission from the Pretreatment Feed (HLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
100-52-7	Benzaldehyde	-	-	-	-
10061-01-5	cis-1,3-Dichloropropene	1.29E-08	6.49E-05	1.07E-07	7.40E-12
10061-02-6	trans-1,3-Dichloropropene	1.34E-08	6.78E-05	1.12E-07	7.73E-12
101-55-3	4-Bromophenylphenyl ether	4.09E-04	2.07E+00	3.42E-03	2.36E-07
101-77-9	4,4-Methylenedianiline	-	-	-	-
103-33-3	Azobenzene	-	-	-	-
103-65-1	n-Propyl benzene (Isocumene)	-	-	-	-
104-51-8	n-Butylbenzene	-	-	-	-
104-76-7	2-Ethyl-1-hexanol	3.30E-04	1.66E+00	2.75E-03	1.90E-07
105-67-9	2,4-Dimethylphenol	1.04E-03	5.25E+00	8.67E-03	5.98E-07
10595-95-6	n-Nitrosomethylethylamine	1.04E-03	5.24E+00	8.66E-03	5.97E-07
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	-	-	-	-
106-44-5	p-Cresol (4-methyl phenol)	-	-	-	-
106-46-7	1,4-Dichlorobenzene	2.21E-06	1.11E-02	1.84E-05	1.27E-09
106-47-8	p-Chloroaniline	1.18E-03	5.95E+00	9.83E-03	6.78E-07
106-49-0	p-Toluidine	-	-	-	-
106-51-4	Quinone	-	-	-	-
106-88-7	1,2-Epoxybutane	3.55E-04	1.79E+00	2.97E-03	2.05E-07
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	-	-	-	-
106-93-4	Ethylene dibromide	3.48E-09	1.76E-05	2.91E-08	2.00E-12
106-99-0	1,3-Butadiene	1.17E-07	5.90E-04	9.76E-07	6.73E-11

Table A-7 Estimate of Organic Emission from the Pretreatment Feed (HLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
107-02-8	Acrolein	1.89E-07	9.54E-04	1.58E-06	1.09E-10
107-05-1	3-Chloropropene	1.29E-08	6.49E-05	1.07E-07	7.40E-12
107-06-2	1,2-Dichloroethane	4.54E-09	2.29E-05	3.79E-08	2.61E-12
107-12-0	Propionitrile	1.19E-06	6.02E-03	9.96E-06	6.87E-10
107-13-1	Acrylonitrile	1.96E-06	9.92E-03	1.64E-05	1.13E-09
107-19-7	Propargyl alcohol	-	-	-	-
107-21-1	Ethylene glycol (1,2-ethanediol)	-	-	-	-
107-98-2	Propylene glycol monomethyl ether	-	-	-	-
108-05-4	Acetic acid vinyl ester	4.24E-04	2.14E+00	3.54E-03	2.44E-07
108-10-1	4-Methyl-2-pentanone	4.53E-08	2.29E-04	3.78E-07	2.61E-11
108-39-4	m-Cresol	1.83E-03	9.24E+00	1.53E-02	1.05E-06
108-60-1	bis (2-Chloroisopropyl)ether	-	-	-	-
108-67-8	1,3,5-Trimethylbenzene	-	-	-	-
108-86-1	Bromobenzene (Phenyl bromide)	-	-	-	-
108-87-2	Methylcyclohexane	1.48E-08	7.47E-05	1.24E-07	8.52E-12
108-88-3	Toluene	1.82E-08	9.17E-05	1.52E-07	1.04E-11
108-90-7	Chlorobenzene	4.19E-09	2.12E-05	3.50E-08	2.41E-12
108-94-1	Cyclohexanone	1.49E-05	7.54E-02	1.25E-04	8.60E-09
108-95-2	Phenol	3.26E-04	1.65E+00	2.72E-03	1.88E-07
109-74-0	n-Butanenitrile	3.42E-04	1.73E+00	2.85E-03	1.97E-07
109-75-1	3-Butenenitrile	-	-	-	-

Table A-7 Estimate of Organic Emission from the Pretreatment Feed (HLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
109-77-3	Malononitrile	-	-	-	-
109-86-4	2-Methoxyethanol	-	-	-	-
109-99-9	Tetrahydrofuran	1.40E-07	7.08E-04	1.17E-06	8.07E-11
110-00-9	Furan	-	-	-	-
110-54-3	n-Hexane	6.78E-07	3.42E-03	5.66E-06	3.90E-10
110-59-8	Pentanenitrile	3.28E-04	1.66E+00	2.74E-03	1.89E-07
110-80-5	2-Ethoxyethanol	5.15E-03	2.60E+01	4.30E-02	2.96E-06
110-82-7	Cyclohexane	1.29E-08	6.49E-05	1.07E-07	7.40E-12
110-83-8	Cyclohexene	1.29E-08	6.49E-05	1.07E-07	7.40E-12
110-86-1	Pyridine	3.62E-06	1.83E-02	3.02E-05	2.08E-09
111-15-9	Ethylene glycol monoethyl ether acetate	-	-	-	-
111-44-4	bis(2-Chloroethyl)ether	2.62E-05	1.32E-01	2.18E-04	1.51E-08
111-65-9	n-Octane	1.55E-07	7.83E-04	1.29E-06	8.93E-11
111-76-2	2-Butoxyethanol	6.83E-04	3.45E+00	5.70E-03	3.93E-07
111-84-2	n-Nonane	1.04E-07	5.25E-04	8.67E-07	5.98E-11
111-91-1	bis(2-Chloroethoxy)methane	1.40E-04	7.08E-01	1.17E-03	8.08E-08
1120-21-4	Undecane	-	-	-	-
1120-71-4	1,3-Propane sultone	-	-	-	-
112-30-1	1-Decanol	-	-	-	-
112-31-2	Decanal	-	-	-	-
112-40-3	Dodecane	-	-	-	-

Table A-7 Estimate of Organic Emission from the Pretreatment Feed (HLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
117-81-7	Bis(2-ethylhexyl) phthalate	1.65E-03	8.33E+00	1.38E-02	9.50E-07
117-84-0	Di-n-octylphthalate	1.41E-03	7.10E+00	1.17E-02	8.09E-07
118-74-1	Hexachlorobenzene	7.34E-09	3.71E-05	6.13E-08	4.22E-12
119-90-4	3,3'-Dimethoxybenzidine	-	-	-	-
120-12-7	Anthracene	2.53E-04	1.28E+00	2.11E-03	1.45E-07
120-82-1	1,2,4-Trichlorobenzene	2.58E-07	1.30E-03	2.15E-06	1.48E-10
120-83-2	2,4-Dichlorophenol	5.35E-04	2.70E+00	4.47E-03	3.08E-07
121-14-2	2,4-Dinitrotoluene	3.25E-03	1.64E+01	2.72E-02	1.87E-06
122-39-4	N,N-Diphenylamine	6.19E-07	3.13E-03	5.17E-06	3.57E-10
122-66-7	1,2-Diphenylhydrazine	-	-	-	-
123-33-1	Maleic hydrazide	-	-	-	-
123-38-6	Propionaldehyde	4.29E-07	2.17E-03	3.58E-06	2.47E-10
123-72-8	Butanal	3.55E-04	1.79E+00	2.97E-03	2.05E-07
123-91-1	1,4-Dioxan	1.77E-07	8.96E-04	1.48E-06	1.02E-10
124-18-5	Decane	-	-	-	-
124-38-9	Carbon dioxide	-	-	-	-
124-48-1	Chlorodibromomethane	1.18E-09	5.97E-06	9.87E-09	6.80E-13
126-73-8	Tributyl phosphate	6.71E-04	3.39E+00	5.60E-03	3.86E-07
126-98-7	2-Methyl-2-propenenitrile	1.29E-07	6.49E-04	1.07E-06	7.40E-11
127-18-4	1,1,2,2-Tetrachloroethene	4.24E-09	2.14E-05	3.54E-08	2.44E-12
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	9.00E-06	4.55E-02	7.51E-05	5.18E-09

Table A-7 Estimate of Organic Emission from the Pretreatment Feed (HLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
129-00-0	Pyrene	1.46E-03	7.37E+00	1.22E-02	8.40E-07
131-11-3	Dimethyl Phthalate	8.63E-05	4.36E-01	7.20E-04	4.97E-08
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	-	-	-	-
132-64-9	Dibenzofuran	4.80E-08	2.42E-04	4.00E-07	2.76E-11
1330-20-7	Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations)	1.24E-06	6.27E-03	1.04E-05	7.15E-10
133-06-2	Captan	-	-	-	-
1336-36-3	Polychlorinated biphenyls (1254 Aroclor)	5.65E-04	2.85E+00	4.72E-03	3.25E-07
134-32-7	alpha-Naphthylamine	6.27E-04	3.17E+00	5.24E-03	3.61E-07
135-98-8	sec-Butylbenzene	-	-	-	-
141-78-6	Acetic acid ethyl ester	1.37E-08	6.93E-05	1.15E-07	7.91E-12
145-73-3	Endothall	-	-	-	-
156-59-2	cis-1,2-Dichloroethene	-	-	-	-
156-60-5	1,2-trans-Dichloroethene	9.55E-04	4.82E+00	7.97E-03	5.50E-07
1634-04-4	Methyl tert-butyl ether	3.47E-04	1.75E+00	2.90E-03	2.00E-07
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	2.82E-14	1.43E-10	2.36E-13	1.63E-17
189-55-9	Dibenzo[a,i]pyrene	5.66E-04	2.86E+00	4.73E-03	3.26E-07
189-64-0	Dibenzo[a,h]pyrene	5.66E-04	2.86E+00	4.73E-03	3.26E-07
191-24-2	Benzo(g,h,i)perylene	8.21E-04	4.15E+00	6.86E-03	4.73E-07
191-30-0	Dibenzo(a,l)pyrene	5.66E-04	2.86E+00	4.73E-03	3.26E-07
192-65-4	Dibenzo[a,e]pyrene	5.66E-04	2.86E+00	4.73E-03	3.26E-07
192-97-2	Benzo(e)pyrene	-	-	-	-

Table A-7 Estimate of Organic Emission from the Pretreatment Feed (HLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
193-39-5	Indeno(1,2,3-cd)pyrene	7.56E-04	3.82E+00	6.31E-03	4.35E-07
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	1.79E-14	9.04E-11	1.49E-13	1.03E-17
205-82-3	Benzo[j]fluoranthene	-	-	-	-
205-99-2	Benzo(b)fluoranthene	1.09E-04	5.48E-01	9.06E-04	6.25E-08
206-44-0	Fluoranthene	1.34E-03	6.77E+00	1.12E-02	7.72E-07
207-08-9	Benzo(k)fluoranthene	3.99E-04	2.01E+00	3.33E-03	2.29E-07
208-96-8	Acenaphthylene	2.50E-04	1.26E+00	2.09E-03	1.44E-07
218-01-9	Chrysene	6.82E-07	3.44E-03	5.69E-06	3.93E-10
224-42-0	Dibenz[a,j]acridine	6.42E-04	3.24E+00	5.36E-03	3.70E-07
2245-38-7	2,3,5-Trimethylnaphthalene	-	-	-	-
226-36-8	Dibenz[a,h]acridine	6.03E-04	3.04E+00	5.03E-03	3.47E-07
23950-58-5	Pronamide	-	-	-	-
27154-33-2	Trichlorofluoroethane	1.49E-03	7.53E+00	1.24E-02	8.58E-07
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	1.31E-14	6.62E-11	1.09E-13	7.54E-18
319-84-6	alpha-BHC	1.64E-08	8.29E-05	1.37E-07	9.45E-12
319-85-7	beta-BHC	1.92E-05	9.70E-02	1.60E-04	1.11E-08
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	1.13E-10	5.68E-07	9.40E-10	6.48E-14
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	8.22E-17	4.15E-13	6.86E-16	4.73E-20
3268-87-9	Octachlorodibenzo(p)dioxin	7.19E-12	3.63E-08	6.00E-11	4.14E-15
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	1.25E-13	6.29E-10	1.04E-12	7.17E-17
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	7.88E-13	3.98E-09	6.57E-12	4.53E-16

Table A-7 Estimate of Organic Emission from the Pretreatment Feed (HLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
3697-24-3	5-Methylchrysene	3.34E-04	1.69E+00	2.79E-03	1.92E-07
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	2.07E-14	1.05E-10	1.73E-13	1.19E-17
39001-02-0	Octachlorodibenzofuran	2.30E-12	1.16E-08	1.92E-11	1.33E-15
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	1.81E-13	9.15E-10	1.51E-12	1.04E-16
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	1.08E-13	5.47E-10	9.04E-13	6.23E-17
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	1.00E-12	5.07E-09	8.38E-12	5.78E-16
4170-30-3	Crotonaldehyde (Propylene aldehyde)	1.76E-07	8.86E-04	1.47E-06	1.01E-10
41851-50-7	Chlorocyclopentadiene	-	-	-	-
460-19-5	Cyanogen (oxalonitrile)	-	-	-	-
4786-20-3	2-Butenenitrile	-	-	-	-
50-00-0	Formaldehyde	1.25E-03	6.31E+00	1.04E-02	7.19E-07
50-32-8	Benzo(a)pyrene	1.71E-04	8.62E-01	1.43E-03	9.83E-08
506-68-3	Cyanogen bromide (bromocyanide)	-	-	-	-
506-77-4	Cyanogen chloride	-	-	-	-
510-15-6	Chlorobenzilate	-	-	-	-
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	5.40E-13	2.73E-09	4.51E-12	3.11E-16
51-28-5	2,4-Dinitrophenol	2.48E-03	1.25E+01	2.07E-02	1.43E-06
51-79-6	Ethyl carbamate (urethane)	-	-	-	-
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	4.66E-12	2.35E-08	3.89E-11	2.68E-15
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	-	-	-	-
532-27-4	2-Chloroacetophenone	-	-	-	-

Table A-7 Estimate of Organic Emission from the Pretreatment Feed (HLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
534-52-1	4,6-Dinitro-o-cresol	1.43E-03	7.20E+00	1.19E-02	8.20E-07
53-70-3	Dibenz[a,h]anthracene	2.94E-05	1.48E-01	2.45E-04	1.69E-08
5385-75-1	Dibenzo(a,e)fluoranthene	-	-	-	-
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	6.66E-13	3.36E-09	5.56E-12	3.83E-16
540-73-8	1,2-Dimethylhydrazine	-	-	-	-
540-84-1	2,2,4-Trimethylpentane	-	-	-	-
541-73-1	1,3-Dichlorobenzene	1.69E-07	8.53E-04	1.41E-06	9.72E-11
542-75-6	1,3-Dichloropropene	-	-	-	-
542-88-1	bis(Chloromethyl)ether	-	-	-	-
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	1.05E-13	5.33E-10	8.80E-13	6.07E-17
56-23-5	Carbon tetrachloride	6.65E-09	3.36E-05	5.55E-08	3.83E-12
56-49-5	3-Methylcholanthrene	3.39E-04	1.71E+00	2.83E-03	1.95E-07
56-55-3	Benzo(a)anthracene	1.61E-04	8.14E-01	1.35E-03	9.28E-08
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	7.54E-13	3.81E-09	6.30E-12	4.34E-16
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	5.57E-13	2.81E-09	4.65E-12	3.21E-16
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	2.87E-13	1.45E-09	2.40E-12	1.65E-16
57-24-9	Strychnine	-	-	-	-
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	4.05E-12	2.04E-08	3.38E-11	2.33E-15
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	1.63E-13	8.21E-10	1.36E-12	9.36E-17
57-74-9	Chlordane	-	-	-	-
581-42-0	2,6-Dimethylnaphthalene	-	-	-	-

Table A-7 Estimate of Organic Emission from the Pretreatment Feed (HLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
584-84-9	2,4-Toluene diisocyanate	-	-	-	-
58-89-9	gamma-BHC (Lindane)	2.99E-08	1.51E-04	2.50E-07	1.72E-11
58-90-2	2,3,4,6-Tetrachlorophenol	1.07E-03	5.40E+00	8.93E-03	6.16E-07
589-38-8	3-Hexanone	3.29E-04	1.66E+00	2.75E-03	1.89E-07
591-50-4	Benzene, iodo-	-	-	-	-
591-78-6	2-Hexanone	5.56E-07	2.81E-03	4.64E-06	3.20E-10
593-60-2	Bromoethene (Vinyl bromide)	-	-	-	-
593-74-8	Dimethyl Mercury	1.80E-10	9.06E-07	1.50E-09	1.03E-13
59-50-7	4-Chloro-3-methylphenol	1.83E-03	9.23E+00	1.53E-02	1.05E-06
59-89-2	N-Nitrosomorpholine	5.88E-03	2.97E+01	4.91E-02	3.38E-06
60-11-7	Dimethyl aminoazobenzene	-	-	-	-
602-87-9	5-Nitroacenaphthene	6.11E-04	3.09E+00	5.10E-03	3.52E-07
60-29-7	Ethyl ether	4.83E-07	2.44E-03	4.03E-06	2.78E-10
60-35-5	Acetamide	1.25E-03	6.31E+00	1.04E-02	7.19E-07
606-20-2	2,6-Dinitrotoluene	2.55E-04	1.29E+00	2.13E-03	1.47E-07
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	1.00E-13	5.06E-10	8.37E-13	5.77E-17
608-93-5	Pentachlorobenzene	-	-	-	-
61626-71-9	Dichloropentadiene	-	-	-	-
621-64-7	N-Nitroso-di-n-propylamine	1.80E-03	9.10E+00	1.50E-02	1.04E-06
624-83-9	Methyl isocyanate	-	-	-	-
62-50-0	Ethyl methanesulfonate	-	-	-	-

Table A-7 Estimate of Organic Emission from the Pretreatment Feed (HLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
62-53-3	Aniline	-	-	-	-
62-75-9	N-Nitroso-N,N-dimethylamine	9.95E-06	5.03E-02	8.31E-05	5.73E-09
628-73-9	Hexanenitrile	3.19E-04	1.61E+00	2.66E-03	1.84E-07
630-20-6	1,1,1,2-Tetrachloroethane	1.65E-03	8.35E+00	1.38E-02	9.52E-07
64-18-6	Formic acid (methanoic acid)	-	-	-	-
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	3.59E-10	1.81E-06	3.00E-09	2.07E-13
65-85-0	Benzoic acid	-	-	-	-
67-56-1	Methyl alcohol	7.88E-04	3.98E+00	6.58E-03	4.54E-07
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	3.29E-13	1.66E-09	2.75E-12	1.89E-16
67-63-0	2-Propyl alcohol	4.34E-07	2.19E-03	3.62E-06	2.50E-10
67-64-1	2-Propanone (Acetone)	4.30E-05	2.17E-01	3.59E-04	2.47E-08
67-66-3	Chloroform	4.35E-09	2.20E-05	3.63E-08	2.51E-12
67-72-1	Hexachloroethane	5.14E-05	2.59E-01	4.29E-04	2.96E-08
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	3.26E-13	1.65E-09	2.72E-12	1.88E-16
70-30-4	Hexachlorophene	-	-	-	-
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	7.43E-13	3.75E-09	6.20E-12	4.27E-16
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	2.42E-13	1.22E-09	2.02E-12	1.39E-16
71-36-3	n-Butyl alcohol	1.24E-05	6.27E-02	1.04E-04	7.14E-09
71-43-2	Benzene	1.10E-08	5.55E-05	9.18E-08	6.33E-12
71-55-6	1,1,1-Trichloroethane	4.30E-09	2.17E-05	3.59E-08	2.48E-12
72-43-5	Methoxychlor	-	-	-	-

Table A-7 Estimate of Organic Emission from the Pretreatment Feed (HLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
72-55-9	4,4-DDE	4.68E-04	2.36E+00	3.91E-03	2.69E-07
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	6.02E-14	3.04E-10	5.03E-13	3.47E-17
7439-97-6	Mercury	-	-	-	-
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	2.97E-14	1.50E-10	2.48E-13	1.71E-17
74-83-9	Bromomethane	8.69E-09	4.39E-05	7.25E-08	5.00E-12
74-87-3	Chloromethane	1.73E-08	8.74E-05	1.45E-07	9.97E-12
74-88-4	Iodomethane	1.78E-13	8.98E-10	1.48E-12	1.02E-16
74-95-3	Methylene bromide	-	-	-	-
74-97-5	Bromochloromethane	-	-	-	-
75-00-3	Chloroethane	8.69E-09	4.39E-05	7.25E-08	5.00E-12
75-01-4	1-Chloroethene	8.82E-09	4.45E-05	7.36E-08	5.08E-12
75-02-5	Fluoroethene (vinyl fluoride)	4.54E-04	2.29E+00	3.79E-03	2.61E-07
75-05-8	Acetonitrile	4.73E-04	2.39E+00	3.95E-03	2.72E-07
75-07-0	Acetaldehyde	4.35E-04	2.19E+00	3.63E-03	2.50E-07
75-09-2	Dichloromethane (Methylene Chloride)	2.58E-06	1.30E-02	2.15E-05	1.48E-09
75-15-0	Carbon disulfide	6.45E-18	3.26E-14	5.38E-17	3.71E-21
75-21-8	Ethylene oxide (Oxirane)	7.49E-07	3.78E-03	6.25E-06	4.31E-10
75-25-2	Bromoform	-	-	-	-
75-27-4	Bromodichloromethane	3.23E-03	1.63E+01	2.70E-02	1.86E-06
75-29-6	2-Chloropropane	-	-	-	-
75-34-3	1,1-Dichloroethane	3.48E-09	1.76E-05	2.91E-08	2.01E-12

Table A-7 Estimate of Organic Emission from the Pretreatment Feed (HLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
75-35-4	1,1-Dichloroethene	5.48E-09	2.77E-05	4.57E-08	3.15E-12
75-44-5	Phosgene (hydrogen phosphide)	-	-	-	-
75-45-6	Chlorodifluoromethane	1.29E-08	6.49E-05	1.07E-07	7.40E-12
75-50-3	Trimethylamine	3.88E-04	1.96E+00	3.24E-03	2.24E-07
75-69-4	Trichlorofluoromethane	1.06E-08	5.34E-05	8.83E-08	6.09E-12
75-71-8	Dichlorodifluoromethane	1.08E-08	5.44E-05	8.99E-08	6.20E-12
76-01-7	Pentachloroethane	-	-	-	-
76-13-1	1,2,2-Trichlorotrifluoroethane	1.06E-08	5.38E-05	8.89E-08	6.13E-12
764-41-0	1,4-Dichloro-2-butene	-	-	-	-
76-44-8	Heptachlor	1.00E-08	5.05E-05	8.35E-08	5.76E-12
765-34-4	Glycidylaldehyde	-	-	-	-
7664-41-7	Ammonia/Ammonium	1.27E-02	6.43E+01	1.06E-01	7.33E-06
77-47-4	Hexachlorocyclopentadiene	8.61E-17	4.35E-13	7.19E-16	4.96E-20
77-78-1	Dimethyl sulfate	-	-	-	-
78-83-1	2-Methylpropyl alcohol	7.06E-03	3.57E+01	5.89E-02	4.06E-06
78-87-5	1,2-Dichloropropane	3.48E-09	1.76E-05	2.91E-08	2.00E-12
78-93-3	2-Butanone	9.13E-06	4.61E-02	7.62E-05	5.26E-09
79-00-5	1,1,2-Trichloroethane	4.08E-09	2.06E-05	3.41E-08	2.35E-12
79-01-6	1,1,2-Trichloroethylene	4.64E-09	2.34E-05	3.87E-08	2.67E-12
79-10-7	2-Propenoic acid	1.94E-03	9.79E+00	1.62E-02	1.12E-06
79-34-5	1,1,2,2-Tetrachloroethane	4.08E-09	2.06E-05	3.41E-08	2.35E-12

Table A-7 Estimate of Organic Emission from the Pretreatment Feed (HLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
79-46-9	2-Nitropropane	8.60E-07	4.34E-03	7.18E-06	4.95E-10
80-62-6	Methyl methacrylate	-	-	-	-
822-06-0	Hexamethylene-1,5-diisocyanate	-	-	-	-
823-40-5	Toluene-2,6-diamine	-	-	-	-
82-68-8	Pentachloronitrobenzene (PCNB)	8.12E-07	4.10E-03	6.78E-06	4.67E-10
832-69-9	1-Methylphenanthrene	-	-	-	-
83-32-9	Acenaphthene	1.23E-03	6.22E+00	1.03E-02	7.09E-07
84-66-2	Diethyl phthalate	1.03E-03	5.21E+00	8.61E-03	5.94E-07
84-74-2	Di-n-butylphthalate	1.40E-02	7.07E+01	1.17E-01	8.06E-06
85-01-8	Phenanthrene	2.74E-04	1.39E+00	2.29E-03	1.58E-07
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	-	-	-	-
85-68-7	Butylbenzylphthalate	4.64E-03	2.34E+01	3.87E-02	2.67E-06
86-73-7	Fluorene	2.54E-04	1.28E+00	2.12E-03	1.46E-07
87-61-6	1,2,3-Trichlorobenzene	-	-	-	-
87-68-3	Hexachlorobutadiene	2.21E-06	1.11E-02	1.84E-05	1.27E-09
87-86-5	Pentachlorophenol	5.30E-06	2.67E-02	4.42E-05	3.05E-09
88-06-2	2,4,6-Trichlorophenol	1.33E-03	6.72E+00	1.11E-02	7.67E-07
88-74-4	o-Nitroaniline (2-nitroaniline)	1.20E-04	6.05E-01	1.00E-03	6.90E-08
88-75-5	2-Nitrophenol	1.45E-03	7.34E+00	1.21E-02	8.36E-07
90-04-0	o-Anisidine	-	-	-	-
90-12-0	1-Methylnaphthalene	-	-	-	-

Table A-7 Estimate of Organic Emission from the Pretreatment Feed (HLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
91-20-3	Naphthalene	1.15E-03	5.82E+00	9.62E-03	6.63E-07
91-22-5	Quinoline	-	-	-	-
91-57-6	2-Methylnaphthalene	2.66E-07	1.34E-03	2.22E-06	1.53E-10
91-58-7	2-Chloronaphthalene	3.21E-04	1.62E+00	2.68E-03	1.85E-07
91-94-1	3,3'-Dichlorobenzidine	4.89E-04	2.47E+00	4.08E-03	2.81E-07
924-16-3	N-Nitroso-di-n-Buetylamine	-	-	-	-
92-52-4	1,1`-Biphenyl	8.12E-07	4.10E-03	6.78E-06	4.67E-10
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	-	-	-	-
94-75-7	2,4-D	-	-	-	-
95-48-7	o-Cresol	2.41E-03	1.22E+01	2.01E-02	1.39E-06
95-49-8	o-Chlorotoluene	-	-	-	-
95-50-1	1,2-Dichlorobenzene	3.36E-06	1.70E-02	2.81E-05	1.94E-09
95-53-4	o-Toluidine	-	-	-	-
95-57-8	2-Chlorophenol	1.17E-03	5.89E+00	9.75E-03	6.72E-07
95-63-6	1,2,4-Trimethyl benzene	-	-	-	-
95-94-3	1,2,4,5-Tetrachlorobenzene	-	-	-	-
95-95-4	2,4,5-Trichlorophenol	1.50E-03	7.57E+00	1.25E-02	8.63E-07
96-12-8	1,2-Dibromo-3-chloropropane	-	-	-	-
96-18-4	1,2,3-Trichloropropane	-	-	-	-
96-45-7	Ethylene thiourea	-	-	-	-
97-63-2	Ethyl methacrylate	-	-	-	-

Table A-7 Estimate of Organic Emission from the Pretreatment Feed (HLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction WF (mg/kg)	Weight Ratio WR (unitless)	Individual Organic Release R_{IO} (g/s)
98-01-1	Furfural	-	-	-	-
98-06-6	tert-Butyl benzene	-	-	-	-
98-07-7	Benzotrichloride	-	-	-	-
98-82-8	Cumene	2.62E-04	1.32E+00	2.19E-03	1.51E-07
98-83-9	Methyl styrene (mixed isomers)	-	-	-	-
98-86-2	Acetophenone	1.21E-06	6.09E-03	1.01E-05	6.94E-10
98-95-3	Nitrobenzene	1.81E-05	9.15E-02	1.51E-04	1.04E-08
99-35-4	1,3,5-Trinitrobenzene	-	-	-	-
99-65-0	1,3-Dinitrobenzene	-	-	-	-
99-87-6	p-Cymene	-	-	-	-
		Weight Fraction Sum = WF_s =	6.03E+02		
			Weight Ratio Sum = WR_s =	1.00E+00	
				Feed Stream Sum =	6.87E-05

The following indicates the stream properties for feed into the Pretreatment Facility from the PWD feed used to calculate the weight fraction:

$$WF = \frac{(Q_m * 1000)}{\left(Q_v * \frac{\rho}{60 * 60}\right)}$$

Where:

Q_m = compound mass flow rate (g/s)
Q_v = volumetric flow rate (m^3/hr) = 2.43
ρ = density (kg/m^3) = 1134.876

A "-" symbol indicates no data are available for approximating the emissions rate (no data were available, or the corresponding values were below the emissions model tolerance).

Table A-8 Estimate of Organic Emission from the Pretreatment Feed (PWD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
100-02-7	p-Nitrophenol	5.59E-03	7.29E+00	4.19E-02	2.23E-07
100-21-0	Phthalic acid	2.24E-03	2.92E+00	1.68E-02	8.94E-08
100-25-4	1,4-Dinitrobenzene	1.01E-05	1.32E-02	7.62E-05	4.04E-10
10028-17-8	Tritium	2.18E-07	2.84E-04	1.64E-06	8.68E-12
100-40-3	4-Ethenylcyclohexene	5.23E-07	6.82E-04	3.93E-06	2.09E-11
100-41-4	Ethyl benzene	1.43E-11	1.86E-08	1.07E-10	5.69E-16
100-42-5	Styrene	9.49E-11	1.24E-07	7.12E-10	3.78E-15
100-44-7	Benzyl chloride	-	-	-	-
100-47-0	Benzonitrile	-	-	-	-
100-51-6	Benzyl alcohol	-	-	-	-
100-52-7	Benzaldehyde	-	-	-	-
10061-01-5	cis-1,3-Dichloropropene	2.53E-11	3.29E-08	1.90E-10	1.01E-15

Table A-8 Estimate of Organic Emission from the Pretreatment Feed (PWD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
10061-02-6	trans-1,3-Dichloropropene	2.64E-11	3.44E-08	1.98E-10	1.05E-15
101-55-3	4-Bromophenylphenyl ether	2.70E-06	3.52E-03	2.03E-05	1.08E-10
101-77-9	4,4-Methylenedianiline	-	-	-	-
103-33-3	Azobenzene	-	-	-	-
103-65-1	n-Propyl benzene (Isocumene)	-	-	-	-
104-51-8	n-Butylbenzene	-	-	-	-
104-76-7	2-Ethyl-1-hexanol	5.54E-05	7.23E-02	4.16E-04	2.21E-09
105-67-9	2,4-Dimethylphenol	1.77E-03	2.31E+00	1.33E-02	7.05E-08
10595-95-6	n-Nitrosomethylethylamine	1.16E-03	1.51E+00	8.67E-03	4.60E-08
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	-	-	-	-
106-44-5	p-Cresol (4-methyl phenol)	-	-	-	-
106-46-7	1,4-Dichlorobenzene	4.39E-09	5.72E-06	3.29E-08	1.75E-13
106-47-8	p-Chloroaniline	1.96E-03	2.55E+00	1.47E-02	7.80E-08
106-49-0	p-Toluidine	-	-	-	-
106-51-4	Quinone	-	-	-	-
106-88-7	1,2-Epoxybutane	1.10E-06	1.44E-03	8.28E-06	4.40E-11
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	-	-	-	-
106-93-4	Ethylene dibromide	6.86E-12	8.95E-09	5.15E-11	2.74E-16
106-99-0	1,3-Butadiene	2.30E-10	2.99E-07	1.72E-09	9.15E-15
107-02-8	Acrolein	1.18E-09	1.54E-06	8.88E-09	4.72E-14
107-05-1	3-Chloropropene	2.53E-11	3.29E-08	1.90E-10	1.01E-15
107-06-2	1,2-Dichloroethane	7.52E-09	9.81E-06	5.65E-08	3.00E-13

Table A-8 Estimate of Organic Emission from the Pretreatment Feed (PWD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
107-12-0	Propionitrile	1.10E-07	1.43E-04	8.23E-07	4.37E-12
107-13-1	Acrylonitrile	1.47E-05	1.92E-02	1.11E-04	5.87E-10
107-19-7	Propargyl alcohol	-	-	-	-
107-21-1	Ethylene glycol (1,2-ethanediol)	-	-	-	-
107-98-2	Propylene glycol monomethyl ether	-	-	-	-
108-05-4	Acetic acid vinyl ester	8.44E-07	1.10E-03	6.34E-06	3.37E-11
108-10-1	4-Methyl-2-pentanone	2.08E-10	2.71E-07	1.56E-09	8.28E-15
108-39-4	m-Cresol	2.21E-03	2.88E+00	1.66E-02	8.79E-08
108-60-1	bis (2-Chloroisopropyl)ether	-	-	-	-
108-67-8	1,3,5-Trimethylbenzene	-	-	-	-
108-86-1	Bromobenzene (Phenyl bromide)	-	-	-	-
108-87-2	Methylcyclohexane	2.91E-11	3.79E-08	2.18E-10	1.16E-15
108-88-3	Toluene	3.67E-11	4.79E-08	2.76E-10	1.46E-15
108-90-7	Chlorobenzene	2.77E-11	3.61E-08	2.08E-10	1.10E-15
108-94-1	Cyclohexanone	8.81E-06	1.15E-02	6.62E-05	3.51E-10
108-95-2	Phenol	5.52E-04	7.20E-01	4.14E-03	2.20E-08
109-74-0	n-Butanenitrile	1.51E-05	1.97E-02	1.13E-04	6.02E-10
109-75-1	3-Butenenitrile	-	-	-	-
109-77-3	Malononitrile	-	-	-	-
109-86-4	2-Methoxyethanol	-	-	-	-
109-99-9	Tetrahydrofuran	2.84E-09	3.70E-06	2.13E-08	1.13E-13
110-00-9	Furan	-	-	-	-

Table A-8 Estimate of Organic Emission from the Pretreatment Feed (PWD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
110-54-3	n-Hexane	1.33E-09	1.74E-06	1.00E-08	5.31E-14
110-59-8	Pentanenitrile	6.96E-06	9.08E-03	5.22E-05	2.77E-10
110-80-5	2-Ethoxyethanol	6.76E-03	8.81E+00	5.07E-02	2.69E-07
110-82-7	Cyclohexane	2.53E-11	3.29E-08	1.90E-10	1.01E-15
110-83-8	Cyclohexene	2.53E-11	3.29E-08	1.90E-10	1.01E-15
110-86-1	Pyridine	2.16E-06	2.82E-03	1.62E-05	8.61E-11
111-15-9	Ethylene glycol monoethyl ether acetate	-	-	-	-
111-44-4	bis(2-Chloroethyl)ether	8.14E-05	1.06E-01	6.11E-04	3.24E-09
111-65-9	n-Octane	3.05E-10	3.97E-07	2.29E-09	1.21E-14
111-76-2	2-Butoxyethanol	7.43E-04	9.68E-01	5.58E-03	2.96E-08
111-84-2	n-Nonane	2.04E-10	2.66E-07	1.53E-09	8.14E-15
111-91-1	bis(2-Chloroethoxy)methane	2.60E-04	3.39E-01	1.95E-03	1.04E-08
1120-21-4	Undecane	-	-	-	-
1120-71-4	1,3-Propane sultone	-	-	-	-
112-30-1	1-Decanol	-	-	-	-
112-31-2	Decanal	-	-	-	-
112-40-3	Dodecane	-	-	-	-
117-81-7	Bis(2-ethylhexyl) phthalate	3.23E-03	4.21E+00	2.42E-02	1.29E-07
117-84-0	Di-n-octylphthalate	3.48E-05	4.54E-02	2.62E-04	1.39E-09
118-74-1	Hexachlorobenzene	7.42E-10	9.68E-07	5.57E-09	2.96E-14
119-90-4	3,3'-Dimethoxybenzidine	-	-	-	-
120-12-7	Anthracene	1.48E-05	1.93E-02	1.11E-04	5.89E-10

Table A-8 Estimate of Organic Emission from the Pretreatment Feed (PWD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
120-82-1	1,2,4-Trichlorobenzene	5.07E-10	6.61E-07	3.80E-09	2.02E-14
120-83-2	2,4-Dichlorophenol	1.05E-06	1.37E-03	7.90E-06	4.19E-11
121-14-2	2,4-Dinitrotoluene	5.52E-03	7.19E+00	4.14E-02	2.20E-07
122-39-4	N,N-Diphenylamine	6.17E-07	8.04E-04	4.63E-06	2.46E-11
122-66-7	1,2-Diphenylhydrazine	-	-	-	-
123-33-1	Maleic hydrazide	-	-	-	-
123-38-6	Propionaldehyde	8.54E-09	1.11E-05	6.41E-08	3.41E-13
123-72-8	Butanal	2.44E-06	3.18E-03	1.83E-05	9.73E-11
123-91-1	1,4-Dioxan	1.47E-07	1.91E-04	1.10E-06	5.85E-12
124-18-5	Decane	-	-	-	-
124-38-9	Carbon dioxide	-	-	-	-
124-48-1	Chlorodibromomethane	1.84E-08	2.40E-05	1.38E-07	7.35E-13
126-73-8	Tributyl phosphate	7.68E-04	1.00E+00	5.77E-03	3.06E-08
126-98-7	2-Methyl-2-propenenitrile	3.01E-10	3.93E-07	2.26E-09	1.20E-14
127-18-4	1,1,2,2-Tetrachloroethene	8.32E-12	1.08E-08	6.25E-11	3.32E-16
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	7.79E-06	1.02E-02	5.85E-05	3.11E-10
129-00-0	Pyrene	8.69E-04	1.13E+00	6.52E-03	3.46E-08
131-11-3	Dimethyl Phthalate	1.79E-04	2.33E-01	1.34E-03	7.12E-09
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	-	-	-	-
132-64-9	Dibenzofuran	5.32E-07	6.94E-04	4.00E-06	2.12E-11
1330-20-7	Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations)	2.44E-09	3.19E-06	1.83E-08	9.74E-14
133-06-2	Captan	-	-	-	-

Table A-8 Estimate of Organic Emission from the Pretreatment Feed (PWD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
1336-36-3	Polychlorinated biphenyls (1254 Aroclor)	1.54E-06	2.01E-03	1.16E-05	6.14E-11
134-32-7	alpha-Naphthylamine	1.10E-03	1.44E+00	8.27E-03	4.39E-08
135-98-8	sec-Butylbenzene	-	-	-	-
141-78-6	Acetic acid ethyl ester	6.86E-11	8.95E-08	5.15E-10	2.73E-15
145-73-3	Endothall	-	-	-	-
156-59-2	cis-1,2-Dichloroethene	-	-	-	-
156-60-5	1,2-trans-Dichloroethene	1.88E-06	2.45E-03	1.41E-05	7.48E-11
1634-04-4	Methyl tert-butyl ether	6.88E-07	8.97E-04	5.16E-06	2.74E-11
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1.21E-13	1.57E-10	9.06E-13	4.81E-18
189-55-9	Dibenzo[a,i]pyrene	1.04E-03	1.35E+00	7.79E-03	4.14E-08
189-64-0	Dibenzo[a,h]pyrene	1.04E-03	1.35E+00	7.79E-03	4.14E-08
191-24-2	Benzo(g,h,i)perylene	1.31E-03	1.71E+00	9.85E-03	5.23E-08
191-30-0	Dibenzo(a,l)pyrene	1.04E-03	1.35E+00	7.79E-03	4.14E-08
192-65-4	Dibenzo[a,e]pyrene	1.04E-03	1.35E+00	7.79E-03	4.14E-08
192-97-2	Benzo(e)pyrene	-	-	-	-
193-39-5	Indeno(1,2,3-cd)pyrene	1.07E-03	1.39E+00	8.00E-03	4.25E-08
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	4.30E-13	5.61E-10	3.23E-12	1.71E-17
205-82-3	Benzo[j]fluoranthene	-	-	-	-
205-99-2	Benzo(b)fluoranthene	2.74E-04	3.57E-01	2.06E-03	1.09E-08
206-44-0	Fluoranthene	5.30E-04	6.91E-01	3.98E-03	2.11E-08
207-08-9	Benzo(k)fluoranthene	7.18E-04	9.36E-01	5.39E-03	2.86E-08
208-96-8	Acenaphthylene	3.99E-06	5.21E-03	3.00E-05	1.59E-10

Table A-8 Estimate of Organic Emission from the Pretreatment Feed (PWD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
218-01-9	Chrysene	5.25E-06	6.84E-03	3.94E-05	2.09E-10
224-42-0	Dibenz[a,j]acridine	1.24E-03	1.62E+00	9.34E-03	4.96E-08
2245-38-7	2,3,5-Trimethylnaphthalene	-	-	-	-
226-36-8	Dibenz[a,h]acridine	1.19E-03	1.55E+00	8.92E-03	4.73E-08
23950-58-5	Pronamide	-	-	-	-
27154-33-2	Trichlorofluoroethane	2.93E-06	3.82E-03	2.20E-05	1.17E-10
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	1.62E-13	2.11E-10	1.21E-12	6.45E-18
319-84-6	alpha-BHC	8.20E-09	1.07E-05	6.16E-08	3.27E-13
319-85-7	beta-BHC	1.50E-05	1.96E-02	1.13E-04	5.98E-10
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	2.79E-11	3.63E-08	2.09E-10	1.11E-15
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	1.29E-15	1.69E-12	9.70E-15	5.15E-20
3268-87-9	Octachlorodibenzo(p)dioxin	1.54E-11	2.01E-08	1.16E-10	6.13E-16
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	8.03E-13	1.05E-09	6.03E-12	3.20E-17
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	2.05E-12	2.68E-09	1.54E-11	8.18E-17
3697-24-3	5-Methylchrysene	2.61E-04	3.41E-01	1.96E-03	1.04E-08
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	1.95E-13	2.54E-10	1.46E-12	7.76E-18
39001-02-0	Octachlorodibenzofuran	4.09E-12	5.33E-09	3.07E-11	1.63E-16
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	4.54E-13	5.92E-10	3.41E-12	1.81E-17
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	5.90E-13	7.70E-10	4.43E-12	2.35E-17
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	1.77E-12	2.31E-09	1.33E-11	7.05E-17
4170-30-3	Crotonaldehyde (Propylene aldehyde)	3.45E-10	4.50E-07	2.59E-09	1.37E-14
41851-50-7	Chlorocyclopentadiene	-	-	-	-

Table A-8 Estimate of Organic Emission from the Pretreatment Feed (PWD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
460-19-5	Cyanogen (oxalonitrile)	-	-	-	-
4786-20-3	2-Butenenitrile	-	-	-	-
50-00-0	Formaldehyde	1.73E-03	2.25E+00	1.30E-02	6.88E-08
50-32-8	Benzo(a)pyrene	3.15E-04	4.11E-01	2.37E-03	1.26E-08
506-68-3	Cyanogen bromide (bromocyanide)	-	-	-	-
506-77-4	Cyanogen chloride	-	-	-	-
510-15-6	Chlorobenzilate	-	-	-	-
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	1.52E-12	1.98E-09	1.14E-11	6.06E-17
51-28-5	2,4-Dinitrophenol	4.49E-03	5.86E+00	3.37E-02	1.79E-07
51-79-6	Ethyl carbamate (urethane)	-	-	-	-
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	8.34E-13	1.09E-09	6.26E-12	3.32E-17
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	-	-	-	-
532-27-4	2-Chloroacetophenone	-	-	-	-
534-52-1	4,6-Dinitro-o-cresol	2.45E-03	3.19E+00	1.84E-02	9.76E-08
53-70-3	Dibenz[a,h]anthracene	1.19E-04	1.55E-01	8.93E-04	4.74E-09
5385-75-1	Dibenzo(a,e)fluoranthene	-	-	-	-
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	1.20E-11	1.56E-08	8.98E-11	4.77E-16
540-73-8	1,2-Dimethylhydrazine	-	-	-	-
540-84-1	2,2,4-Trimethylpentane	-	-	-	-
541-73-1	1,3-Dichlorobenzene	3.32E-10	4.33E-07	2.49E-09	1.32E-14
542-75-6	1,3-Dichloropropene	-	-	-	-
542-88-1	bis(Chloromethyl)ether	-	-	-	-

Table A-8 Estimate of Organic Emission from the Pretreatment Feed (PWD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	2.93E-13	3.83E-10	2.20E-12	1.17E-17
56-23-5	Carbon tetrachloride	1.31E-11	1.70E-08	9.80E-11	5.21E-16
56-49-5	3-Methylcholanthrene	2.72E-04	3.54E-01	2.04E-03	1.08E-08
56-55-3	Benzo(a)anthracene	2.98E-04	3.89E-01	2.24E-03	1.19E-08
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	1.49E-12	1.95E-09	1.12E-11	5.95E-17
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	1.11E-12	1.45E-09	8.33E-12	4.42E-17
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	6.07E-13	7.91E-10	4.56E-12	2.42E-17
57-24-9	Strychnine	-	-	-	-
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	9.10E-12	1.19E-08	6.83E-11	3.63E-16
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	4.53E-13	5.91E-10	3.40E-12	1.80E-17
57-74-9	Chlordane	-	-	-	-
581-42-0	2,6-Dimethylnaphthalene	-	-	-	-
584-84-9	2,4-Toluene diisocyanate	-	-	-	-
58-89-9	gamma-BHC (Lindane)	2.21E-08	2.88E-05	1.66E-07	8.81E-13
58-90-2	2,3,4,6-Tetrachlorophenol	9.21E-04	1.20E+00	6.91E-03	3.67E-08
589-38-8	3-Hexanone	1.89E-06	2.46E-03	1.42E-05	7.53E-11
591-50-4	Benzene, iodo-	-	-	-	-
591-78-6	2-Hexanone	6.21E-09	8.10E-06	4.66E-08	2.48E-13
593-60-2	Bromoethene (Vinyl bromide)	-	-	-	-
593-74-8	Dimethyl Mercury	9.57E-10	1.25E-06	7.19E-09	3.82E-14
59-50-7	4-Chloro-3-methylphenol	1.84E-03	2.39E+00	1.38E-02	7.32E-08
59-89-2	N-Nitrosomorpholine	9.49E-03	1.24E+01	7.13E-02	3.78E-07

Table A-8 Estimate of Organic Emission from the Pretreatment Feed (PWD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
60-11-7	Dimethyl aminoazobenzene	-	-	-	-
602-87-9	5-Nitroacenaphthene	7.41E-04	9.66E-01	5.56E-03	2.95E-08
60-29-7	Ethyl ether	9.49E-10	1.24E-06	7.12E-09	3.78E-14
60-35-5	Acetamide	1.94E-03	2.53E+00	1.45E-02	7.72E-08
606-20-2	2,6-Dinitrotoluene	4.41E-04	5.75E-01	3.31E-03	1.76E-08
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	2.52E-13	3.28E-10	1.89E-12	1.00E-17
608-93-5	Pentachlorobenzene	-	-	-	-
61626-71-9	Dichloropentadiene	-	-	-	-
621-64-7	N-Nitroso-di-n-propylamine	1.84E-03	2.40E+00	1.38E-02	7.35E-08
624-83-9	Methyl isocyanate	-	-	-	-
62-50-0	Ethyl methanesulfonate	-	-	-	-
62-53-3	Aniline	-	-	-	-
62-75-9	N-Nitroso-N,N-dimethylamine	1.06E-05	1.39E-02	7.98E-05	4.23E-10
628-73-9	Hexanenitrile	3.42E-06	4.45E-03	2.56E-05	1.36E-10
630-20-6	1,1,1,2-Tetrachloroethane	3.25E-06	4.24E-03	2.44E-05	1.29E-10
64-18-6	Formic acid (methanoic acid)	-	-	-	-
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	1.27E-09	1.65E-06	9.52E-09	5.05E-14
65-85-0	Benzoic acid	-	-	-	-
67-56-1	Methyl alcohol	7.24E-04	9.44E-01	5.43E-03	2.89E-08
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	9.16E-13	1.19E-09	6.87E-12	3.65E-17
67-63-0	2-Propyl alcohol	2.76E-07	3.60E-04	2.08E-06	1.10E-11
67-64-1	2-Propanone (Acetone)	1.74E-04	2.26E-01	1.30E-03	6.92E-09

Table A-8 Estimate of Organic Emission from the Pretreatment Feed (PWD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
67-66-3	Chloroform	2.80E-11	3.65E-08	2.10E-10	1.12E-15
67-72-1	Hexachloroethane	1.01E-07	1.32E-04	7.58E-07	4.02E-12
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	1.77E-12	2.31E-09	1.33E-11	7.07E-17
70-30-4	Hexachlorophene	-	-	-	-
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	2.56E-12	3.34E-09	1.92E-11	1.02E-16
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	6.77E-13	8.82E-10	5.08E-12	2.70E-17
71-36-3	n-Butyl alcohol	7.44E-06	9.70E-03	5.58E-05	2.96E-10
71-43-2	Benzene	2.41E-11	3.14E-08	1.81E-10	9.59E-16
71-55-6	1,1,1-Trichloroethane	8.46E-12	1.10E-08	6.35E-11	3.37E-16
72-43-5	Methoxychlor	-	-	-	-
72-55-9	4,4-DDE	1.13E-04	1.47E-01	8.45E-04	4.49E-09
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	1.51E-13	1.97E-10	1.13E-12	6.02E-18
7439-97-6	Mercury	-	-	-	-
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	2.26E-13	2.95E-10	1.70E-12	9.01E-18
74-83-9	Bromomethane	1.85E-11	2.41E-08	1.39E-10	7.37E-16
74-87-3	Chloromethane	3.42E-11	4.47E-08	2.57E-10	1.36E-15
74-88-4	Iodomethane	3.22E-12	4.20E-09	2.42E-11	1.28E-16
74-95-3	Methylene bromide	-	-	-	-
74-97-5	Bromochloromethane	-	-	-	-
75-00-3	Chloroethane	1.71E-11	2.23E-08	1.28E-10	6.80E-16
75-01-4	1-Chloroethene	1.73E-11	2.26E-08	1.30E-10	6.91E-16
75-02-5	Fluoroethene (vinyl fluoride)	8.91E-07	1.16E-03	6.69E-06	3.55E-11

Table A-8 Estimate of Organic Emission from the Pretreatment Feed (PWD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
75-05-8	Acetonitrile	2.06E-03	2.69E+00	1.55E-02	8.23E-08
75-07-0	Acetaldehyde	7.26E-06	9.47E-03	5.45E-05	2.89E-10
75-09-2	Dichloromethane (Methylene Chloride)	1.10E-08	1.43E-05	8.25E-08	4.38E-13
75-15-0	Carbon disulfide	1.20E-16	1.56E-13	8.99E-16	4.77E-21
75-21-8	Ethylene oxide (Oxirane)	3.12E-09	4.06E-06	2.34E-08	1.24E-13
75-25-2	Bromoform	-	-	-	-
75-27-4	Bromodichloromethane	6.35E-06	8.27E-03	4.76E-05	2.53E-10
75-29-6	2-Chloropropane	-	-	-	-
75-34-3	1,1-Dichloroethane	6.84E-12	8.92E-09	5.14E-11	2.73E-16
75-35-4	1,1-Dichloroethene	1.08E-11	1.40E-08	8.08E-11	4.29E-16
75-44-5	Phosgene (hydrogen phosphide)	-	-	-	-
75-45-6	Chlorodifluoromethane	2.53E-11	3.29E-08	1.90E-10	1.01E-15
75-50-3	Trimethylamine	3.35E-06	4.37E-03	2.51E-05	1.33E-10
75-69-4	Trichlorofluoromethane	2.08E-11	2.71E-08	1.56E-10	8.29E-16
75-71-8	Dichlorodifluoromethane	2.12E-11	2.76E-08	1.59E-10	8.44E-16
76-01-7	Pentachloroethane	-	-	-	-
76-13-1	1,2,2-Trichlorotrifluoroethane	2.09E-11	2.73E-08	1.57E-10	8.34E-16
764-41-0	1,4-Dichloro-2-butene	-	-	-	-
76-44-8	Heptachlor	1.97E-11	2.56E-08	1.48E-10	7.84E-16
765-34-4	Glycidylaldehyde	-	-	-	-
7664-41-7	Ammonia/Ammonium	1.98E-02	2.59E+01	1.49E-01	7.90E-07
77-47-4	Hexachlorocyclopentadiene	1.60E-15	2.08E-12	1.20E-14	6.36E-20

Table A-8 Estimate of Organic Emission from the Pretreatment Feed (PWD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
77-78-1	Dimethyl sulfate	-	-	-	-
78-83-1	2-Methylpropyl alcohol	3.91E-03	5.10E+00	2.94E-02	1.56E-07
78-87-5	1,2-Dichloropropane	6.84E-12	8.92E-09	5.14E-11	2.73E-16
78-93-3	2-Butanone	4.46E-05	5.82E-02	3.35E-04	1.78E-09
79-00-5	1,1,2-Trichloroethane	8.03E-12	1.05E-08	6.03E-11	3.20E-16
79-01-6	1,1,2-Trichloroethylene	9.22E-12	1.20E-08	6.93E-11	3.68E-16
79-10-7	2-Propenoic acid	2.62E-03	3.42E+00	1.97E-02	1.05E-07
79-34-5	1,1,2,2-Tetrachloroethane	8.51E-12	1.11E-08	6.39E-11	3.39E-16
79-46-9	2-Nitropropane	5.47E-09	7.13E-06	4.11E-08	2.18E-13
80-62-6	Methyl methacrylate	-	-	-	-
822-06-0	Hexamethylene-1,5-diisocyanate	-	-	-	-
823-40-5	Toluene-2,6-diamine	-	-	-	-
82-68-8	Pentachloronitrobenzene (PCNB)	1.66E-09	2.16E-06	1.25E-08	6.61E-14
832-69-9	1-Methylphenanthrene	-	-	-	-
83-32-9	Acenaphthene	5.49E-06	7.16E-03	4.12E-05	2.19E-10
84-66-2	Diethyl phthalate	1.55E-03	2.02E+00	1.17E-02	6.19E-08
84-74-2	Di-n-butylphthalate	1.61E-02	2.10E+01	1.21E-01	6.42E-07
85-01-8	Phenanthrene	1.05E-04	1.37E-01	7.87E-04	4.18E-09
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	-	-	-	-
85-68-7	Butylbenzylphthalate	5.59E-03	7.29E+00	4.20E-02	2.23E-07
86-73-7	Fluorene	1.74E-05	2.27E-02	1.31E-04	6.94E-10
87-61-6	1,2,3-Trichlorobenzene	-	-	-	-

Table A-8 Estimate of Organic Emission from the Pretreatment Feed (PWD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
87-68-3	Hexachlorobutadiene	4.33E-09	5.65E-06	3.25E-08	1.73E-13
87-86-5	Pentachlorophenol	9.94E-06	1.30E-02	7.47E-05	3.96E-10
88-06-2	2,4,6-Trichlorophenol	8.65E-04	1.13E+00	6.49E-03	3.45E-08
88-74-4	o-Nitroaniline (2-nitroaniline)	2.48E-04	3.23E-01	1.86E-03	9.87E-09
88-75-5	2-Nitrophenol	1.11E-03	1.45E+00	8.36E-03	4.44E-08
90-04-0	o-Anisidine	-	-	-	-
90-12-0	1-Methylnaphthalene	-	-	-	-
91-20-3	Naphthalene	6.41E-06	8.36E-03	4.81E-05	2.55E-10
91-22-5	Quinoline	-	-	-	-
91-57-6	2-Methylnaphthalene	3.85E-06	5.02E-03	2.89E-05	1.53E-10
91-58-7	2-Chloronaphthalene	6.80E-07	8.87E-04	5.11E-06	2.71E-11
91-94-1	3,3'-Dichlorobenzidine	1.13E-03	1.47E+00	8.49E-03	4.51E-08
924-16-3	N-Nitroso-di-n-Buetylamine	-	-	-	-
92-52-4	1,1`-Biphenyl	1.73E-09	2.26E-06	1.30E-08	6.91E-14
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	-	-	-	-
94-75-7	2,4-D	-	-	-	-
95-48-7	o-Cresol	2.76E-03	3.60E+00	2.07E-02	1.10E-07
95-49-8	o-Chlorotoluene	-	-	-	-
95-50-1	1,2-Dichlorobenzene	6.60E-09	8.61E-06	4.96E-08	2.63E-13
95-53-4	o-Toluidine	-	-	-	-
95-57-8	2-Chlorophenol	2.38E-06	3.10E-03	1.78E-05	9.47E-11
95-63-6	1,2,4-Trimethyl benzene	-	-	-	-

Table A-8 Estimate of Organic Emission from the Pretreatment Feed (PWD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction WF (mg/kg)	Weight Ratio WR (unitless)	Individual Organic Release R_{IO} (g/s)
95-94-3	1,2,4,5-Tetrachlorobenzene	-	-	-	-
95-95-4	2,4,5-Trichlorophenol	1.29E-03	1.68E+00	9.66E-03	5.13E-08
96-12-8	1,2-Dibromo-3-chloropropane	-	-	-	-
96-18-4	1,2,3-Trichloropropane	-	-	-	-
96-45-7	Ethylene thiourea	-	-	-	-
97-63-2	Ethyl methacrylate	-	-	-	-
98-01-1	Furfural	-	-	-	-
98-06-6	tert-Butyl benzene	-	-	-	-
98-07-7	Benzotrichloride	-	-	-	-
98-82-8	Cumene	5.15E-07	6.72E-04	3.87E-06	2.05E-11
98-83-9	Methyl styrene (mixed isomers)	-	-	-	-
98-86-2	Acetophenone	1.16E-06	1.52E-03	8.72E-06	4.63E-11
98-95-3	Nitrobenzene	5.53E-05	7.21E-02	4.15E-04	2.20E-09
99-35-4	1,3,5-Trinitrobenzene	-	-	-	-
99-65-0	1,3-Dinitrobenzene	-	-	-	-
99-87-6	p-Cymene	-	-	-	-
			Weight Fraction Sum = WF_s =	1.74E+02	
				Weight Ratio Sum = WR_s =	1.00E+00
					Feed Stream Sum = 5.31E-06

The following indicates the stream properties for feed into the Pretreatment Facility from the RDD feed used to calculate the weight fraction:

$$WF = \frac{(Q_m * 1000)}{\left(Q_v * \frac{\rho}{60 * 60}\right)}$$

Where:

Q_m = compound mass flow rate (g/s)
Q_v = volumetric flow rate (m^3/hr) = 1.71E-03
ρ = density (kg/m^3) = 997.308

A "-" symbol indicates no data are available for approximating the emissions rate (no data were available, or the corresponding values were below the emissions model tolerance).

Table A-9 Estimate of Organic Emission from the Pretreatment Feed (RDP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
100-02-7	p-Nitrophenol	1.50E-11	3.17E-05	3.36E-02	1.22E-12
100-21-0	Phthalic acid	5.94E-12	1.25E-05	1.33E-02	4.84E-13
100-25-4	1,4-Dinitrobenzene	1.29E-14	2.73E-08	2.89E-05	1.05E-15
10028-17-8	Tritium	3.50E-14	7.38E-08	7.81E-05	2.85E-15
100-40-3	4-Ethenylcyclohexene	-	-	-	-
100-41-4	Ethyl benzene	-	-	-	-
100-42-5	Styrene	-	-	-	-
100-44-7	Benzyl chloride	-	-	-	-
100-47-0	Benzonitrile	-	-	-	-
100-51-6	Benzyl alcohol	-	-	-	-
100-52-7	Benzaldehyde	-	-	-	-
10061-01-5	cis-1,3-Dichloropropene	-	-	-	-

Table A-9 Estimate of Organic Emission from the Pretreatment Feed (RDP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
10061-02-6	trans-1,3-Dichloropropene	-	-	-	-
101-55-3	4-Bromophenylphenyl ether	9.72E-18	2.05E-11	2.17E-08	7.92E-19
101-77-9	4,4-Methylenedianiline	-	-	-	-
103-33-3	Azobenzene	-	-	-	-
103-65-1	n-Propyl benzene (Isocumene)	-	-	-	-
104-51-8	n-Butylbenzene	-	-	-	-
104-76-7	2-Ethyl-1-hexanol	1.95E-15	4.11E-09	4.35E-06	1.59E-16
105-67-9	2,4-Dimethylphenol	1.47E-13	3.11E-07	3.29E-04	1.20E-14
10595-95-6	n-Nitrosomethylethylamine	9.04E-13	1.91E-06	2.02E-03	7.37E-14
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	-	-	-	-
106-44-5	p-Cresol (4-methyl phenol)	-	-	-	-
106-46-7	1,4-Dichlorobenzene	-	-	-	-
106-47-8	p-Chloroaniline	4.04E-13	8.53E-07	9.03E-04	3.29E-14
106-49-0	p-Toluidine	-	-	-	-
106-51-4	Quinone	-	-	-	-
106-88-7	1,2-Epoxybutane	1.12E-18	2.37E-12	2.51E-09	9.15E-20
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	-	-	-	-
106-93-4	Ethylene dibromide	-	-	-	-
106-99-0	1,3-Butadiene	-	-	-	-
107-02-8	Acrolein	4.01E-21	8.48E-15	8.97E-12	3.27E-22
107-05-1	3-Chloropropene	-	-	-	-

Table A-9 Estimate of Organic Emission from the Pretreatment Feed (RDP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
107-06-2	1,2-Dichloroethane	1.66E-24	3.50E-18	3.70E-15	1.35E-25
107-12-0	Propionitrile	2.51E-18	5.30E-12	5.61E-09	2.04E-19
107-13-1	Acrylonitrile	2.31E-19	4.88E-13	5.16E-10	1.88E-20
107-19-7	Propargyl alcohol	-	-	-	-
107-21-1	Ethylene glycol (1,2-ethanediol)	-	-	-	-
107-98-2	Propylene glycol monomethyl ether	-	-	-	-
108-05-4	Acetic acid vinyl ester	5.67E-21	1.20E-14	1.27E-11	4.62E-22
108-10-1	4-Methyl-2-pentanone	4.72E-22	9.96E-16	1.05E-12	3.84E-23
108-39-4	m-Cresol	2.78E-12	5.87E-06	6.21E-03	2.27E-13
108-60-1	bis (2-Chloroisopropyl)ether	-	-	-	-
108-67-8	1,3,5-Trimethylbenzene	-	-	-	-
108-86-1	Bromobenzene (Phenyl bromide)	-	-	-	-
108-87-2	Methylcyclohexane	-	-	-	-
108-88-3	Toluene	-	-	-	-
108-90-7	Chlorobenzene	-	-	-	-
108-94-1	Cyclohexanone	1.08E-15	2.27E-09	2.40E-06	8.77E-17
108-95-2	Phenol	4.78E-13	1.01E-06	1.07E-03	3.90E-14
109-74-0	n-Butanenitrile	2.18E-16	4.60E-10	4.87E-07	1.77E-17
109-75-1	3-Butenenitrile	-	-	-	-
109-77-3	Malononitrile	-	-	-	-
109-86-4	2-Methoxyethanol	-	-	-	-

Table A-9 Estimate of Organic Emission from the Pretreatment Feed (RDP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
109-99-9	Tetrahydrofuran	2.46E-20	5.19E-14	5.49E-11	2.00E-21
110-00-9	Furan	-	-	-	-
110-54-3	n-Hexane	-	-	-	-
110-59-8	Pentanenitrile	6.30E-17	1.33E-10	1.41E-07	5.13E-18
110-80-5	2-Ethoxyethanol	1.44E-11	3.05E-05	3.22E-02	1.17E-12
110-82-7	Cyclohexane	-	-	-	-
110-83-8	Cyclohexene	-	-	-	-
110-86-1	Pyridine	2.69E-16	5.68E-10	6.01E-07	2.19E-17
111-15-9	Ethylene glycol monoethyl ether acetate	-	-	-	-
111-44-4	bis(2-Chloroethyl)ether	7.63E-17	1.61E-10	1.70E-07	6.22E-18
111-65-9	n-Octane	-	-	-	-
111-76-2	2-Butoxyethanol	5.27E-13	1.11E-06	1.18E-03	4.29E-14
111-84-2	n-Nonane	-	-	-	-
111-91-1	bis(2-Chloroethoxy)methane	6.50E-15	1.37E-08	1.45E-05	5.29E-16
1120-21-4	Undecane	-	-	-	-
1120-71-4	1,3-Propane sultone	-	-	-	-
112-30-1	1-Decanol	-	-	-	-
112-31-2	Decanal	-	-	-	-
112-40-3	Dodecane	-	-	-	-
117-81-7	Bis(2-ethylhexyl) phthalate	1.21E-11	2.55E-05	2.70E-02	9.84E-13
117-84-0	Di-n-octylphthalate	3.49E-16	7.37E-10	7.80E-07	2.84E-17

Table A-9 Estimate of Organic Emission from the Pretreatment Feed (RDP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
118-74-1	Hexachlorobenzene	1.14E-25	2.40E-19	2.54E-16	9.25E-27
119-90-4	3,3'-Dimethoxybenzidine	-	-	-	-
120-12-7	Anthracene	7.07E-17	1.49E-10	1.58E-07	5.76E-18
120-82-1	1,2,4-Trichlorobenzene	-	-	-	-
120-83-2	2,4-Dichlorophenol	7.22E-25	1.52E-18	1.61E-15	5.88E-26
121-14-2	2,4-Dinitrotoluene	2.60E-11	5.48E-05	5.80E-02	2.12E-12
122-39-4	N,N-Diphenylamine	2.69E-16	5.68E-10	6.01E-07	2.19E-17
122-66-7	1,2-Diphenylhydrazine	-	-	-	-
123-33-1	Maleic hydrazide	-	-	-	-
123-38-6	Propionaldehyde	7.42E-20	1.57E-13	1.66E-10	6.05E-21
123-72-8	Butanal	9.15E-18	1.93E-11	2.04E-08	7.45E-19
123-91-1	1,4-Dioxan	3.47E-17	7.33E-11	7.75E-08	2.83E-18
124-18-5	Decane	-	-	-	-
124-38-9	Carbon dioxide	-	-	-	-
124-48-1	Chlorodibromomethane	5.47E-24	1.15E-17	1.22E-14	4.46E-25
126-73-8	Tributyl phosphate	6.39E-13	1.35E-06	1.43E-03	5.21E-14
126-98-7	2-Methyl-2-propenenitrile	8.38E-23	1.77E-16	1.87E-13	6.83E-24
127-18-4	1,1,2,2-Tetrachloroethene	-	-	-	-
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	2.19E-15	4.63E-09	4.90E-06	1.79E-16
129-00-0	Pyrene	7.01E-14	1.48E-07	1.57E-04	5.71E-15
131-11-3	Dimethyl Phthalate	5.05E-13	1.07E-06	1.13E-03	4.11E-14

Table A-9 Estimate of Organic Emission from the Pretreatment Feed (RDP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	-	-	-	-
132-64-9	Dibenzofuran	1.56E-21	3.30E-15	3.49E-12	1.27E-22
1330-20-7	Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations)	-	-	-	-
133-06-2	Captan	-	-	-	-
1336-36-3	Polychlorinated biphenyls (1254 Aroclor)	1.38E-18	2.91E-12	3.08E-09	1.12E-19
134-32-7	alpha-Naphthylamine	5.17E-12	1.09E-05	1.16E-02	4.22E-13
135-98-8	sec-Butylbenzene	-	-	-	-
141-78-6	Acetic acid ethyl ester	1.76E-22	3.72E-16	3.94E-13	1.44E-23
145-73-3	Endothall	-	-	-	-
156-59-2	cis-1,2-Dichloroethene	-	-	-	-
156-60-5	1,2-trans-Dichloroethene	-	-	-	-
1634-04-4	Methyl tert-butyl ether	2.09E-21	4.42E-15	4.68E-12	1.71E-22
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	3.04E-26	6.41E-20	6.79E-17	2.47E-27
189-55-9	Dibenzo[a,i]pyrene	4.37E-12	9.23E-06	9.77E-03	3.56E-13
189-64-0	Dibenzo[a,h]pyrene	4.37E-12	9.23E-06	9.77E-03	3.56E-13
191-24-2	Benzo(g,h,i)perylene	3.27E-12	6.89E-06	7.30E-03	2.66E-13
191-30-0	Dibenzo(a,l)pyrene	4.37E-12	9.23E-06	9.77E-03	3.56E-13
192-65-4	Dibenzo[a,e]pyrene	4.37E-12	9.23E-06	9.77E-03	3.56E-13
192-97-2	Benzo(e)pyrene	-	-	-	-
193-39-5	Indeno(1,2,3-cd)pyrene	4.90E-13	1.03E-06	1.09E-03	3.99E-14
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	2.11E-24	4.45E-18	4.71E-15	1.72E-25

Table A-9 Estimate of Organic Emission from the Pretreatment Feed (RDP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
205-82-3	Benzo[j]fluoranthene	-	-	-	-
205-99-2	Benzo(b)fluoranthene	1.03E-15	2.17E-09	2.30E-06	8.37E-17
206-44-0	Fluoranthene	2.92E-14	6.16E-08	6.52E-05	2.38E-15
207-08-9	Benzo(k)fluoranthene	3.91E-13	8.26E-07	8.74E-04	3.19E-14
208-96-8	Acenaphthylene	6.74E-18	1.42E-11	1.51E-08	5.49E-19
218-01-9	Chrysene	9.99E-20	2.11E-13	2.23E-10	8.14E-21
224-42-0	Dibenz[a,j]acridine	3.72E-12	7.85E-06	8.31E-03	3.03E-13
2245-38-7	2,3,5-Trimethylnaphthalene	-	-	-	-
226-36-8	Dibenz[a,h]acridine	3.57E-12	7.54E-06	7.98E-03	2.91E-13
23950-58-5	Pronamide	-	-	-	-
27154-33-2	Trichlorofluoroethane	-	-	-	-
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	-	-	-	-
319-84-6	alpha-BHC	8.15E-19	1.72E-12	1.82E-09	6.64E-20
319-85-7	beta-BHC	1.39E-14	2.94E-08	3.11E-05	1.13E-15
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	1.36E-22	2.87E-16	3.04E-13	1.11E-23
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	-	-	-	-
3268-87-9	Octachlorodibenzo(p)dioxin	1.94E-22	4.09E-16	4.33E-13	1.58E-23
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	3.31E-26	6.98E-20	7.39E-17	2.69E-27
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	-	-	-	-
3697-24-3	5-Methylchrysene	5.43E-14	1.15E-07	1.21E-04	4.42E-15
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	-	-	-	-

Table A-9 Estimate of Organic Emission from the Pretreatment Feed (RDP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
39001-02-0	Octachlorodibenzofuran	6.50E-22	1.37E-15	1.45E-12	5.30E-23
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	2.75E-24	5.81E-18	6.15E-15	2.24E-25
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	5.04E-26	1.06E-19	1.13E-16	4.11E-27
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	1.30E-22	2.73E-16	2.89E-13	1.05E-23
4170-30-3	Crotonaldehyde (Propylene aldehyde)	-	-	-	-
41851-50-7	Chlorocyclopentadiene	-	-	-	-
460-19-5	Cyanogen (oxalonitrile)	-	-	-	-
4786-20-3	2-Butenenitrile	-	-	-	-
50-00-0	Formaldehyde	4.76E-12	1.00E-05	1.06E-02	3.87E-13
50-32-8	Benzo(a)pyrene	1.66E-14	3.51E-08	3.72E-05	1.35E-15
506-68-3	Cyanogen bromide (bromocyanide)	-	-	-	-
506-77-4	Cyanogen chloride	-	-	-	-
510-15-6	Chlorobenzilate	-	-	-	-
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	3.36E-24	7.09E-18	7.51E-15	2.74E-25
51-28-5	2,4-Dinitrophenol	4.50E-12	9.51E-06	1.01E-02	3.67E-13
51-79-6	Ethyl carbamate (urethane)	-	-	-	-
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	3.43E-26	7.25E-20	7.67E-17	2.80E-27
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	-	-	-	-
532-27-4	2-Chloroacetophenone	-	-	-	-
534-52-1	4,6-Dinitro-o-cresol	5.02E-13	1.06E-06	1.12E-03	4.09E-14
53-70-3	Dibenz[a,h]anthracene	2.96E-13	6.26E-07	6.62E-04	2.41E-14

Table A-9 Estimate of Organic Emission from the Pretreatment Feed (RDP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
5385-75-1	Dibenzo(a,e)fluoranthene	-	-	-	-
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	-	-	-	-
540-73-8	1,2-Dimethylhydrazine	-	-	-	-
540-84-1	2,2,4-Trimethylpentane	-	-	-	-
541-73-1	1,3-Dichlorobenzene	-	-	-	-
542-75-6	1,3-Dichloropropene	-	-	-	-
542-88-1	bis(Chloromethyl)ether	-	-	-	-
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	5.60E-25	1.18E-18	1.25E-15	4.56E-26
56-23-5	Carbon tetrachloride	-	-	-	-
56-49-5	3-Methylcholanthrene	5.97E-14	1.26E-07	1.33E-04	4.87E-15
56-55-3	Benzo(a)anthracene	1.45E-14	3.07E-08	3.25E-05	1.18E-15
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	3.34E-23	7.05E-17	7.46E-14	2.72E-24
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	2.70E-23	5.70E-17	6.03E-14	2.20E-24
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	5.43E-24	1.15E-17	1.21E-14	4.43E-25
57-24-9	Strychnine	-	-	-	-
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	4.10E-23	8.65E-17	9.16E-14	3.34E-24
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	1.13E-24	2.38E-18	2.52E-15	9.18E-26
57-74-9	Chlordane	-	-	-	-
581-42-0	2,6-Dimethylnaphthalene	-	-	-	-
584-84-9	2,4-Toluene diisocyanate	-	-	-	-
58-89-9	gamma-BHC (Lindane)	4.80E-18	1.01E-11	1.07E-08	3.91E-19

Table A-9 Estimate of Organic Emission from the Pretreatment Feed (RDP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
58-90-2	2,3,4,6-Tetrachlorophenol	2.44E-13	5.16E-07	5.46E-04	1.99E-14
589-38-8	3-Hexanone	5.80E-18	1.23E-11	1.30E-08	4.73E-19
591-50-4	Benzene, iodo-	-	-	-	-
591-78-6	2-Hexanone	3.58E-20	7.56E-14	8.00E-11	2.92E-21
593-60-2	Bromoethene (Vinyl bromide)	-	-	-	-
593-74-8	Dimethyl Mercury	6.37E-25	1.35E-18	1.42E-15	5.19E-26
59-50-7	4-Chloro-3-methylphenol	8.54E-13	1.80E-06	1.91E-03	6.96E-14
59-89-2	N-Nitrosomorpholine	6.58E-11	1.39E-04	1.47E-01	5.36E-12
60-11-7	Dimethyl aminoazobenzene	-	-	-	-
602-87-9	5-Nitroacenaphthene	7.81E-13	1.65E-06	1.75E-03	6.36E-14
60-29-7	Ethyl ether	3.87E-26	8.17E-20	8.65E-17	3.15E-27
60-35-5	Acetamide	1.50E-11	3.17E-05	3.36E-02	1.22E-12
606-20-2	2,6-Dinitrotoluene	2.32E-13	4.89E-07	5.18E-04	1.89E-14
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	8.79E-25	1.86E-18	1.96E-15	7.16E-26
608-93-5	Pentachlorobenzene	-	-	-	-
61626-71-9	Dichloropentadiene	-	-	-	-
621-64-7	N-Nitroso-di-n-propylamine	9.34E-13	1.97E-06	2.09E-03	7.60E-14
624-83-9	Methyl isocyanate	-	-	-	-
62-50-0	Ethyl methanesulfonate	-	-	-	-
62-53-3	Aniline	-	-	-	-
62-75-9	N-Nitroso-N,N-dimethylamine	6.60E-15	1.39E-08	1.48E-05	5.38E-16

Table A-9 Estimate of Organic Emission from the Pretreatment Feed (RDP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
628-73-9	Hexanenitrile	1.90E-17	4.02E-11	4.25E-08	1.55E-18
630-20-6	1,1,1,2-Tetrachloroethane	2.12E-24	4.48E-18	4.74E-15	1.73E-25
64-18-6	Formic acid (methanoic acid)	-	-	-	-
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	6.88E-22	1.45E-15	1.54E-12	5.60E-23
65-85-0	Benzoic acid	-	-	-	-
67-56-1	Methyl alcohol	1.85E-13	3.91E-07	4.14E-04	1.51E-14
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	2.46E-24	5.18E-18	5.49E-15	2.00E-25
67-63-0	2-Propyl alcohol	3.79E-17	8.00E-11	8.47E-08	3.09E-18
67-64-1	2-Propanone (Acetone)	3.74E-17	7.89E-11	8.35E-08	3.04E-18
67-66-3	Chloroform	-	-	-	-
67-72-1	Hexachloroethane	-	-	-	-
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	1.50E-25	3.17E-19	3.35E-16	1.22E-26
70-30-4	Hexachlorophene	-	-	-	-
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	1.58E-24	3.34E-18	3.53E-15	1.29E-25
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	1.35E-24	2.85E-18	3.01E-15	1.10E-25
71-36-3	n-Butyl alcohol	9.30E-16	1.96E-09	2.08E-06	7.58E-17
71-43-2	Benzene	-	-	-	-
71-55-6	1,1,1-Trichloroethane	-	-	-	-
72-43-5	Methoxychlor	-	-	-	-
72-55-9	4,4-DDE	5.24E-15	1.11E-08	1.17E-05	4.27E-16
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	5.14E-25	1.08E-18	1.15E-15	4.19E-26

Table A-9 Estimate of Organic Emission from the Pretreatment Feed (RDP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
7439-97-6	Mercury	-	-	-	-
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	-	-	-	-
74-83-9	Bromomethane	-	-	-	-
74-87-3	Chloromethane	-	-	-	-
74-88-4	Iodomethane	-	-	-	-
74-95-3	Methylene bromide	-	-	-	-
74-97-5	Bromochloromethane	-	-	-	-
75-00-3	Chloroethane	-	-	-	-
75-01-4	1-Chloroethene	-	-	-	-
75-02-5	Fluoroethene (vinyl fluoride)	-	-	-	-
75-05-8	Acetonitrile	4.24E-16	8.95E-10	9.47E-07	3.45E-17
75-07-0	Acetaldehyde	5.61E-17	1.18E-10	1.25E-07	4.57E-18
75-09-2	Dichloromethane (Methylene Chloride)	5.10E-25	1.08E-18	1.14E-15	4.15E-26
75-15-0	Carbon disulfide	-	-	-	-
75-21-8	Ethylene oxide (Oxirane)	6.05E-21	1.28E-14	1.35E-11	4.93E-22
75-25-2	Bromoform	-	-	-	-
75-27-4	Bromodichloromethane	5.32E-23	1.12E-16	1.19E-13	4.33E-24
75-29-6	2-Chloropropane	-	-	-	-
75-34-3	1,1-Dichloroethane	-	-	-	-
75-35-4	1,1-Dichloroethene	-	-	-	-
75-44-5	Phosgene (hydrogen phosphide)	-	-	-	-

Table A-9 Estimate of Organic Emission from the Pretreatment Feed (RDP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
75-45-6	Chlorodifluoromethane	-	-	-	-
75-50-3	Trimethylamine	1.56E-17	3.29E-11	3.48E-08	1.27E-18
75-69-4	Trichlorofluoromethane	-	-	-	-
75-71-8	Dichlorodifluoromethane	-	-	-	-
76-01-7	Pentachloroethane	-	-	-	-
76-13-1	1,2,2-Trichlorotrifluoroethane	-	-	-	-
764-41-0	1,4-Dichloro-2-butene	-	-	-	-
76-44-8	Heptachlor	-	-	-	-
765-34-4	Glycidylaldehyde	-	-	-	-
7664-41-7	Ammonia/Ammonium	2.08E-10	4.40E-04	4.65E-01	1.70E-11
77-47-4	Hexachlorocyclopentadiene	-	-	-	-
77-78-1	Dimethyl sulfate	-	-	-	-
78-83-1	2-Methylpropyl alcohol	4.36E-13	9.21E-07	9.75E-04	3.55E-14
78-87-5	1,2-Dichloropropane	-	-	-	-
78-93-3	2-Butanone	3.59E-18	7.57E-12	8.01E-09	2.92E-19
79-00-5	1,1,2-Trichloroethane	-	-	-	-
79-01-6	1,1,2-Trichloroethylene	-	-	-	-
79-10-7	2-Propenoic acid	6.73E-12	1.42E-05	1.50E-02	5.48E-13
79-34-5	1,1,2,2-Tetrachloroethane	5.00E-25	1.06E-18	1.12E-15	4.07E-26
79-46-9	2-Nitropropane	1.89E-20	3.99E-14	4.22E-11	1.54E-21
80-62-6	Methyl methacrylate	-	-	-	-

Table A-9 Estimate of Organic Emission from the Pretreatment Feed (RDP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
822-06-0	Hexamethylene-1,5-diisocyanate	-	-	-	-
823-40-5	Toluene-2,6-diamine	-	-	-	-
82-68-8	Pentachloronitrobenzene (PCNB)	5.46E-23	1.15E-16	1.22E-13	4.45E-24
832-69-9	1-Methylphenanthrene	-	-	-	-
83-32-9	Acenaphthene	6.93E-18	1.46E-11	1.55E-08	5.64E-19
84-66-2	Diethyl phthalate	3.00E-12	6.34E-06	6.71E-03	2.45E-13
84-74-2	Di-n-butylphthalate	9.49E-12	2.00E-05	2.12E-02	7.73E-13
85-01-8	Phenanthrene	2.31E-15	4.89E-09	5.17E-06	1.89E-16
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	-	-	-	-
85-68-7	Butylbenzylphthalate	4.75E-12	1.00E-05	1.06E-02	3.87E-13
86-73-7	Fluorene	7.58E-17	1.60E-10	1.69E-07	6.17E-18
87-61-6	1,2,3-Trichlorobenzene	-	-	-	-
87-68-3	Hexachlorobutadiene	-	-	-	-
87-86-5	Pentachlorophenol	4.56E-14	9.62E-08	1.02E-04	3.71E-15
88-06-2	2,4,6-Trichlorophenol	1.23E-13	2.60E-07	2.75E-04	1.00E-14
88-74-4	o-Nitroaniline (2-nitroaniline)	6.90E-13	1.46E-06	1.54E-03	5.62E-14
88-75-5	2-Nitrophenol	8.64E-14	1.82E-07	1.93E-04	7.04E-15
90-04-0	o-Anisidine	-	-	-	-
90-12-0	1-Methylnaphthalene	-	-	-	-
91-20-3	Naphthalene	2.41E-20	5.10E-14	5.39E-11	1.97E-21
91-22-5	Quinoline	-	-	-	-

Table A-9 Estimate of Organic Emission from the Pretreatment Feed (RDP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
91-57-6	2-Methylnaphthalene	2.10E-21	4.43E-15	4.69E-12	1.71E-22
91-58-7	2-Chloronaphthalene	5.98E-20	1.26E-13	1.34E-10	4.87E-21
91-94-1	3,3'-Dichlorobenzidine	2.58E-12	5.44E-06	5.76E-03	2.10E-13
924-16-3	N-Nitroso-di-n-Buetylamine	-	-	-	-
92-52-4	1,1`-Biphenyl	1.67E-22	3.54E-16	3.74E-13	1.36E-23
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	-	-	-	-
94-75-7	2,4-D	-	-	-	-
95-48-7	o-Cresol	2.57E-12	5.42E-06	5.74E-03	2.09E-13
95-49-8	o-Chlorotoluene	-	-	-	-
95-50-1	1,2-Dichlorobenzene	-	-	-	-
95-53-4	o-Toluidine	-	-	-	-
95-57-8	2-Chlorophenol	6.73E-20	1.42E-13	1.50E-10	5.48E-21
95-63-6	1,2,4-Trimethyl benzene	-	-	-	-
95-94-3	1,2,4,5-Tetrachlorobenzene	-	-	-	-
95-95-4	2,4,5-Trichlorophenol	3.39E-13	7.15E-07	7.56E-04	2.76E-14
96-12-8	1,2-Dibromo-3-chloropropane	-	-	-	-
96-18-4	1,2,3-Trichloropropane	-	-	-	-
96-45-7	Ethylene thiourea	-	-	-	-
97-63-2	Ethyl methacrylate	-	-	-	-
98-01-1	Furfural	-	-	-	-
98-06-6	tert-Butyl benzene	-	-	-	-

Table A-9 Estimate of Organic Emission from the Pretreatment Feed (RDP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction WF (mg/kg)	Weight Ratio WR (unitless)	Individual Organic Release R_{IO} (g/s)
98-07-7	Benzotrichloride	-	-	-	-
98-82-8	Cumene	-	-	-	-
98-83-9	Methyl styrene (mixed isomers)	-	-	-	-
98-86-2	Acetophenone	5.21E-17	1.10E-10	1.16E-07	4.24E-18
98-95-3	Nitrobenzene	4.93E-17	1.04E-10	1.10E-07	4.02E-18
99-35-4	1,3,5-Trinitrobenzene	-	-	-	-
99-65-0	1,3-Dinitrobenzene	-	-	-	-
99-87-6	p-Cymene	-	-	-	-
			Weight Fraction Sum = WF_s =	9.45E-04	
				Weight Ratio Sum = WR_s =	1.00E+00
					Feed Stream Sum = 3.64E-11

The following indicates the stream properties for feed into the Pretreatment Facility from the RLD feed used to calculate the weight fraction:

$$WF = \frac{(Q_m * 1000)}{\left(Q_v * \frac{\rho}{60 * 60}\right)}$$

Where:

Q_m = compound mass flow rate (g/s)
Q_v = volumetric flow rate (m^3/hr) = 2.66
ρ = density (kg/m^3) = 999.268

A "-" symbol indicates no data are available for approximating the emissions rate (no data were available, or the corresponding values were below the emissions model tolerance).

Table A-10 Estimate of Organic Emission from the Pretreatment Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
100-02-7	p-Nitrophenol	3.66E-03	4.97E+00	2.20E-02	1.01E-08
100-21-0	Phthalic acid	1.44E-03	1.95E+00	8.64E-03	3.97E-09
100-25-4	1,4-Dinitrobenzene	1.17E-05	1.58E-02	7.02E-05	3.22E-11
10028-17-8	Tritium	1.99E-07	2.69E-04	1.19E-06	5.48E-13
100-40-3	4-Ethenylcyclohexene	7.14E-19	9.68E-16	4.29E-18	1.97E-24
100-41-4	Ethyl benzene	2.09E-19	2.84E-16	1.26E-18	5.77E-25
100-42-5	Styrene	3.33E-09	4.52E-06	2.00E-08	9.19E-15
100-44-7	Benzyl chloride	-	-	-	-
100-47-0	Benzonitrile	-	-	-	-
100-51-6	Benzyl alcohol	-	-	-	-
100-52-7	Benzaldehyde	-	-	-	-
10061-01-5	cis-1,3-Dichloropropene	8.15E-17	1.10E-13	4.89E-16	2.25E-22

Table A-10 Estimate of Organic Emission from the Pretreatment Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
10061-02-6	trans-1,3-Dichloropropene	2.40E-14	3.26E-11	1.44E-13	6.62E-20
101-55-3	4-Bromophenylphenyl ether	2.62E-06	3.56E-03	1.58E-05	7.23E-12
101-77-9	4,4-Methylenedianiline	-	-	-	-
103-33-3	Azobenzene	-	-	-	-
103-65-1	n-Propyl benzene (Isocumene)	-	-	-	-
104-51-8	n-Butylbenzene	-	-	-	-
104-76-7	2-Ethyl-1-hexanol	6.81E-05	9.23E-02	4.09E-04	1.88E-10
105-67-9	2,4-Dimethylphenol	3.65E-03	4.94E+00	2.19E-02	1.01E-08
10595-95-6	n-Nitrosomethylethylamine	1.31E-03	1.77E+00	7.86E-03	3.61E-09
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	-	-	-	-
106-44-5	p-Cresol (4-methyl phenol)	-	-	-	-
106-46-7	1,4-Dichlorobenzene	1.85E-09	2.51E-06	1.11E-08	5.10E-15
106-47-8	p-Chloroaniline	3.86E-03	5.24E+00	2.32E-02	1.06E-08
106-49-0	p-Toluidine	-	-	-	-
106-51-4	Quinone	-	-	-	-
106-88-7	1,2-Epoxybutane	5.46E-07	7.40E-04	3.28E-06	1.50E-12
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	-	-	-	-
106-93-4	Ethylene dibromide	1.37E-14	1.86E-11	8.22E-14	3.77E-20
106-99-0	1,3-Butadiene	2.09E-23	2.83E-20	1.25E-22	5.75E-29
107-02-8	Acrolein	1.12E-09	1.52E-06	6.75E-09	3.10E-15
107-05-1	3-Chloropropene	5.36E-20	7.27E-17	3.22E-19	1.48E-25

Table A-10 Estimate of Organic Emission from the Pretreatment Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
107-06-2	1,2-Dichloroethane	1.14E-07	1.54E-04	6.83E-07	3.13E-13
107-12-0	Propionitrile	1.37E-07	1.86E-04	8.22E-07	3.77E-13
107-13-1	Acrylonitrile	5.22E-05	7.08E-02	3.13E-04	1.44E-10
107-19-7	Propargyl alcohol	-	-	-	-
107-21-1	Ethylene glycol (1,2-ethanediol)	-	-	-	-
107-98-2	Propylene glycol monomethyl ether	-	-	-	-
108-05-4	Acetic acid vinyl ester	9.45E-09	1.28E-05	5.68E-08	2.60E-14
108-10-1	4-Methyl-2-pentanone	1.64E-10	2.23E-07	9.86E-10	4.53E-16
108-39-4	m-Cresol	2.40E-03	3.25E+00	1.44E-02	6.62E-09
108-60-1	bis (2-Chloroisopropyl)ether	-	-	-	-
108-67-8	1,3,5-Trimethylbenzene	-	-	-	-
108-86-1	Bromobenzene (Phenyl bromide)	-	-	-	-
108-87-2	Methylcyclohexane	-	-	-	-
108-88-3	Toluene	9.41E-11	1.28E-07	5.65E-10	2.59E-16
108-90-7	Chlorobenzene	9.93E-10	1.35E-06	5.96E-09	2.74E-15
108-94-1	Cyclohexanone	1.04E-05	1.41E-02	6.25E-05	2.87E-11
108-95-2	Phenol	9.74E-04	1.32E+00	5.85E-03	2.68E-09
109-74-0	n-Butanenitrile	1.90E-05	2.57E-02	1.14E-04	5.23E-11
109-75-1	3-Butenenitrile	-	-	-	-
109-77-3	Malononitrile	-	-	-	-
109-86-4	2-Methoxyethanol	-	-	-	-

Table A-10 Estimate of Organic Emission from the Pretreatment Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
109-99-9	Tetrahydrofuran	3.52E-09	4.77E-06	2.11E-08	9.69E-15
110-00-9	Furan	-	-	-	-
110-54-3	n-Hexane	-	-	-	-
110-59-8	Pentanenitrile	8.53E-06	1.16E-02	5.12E-05	2.35E-11
110-80-5	2-Ethoxyethanol	6.84E-03	9.27E+00	4.11E-02	1.88E-08
110-82-7	Cyclohexane	5.04E-26	6.83E-23	3.02E-25	1.39E-31
110-83-8	Cyclohexene	3.17E-23	4.29E-20	1.90E-22	8.73E-29
110-86-1	Pyridine	2.55E-06	3.46E-03	1.53E-05	7.04E-12
111-15-9	Ethylene glycol monoethyl ether acetate	-	-	-	-
111-44-4	bis(2-Chloroethyl)ether	1.96E-04	2.66E-01	1.18E-03	5.40E-10
111-65-9	n-Octane	-	-	-	-
111-76-2	2-Butoxyethanol	8.45E-04	1.15E+00	5.07E-03	2.33E-09
111-84-2	n-Nonane	-	-	-	-
111-91-1	bis(2-Chloroethoxy)methane	5.60E-04	7.59E-01	3.36E-03	1.54E-09
1120-21-4	Undecane	-	-	-	-
1120-71-4	1,3-Propane sultone	-	-	-	-
112-30-1	1-Decanol	-	-	-	-
112-31-2	Decanal	-	-	-	-
112-40-3	Dodecane	-	-	-	-
117-81-7	Bis(2-ethylhexyl) phthalate	3.28E-03	4.45E+00	1.97E-02	9.05E-09
117-84-0	Di-n-octylphthalate	4.30E-05	5.83E-02	2.58E-04	1.19E-10

Table A-10 Estimate of Organic Emission from the Pretreatment Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
118-74-1	Hexachlorobenzene	1.41E-08	1.91E-05	8.46E-08	3.88E-14
119-90-4	3,3'-Dimethoxybenzidine	-	-	-	-
120-12-7	Anthracene	3.29E-05	4.46E-02	1.97E-04	9.06E-11
120-82-1	1,2,4-Trichlorobenzene	4.43E-14	6.00E-11	2.66E-13	1.22E-19
120-83-2	2,4-Dichlorophenol	6.21E-12	8.42E-09	3.73E-11	1.71E-17
121-14-2	2,4-Dinitrotoluene	4.02E-03	5.44E+00	2.41E-02	1.11E-08
122-39-4	N,N-Diphenylamine	6.96E-07	9.44E-04	4.18E-06	1.92E-12
122-66-7	1,2-Diphenylhydrazine	-	-	-	-
123-33-1	Maleic hydrazide	-	-	-	-
123-38-6	Propionaldehyde	1.04E-08	1.41E-05	6.26E-08	2.87E-14
123-72-8	Butanal	2.41E-06	3.27E-03	1.45E-05	6.65E-12
123-91-1	1,4-Dioxan	1.73E-07	2.34E-04	1.04E-06	4.76E-13
124-18-5	Decane	-	-	-	-
124-38-9	Carbon dioxide	-	-	-	-
124-48-1	Chlorodibromomethane	2.31E-07	3.13E-04	1.39E-06	6.37E-13
126-73-8	Tributyl phosphate	8.21E-04	1.11E+00	4.93E-03	2.26E-09
126-98-7	2-Methyl-2-propenenitrile	6.12E-11	8.29E-08	3.67E-10	1.69E-16
127-18-4	1,1,2,2-Tetrachloroethene	1.60E-21	2.17E-18	9.61E-21	4.41E-27
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	9.00E-06	1.22E-02	5.40E-05	2.48E-11
129-00-0	Pyrene	1.20E-03	1.63E+00	7.23E-03	3.32E-09
131-11-3	Dimethyl Phthalate	2.32E-04	3.15E-01	1.40E-03	6.40E-10

Table A-10 Estimate of Organic Emission from the Pretreatment Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	-	-	-	-
132-64-9	Dibenzofuran	2.66E-06	3.61E-03	1.60E-05	7.34E-12
1330-20-7	Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations)	2.56E-10	3.48E-07	1.54E-09	7.07E-16
133-06-2	Captan	-	-	-	-
1336-36-3	Polychlorinated biphenyls (1254 Aroclor)	2.20E-07	2.99E-04	1.32E-06	6.08E-13
134-32-7	alpha-Naphthylamine	7.61E-04	1.03E+00	4.57E-03	2.10E-09
135-98-8	sec-Butylbenzene	-	-	-	-
141-78-6	Acetic acid ethyl ester	5.75E-11	7.79E-08	3.45E-10	1.58E-16
145-73-3	Endothall	-	-	-	-
156-59-2	cis-1,2-Dichloroethene	-	-	-	-
156-60-5	1,2-trans-Dichloroethene	1.12E-14	1.52E-11	6.72E-14	3.08E-20
1634-04-4	Methyl tert-butyl ether	4.06E-09	5.50E-06	2.44E-08	1.12E-14
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	3.15E-13	4.27E-10	1.89E-12	8.69E-19
189-55-9	Dibenzo[a,i]pyrene	6.10E-04	8.27E-01	3.67E-03	1.68E-09
189-64-0	Dibenzo[a,h]pyrene	6.10E-04	8.27E-01	3.67E-03	1.68E-09
191-24-2	Benzo(g,h,i)perylene	1.25E-03	1.69E+00	7.49E-03	3.44E-09
191-30-0	Dibenzo(a,l)pyrene	6.10E-04	8.27E-01	3.67E-03	1.68E-09
192-65-4	Dibenzo[a,e]pyrene	6.10E-04	8.27E-01	3.67E-03	1.68E-09
192-97-2	Benzo(e)pyrene	-	-	-	-
193-39-5	Indeno(1,2,3-cd)pyrene	1.60E-03	2.16E+00	9.59E-03	4.40E-09
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	9.80E-13	1.33E-09	5.88E-12	2.70E-18

Table A-10 Estimate of Organic Emission from the Pretreatment Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
205-82-3	Benzo[j]fluoranthene	-	-	-	-
205-99-2	Benzo(b)fluoranthene	6.28E-04	8.51E-01	3.77E-03	1.73E-09
206-44-0	Fluoranthene	7.25E-04	9.82E-01	4.35E-03	2.00E-09
207-08-9	Benzo(k)fluoranthene	1.23E-03	1.67E+00	7.39E-03	3.39E-09
208-96-8	Acenaphthylene	1.00E-05	1.36E-02	6.02E-05	2.76E-11
218-01-9	Chrysene	1.80E-05	2.45E-02	1.08E-04	4.97E-11
224-42-0	Dibenz[a,j]acridine	7.57E-04	1.03E+00	4.55E-03	2.09E-09
2245-38-7	2,3,5-Trimethylnaphthalene	-	-	-	-
226-36-8	Dibenz[a,h]acridine	7.06E-04	9.58E-01	4.24E-03	1.95E-09
23950-58-5	Pronamide	-	-	-	-
27154-33-2	Trichlorofluoroethane	1.07E-14	1.45E-11	6.41E-14	2.94E-20
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	9.69E-13	1.31E-09	5.82E-12	2.67E-18
319-84-6	alpha-BHC	9.57E-09	1.30E-05	5.75E-08	2.64E-14
319-85-7	beta-BHC	2.18E-05	2.96E-02	1.31E-04	6.01E-11
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	6.32E-11	8.56E-08	3.79E-10	1.74E-16
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	1.69E-14	2.29E-11	1.02E-13	4.66E-20
3268-87-9	Octachlorodibenzo(p)dioxin	3.38E-11	4.58E-08	2.03E-10	9.32E-17
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	2.48E-12	3.36E-09	1.49E-11	6.84E-18
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	4.73E-12	6.41E-09	2.84E-11	1.30E-17
3697-24-3	5-Methylchrysene	3.02E-04	4.10E-01	1.82E-03	8.33E-10
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	7.93E-13	1.08E-09	4.76E-12	2.19E-18

Table A-10 Estimate of Organic Emission from the Pretreatment Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
39001-02-0	Octachlorodibenzofuran	7.90E-12	1.07E-08	4.75E-11	2.18E-17
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	1.03E-12	1.39E-09	6.17E-12	2.83E-18
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	1.68E-12	2.28E-09	1.01E-11	4.64E-18
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	3.62E-12	4.91E-09	2.18E-11	9.99E-18
4170-30-3	Crotonaldehyde (Propylene aldehyde)	5.78E-16	7.83E-13	3.47E-15	1.59E-21
41851-50-7	Chlorocyclopentadiene	-	-	-	-
460-19-5	Cyanogen (oxalonitrile)	-	-	-	-
4786-20-3	2-Butenenitrile	-	-	-	-
50-00-0	Formaldehyde	1.67E-03	2.26E+00	1.00E-02	4.60E-09
50-32-8	Benzo(a)pyrene	6.55E-04	8.87E-01	3.93E-03	1.80E-09
506-68-3	Cyanogen bromide (bromocyanide)	-	-	-	-
506-77-4	Cyanogen chloride	-	-	-	-
510-15-6	Chlorobenzilate	-	-	-	-
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	3.57E-12	4.83E-09	2.14E-11	9.83E-18
51-28-5	2,4-Dinitrophenol	7.34E-03	9.96E+00	4.41E-02	2.02E-08
51-79-6	Ethyl carbamate (urethane)	-	-	-	-
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	2.58E-12	3.49E-09	1.55E-11	7.10E-18
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	-	-	-	-
532-27-4	2-Chloroacetophenone	-	-	-	-
534-52-1	4,6-Dinitro-o-cresol	4.73E-03	6.41E+00	2.84E-02	1.30E-08
53-70-3	Dibenz[a,h]anthracene	3.42E-05	4.64E-02	2.05E-04	9.43E-11

Table A-10 Estimate of Organic Emission from the Pretreatment Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
5385-75-1	Dibenzo(a,e)fluoranthene	-	-	-	-
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	6.72E-10	9.11E-07	4.04E-09	1.85E-15
540-73-8	1,2-Dimethylhydrazine	-	-	-	-
540-84-1	2,2,4-Trimethylpentane	-	-	-	-
541-73-1	1,3-Dichlorobenzene	5.47E-16	7.42E-13	3.28E-15	1.51E-21
542-75-6	1,3-Dichloropropene	-	-	-	-
542-88-1	bis(Chloromethyl)ether	-	-	-	-
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	6.88E-13	9.33E-10	4.13E-12	1.90E-18
56-23-5	Carbon tetrachloride	1.01E-13	1.37E-10	6.07E-13	2.79E-19
56-49-5	3-Methylcholanthrene	3.14E-04	4.26E-01	1.89E-03	8.65E-10
56-55-3	Benzo(a)anthracene	6.21E-04	8.41E-01	3.73E-03	1.71E-09
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	3.21E-12	4.35E-09	1.93E-11	8.84E-18
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	2.37E-12	3.21E-09	1.42E-11	6.52E-18
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	1.35E-12	1.83E-09	8.10E-12	3.72E-18
57-24-9	Strychnine	-	-	-	-
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	2.07E-11	2.80E-08	1.24E-10	5.70E-17
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	1.06E-12	1.43E-09	6.36E-12	2.92E-18
57-74-9	Chlordane	-	-	-	-
581-42-0	2,6-Dimethylnaphthalene	-	-	-	-
584-84-9	2,4-Toluene diisocyanate	-	-	-	-
58-89-9	gamma-BHC (Lindane)	2.63E-08	3.56E-05	1.58E-07	7.25E-14

Table A-10 Estimate of Organic Emission from the Pretreatment Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
58-90-2	2,3,4,6-Tetrachlorophenol	1.06E-03	1.44E+00	6.36E-03	2.92E-09
589-38-8	3-Hexanone	1.72E-06	2.33E-03	1.03E-05	4.74E-12
591-50-4	Benzene, iodo-	-	-	-	-
591-78-6	2-Hexanone	7.04E-09	9.54E-06	4.23E-08	1.94E-14
593-60-2	Bromoethene (Vinyl bromide)	-	-	-	-
593-74-8	Dimethyl Mercury	1.28E-10	1.73E-07	7.69E-10	3.53E-16
59-50-7	4-Chloro-3-methylphenol	2.14E-03	2.90E+00	1.28E-02	5.89E-09
59-89-2	N-Nitrosomorpholine	7.68E-03	1.04E+01	4.61E-02	2.12E-08
60-11-7	Dimethyl aminoazobenzene	-	-	-	-
602-87-9	5-Nitroacenaphthene	7.63E-04	1.03E+00	4.58E-03	2.10E-09
60-29-7	Ethyl ether	1.58E-13	2.14E-10	9.48E-13	4.35E-19
60-35-5	Acetamide	1.43E-03	1.94E+00	8.58E-03	3.94E-09
606-20-2	2,6-Dinitrotoluene	7.82E-04	1.06E+00	4.70E-03	2.16E-09
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	5.78E-13	7.83E-10	3.47E-12	1.59E-18
608-93-5	Pentachlorobenzene	-	-	-	-
61626-71-9	Dichloropentadiene	-	-	-	-
621-64-7	N-Nitroso-di-n-propylamine	2.14E-03	2.90E+00	1.29E-02	5.90E-09
624-83-9	Methyl isocyanate	-	-	-	-
62-50-0	Ethyl methanesulfonate	-	-	-	-
62-53-3	Aniline	-	-	-	-
62-75-9	N-Nitroso-N,N-dimethylamine	1.22E-05	1.66E-02	7.34E-05	3.37E-11

Table A-10 Estimate of Organic Emission from the Pretreatment Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
628-73-9	Hexanenitrile	3.84E-06	5.20E-03	2.30E-05	1.06E-11
630-20-6	1,1,1,2-Tetrachloroethane	1.84E-11	2.50E-08	1.11E-10	5.08E-17
64-18-6	Formic acid (methanoic acid)	-	-	-	-
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	3.15E-09	4.27E-06	1.89E-08	8.69E-15
65-85-0	Benzoic acid	-	-	-	-
67-56-1	Methyl alcohol	8.33E-04	1.13E+00	5.00E-03	2.30E-09
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	2.15E-12	2.91E-09	1.29E-11	5.92E-18
67-63-0	2-Propyl alcohol	3.26E-07	4.42E-04	1.96E-06	8.98E-13
67-64-1	2-Propanone (Acetone)	4.67E-04	6.33E-01	2.81E-03	1.29E-09
67-66-3	Chloroform	9.93E-10	1.35E-06	5.96E-09	2.74E-15
67-72-1	Hexachloroethane	5.35E-14	7.25E-11	3.21E-13	1.47E-19
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	5.07E-12	6.87E-09	3.04E-11	1.40E-17
70-30-4	Hexachlorophene	-	-	-	-
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	6.32E-12	8.57E-09	3.80E-11	1.74E-17
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	1.59E-12	2.15E-09	9.54E-12	4.38E-18
71-36-3	n-Butyl alcohol	8.79E-06	1.19E-02	5.28E-05	2.42E-11
71-43-2	Benzene	1.87E-10	2.53E-07	1.12E-09	5.15E-16
71-55-6	1,1,1-Trichloroethane	2.20E-21	2.98E-18	1.32E-20	6.07E-27
72-43-5	Methoxychlor	-	-	-	-
72-55-9	4,4-DDE	1.36E-04	1.84E-01	8.16E-04	3.75E-10
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	3.47E-13	4.70E-10	2.08E-12	9.56E-19

Table A-10 Estimate of Organic Emission from the Pretreatment Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
7439-97-6	Mercury	-	-	-	-
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	7.70E-13	1.04E-09	4.62E-12	2.12E-18
74-83-9	Bromomethane	1.19E-10	1.62E-07	7.16E-10	3.29E-16
74-87-3	Chloromethane	2.72E-11	3.69E-08	1.63E-10	7.50E-17
74-88-4	Iodomethane	2.31E-10	3.13E-07	1.38E-09	6.36E-16
74-95-3	Methylene bromide	-	-	-	-
74-97-5	Bromochloromethane	-	-	-	-
75-00-3	Chloroethane	1.43E-19	1.94E-16	8.61E-19	3.95E-25
75-01-4	1-Chloroethene	3.73E-22	5.05E-19	2.24E-21	1.03E-27
75-02-5	Fluoroethene (vinyl fluoride)	6.39E-21	8.66E-18	3.83E-20	1.76E-26
75-05-8	Acetonitrile	5.44E-03	7.38E+00	3.27E-02	1.50E-08
75-07-0	Acetaldehyde	8.72E-06	1.18E-02	5.23E-05	2.40E-11
75-09-2	Dichloromethane (Methylene Chloride)	1.85E-07	2.51E-04	1.11E-06	5.10E-13
75-15-0	Carbon disulfide	4.78E-14	6.47E-11	2.87E-13	1.32E-19
75-21-8	Ethylene oxide (Oxirane)	2.26E-09	3.06E-06	1.36E-08	6.23E-15
75-25-2	Bromoform	2.81E-25	3.80E-22	1.68E-24	7.73E-31
75-27-4	Bromodichloromethane	2.85E-10	3.86E-07	1.71E-09	7.86E-16
75-29-6	2-Chloropropane	-	-	-	-
75-34-3	1,1-Dichloroethane	5.81E-19	7.87E-16	3.49E-18	1.60E-24
75-35-4	1,1-Dichloroethene	2.85E-22	3.86E-19	1.71E-21	7.84E-28
75-44-5	Phosgene (hydrogen phosphide)	-	-	-	-

Table A-10 Estimate of Organic Emission from the Pretreatment Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
75-45-6	Chlorodifluoromethane	5.89E-23	7.98E-20	3.54E-22	1.62E-28
75-50-3	Trimethylamine	3.57E-06	4.84E-03	2.14E-05	9.84E-12
75-69-4	Trichlorofluoromethane	4.26E-25	5.77E-22	2.56E-24	1.17E-30
75-71-8	Dichlorodifluoromethane	-	-	-	-
76-01-7	Pentachloroethane	-	-	-	-
76-13-1	1,2,2-Trichlorotrifluoroethane	-	-	-	-
764-41-0	1,4-Dichloro-2-butene	-	-	-	-
76-44-8	Heptachlor	-	-	-	-
765-34-4	Glycidylaldehyde	-	-	-	-
7664-41-7	Ammonia/Ammonium	3.81E-02	5.17E+01	2.29E-01	1.05E-07
77-47-4	Hexachlorocyclopentadiene	5.73E-13	7.77E-10	3.44E-12	1.58E-18
77-78-1	Dimethyl sulfate	-	-	-	-
78-83-1	2-Methylpropyl alcohol	4.62E-03	6.27E+00	2.78E-02	1.27E-08
78-87-5	1,2-Dichloropropane	1.88E-17	2.54E-14	1.13E-16	5.17E-23
78-93-3	2-Butanone	1.30E-04	1.77E-01	7.83E-04	3.59E-10
79-00-5	1,1,2-Trichloroethane	5.91E-15	8.01E-12	3.55E-14	1.63E-20
79-01-6	1,1,2-Trichloroethylene	1.57E-11	2.13E-08	9.43E-11	4.33E-17
79-10-7	2-Propenoic acid	2.58E-03	3.50E+00	1.55E-02	7.11E-09
79-34-5	1,1,2,2-Tetrachloroethane	5.36E-13	7.26E-10	3.22E-12	1.48E-18
79-46-9	2-Nitropropane	5.23E-09	7.09E-06	3.14E-08	1.44E-14
80-62-6	Methyl methacrylate	-	-	-	-

Table A-10 Estimate of Organic Emission from the Pretreatment Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
822-06-0	Hexamethylene-1,5-diisocyanate	-	-	-	-
823-40-5	Toluene-2,6-diamine	-	-	-	-
82-68-8	Pentachloronitrobenzene (PCNB)	6.65E-11	9.01E-08	3.99E-10	1.83E-16
832-69-9	1-Methylphenanthrene	-	-	-	-
83-32-9	Acenaphthene	7.08E-06	9.60E-03	4.25E-05	1.95E-11
84-66-2	Diethyl phthalate	1.71E-03	2.31E+00	1.02E-02	4.70E-09
84-74-2	Di-n-butylphthalate	1.94E-02	2.63E+01	1.17E-01	5.36E-08
85-01-8	Phenanthrene	1.90E-04	2.58E-01	1.14E-03	5.25E-10
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	-	-	-	-
85-68-7	Butylbenzylphthalate	6.28E-03	8.51E+00	3.77E-02	1.73E-08
86-73-7	Fluorene	4.03E-05	5.46E-02	2.42E-04	1.11E-10
87-61-6	1,2,3-Trichlorobenzene	-	-	-	-
87-68-3	Hexachlorobutadiene	5.59E-17	7.57E-14	3.36E-16	1.54E-22
87-86-5	Pentachlorophenol	6.32E-06	8.57E-03	3.80E-05	1.74E-11
88-06-2	2,4,6-Trichlorophenol	1.02E-03	1.38E+00	6.13E-03	2.81E-09
88-74-4	o-Nitroaniline (2-nitroaniline)	3.23E-04	4.38E-01	1.94E-03	8.91E-10
88-75-5	2-Nitrophenol	1.73E-03	2.35E+00	1.04E-02	4.78E-09
90-04-0	o-Anisidine	-	-	-	-
90-12-0	1-Methylnaphthalene	-	-	-	-
91-20-3	Naphthalene	3.51E-05	4.75E-02	2.11E-04	9.67E-11
91-22-5	Quinoline	-	-	-	-

Table A-10 Estimate of Organic Emission from the Pretreatment Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
91-57-6	2-Methylnaphthalene	3.48E-05	4.71E-02	2.09E-04	9.59E-11
91-58-7	2-Chloronaphthalene	5.84E-08	7.92E-05	3.51E-07	1.61E-13
91-94-1	3,3'-Dichlorobenzidine	1.23E-03	1.66E+00	7.37E-03	3.38E-09
924-16-3	N-Nitroso-di-n-Buetylamine	-	-	-	-
92-52-4	1,1`-Biphenyl	1.60E-10	2.17E-07	9.60E-10	4.41E-16
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	-	-	-	-
94-75-7	2,4-D	-	-	-	-
95-48-7	o-Cresol	3.09E-03	4.19E+00	1.85E-02	8.51E-09
95-49-8	o-Chlorotoluene	-	-	-	-
95-50-1	1,2-Dichlorobenzene	1.26E-13	1.70E-10	7.55E-13	3.46E-19
95-53-4	o-Toluidine	-	-	-	-
95-57-8	2-Chlorophenol	8.44E-08	1.14E-04	5.07E-07	2.33E-13
95-63-6	1,2,4-Trimethyl benzene	-	-	-	-
95-94-3	1,2,4,5-Tetrachlorobenzene	-	-	-	-
95-95-4	2,4,5-Trichlorophenol	1.51E-03	2.05E+00	9.09E-03	4.17E-09
96-12-8	1,2-Dibromo-3-chloropropane	-	-	-	-
96-18-4	1,2,3-Trichloropropane	-	-	-	-
96-45-7	Ethylene thiourea	-	-	-	-
97-63-2	Ethyl methacrylate	-	-	-	-
98-01-1	Furfural	-	-	-	-
98-06-6	tert-Butyl benzene	-	-	-	-

Table A-10 Estimate of Organic Emission from the Pretreatment Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
98-07-7	Benzotrichloride	-	-	-	-
98-82-8	Cumene	-	-	-	-
98-83-9	Methyl styrene (mixed isomers)	-	-	-	-
98-86-2	Acetophenone	2.12E-06	2.87E-03	1.27E-05	5.84E-12
98-95-3	Nitrobenzene	1.37E-04	1.86E-01	8.23E-04	3.78E-10
99-35-4	1,3,5-Trinitrobenzene	-	-	-	-
99-65-0	1,3-Dinitrobenzene	-	-	-	-
99-87-6	p-Cymene	-	-	-	-
			Weight Fraction Sum = WF_s =	2.26E+02	
				Weight Ratio Sum = WR_s =	1.00E+00
					Feed Stream Sum = 4.59E-07

The following indicates the stream properties for feed into the Pretreatment Facility from the TCP feed used to calculate the weight fraction:

$$WF = \frac{(Q_m * 1000)}{\left(Q_v * \frac{\rho}{60 * 60}\right)}$$

Where:

Q_m = compound mass flow rate (g/s)
Q_v = volumetric flow rate (m^3/hr) = 7.90-01
ρ = density (kg/m^3) = 1398.3764

A "-" symbol indicates no data are available for approximating the emissions rate (no data were available, or the corresponding values were below the emissions model tolerance).

Table A-11 Estimate of Organic Emission from the Pretreatment Feed (TCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
100-02-7	p-Nitrophenol	2.69E-02	8.77E+01	1.53E-01	1.78E-07
100-21-0	Phthalic acid	1.01E-02	3.28E+01	5.70E-02	6.66E-08
100-25-4	1,4-Dinitrobenzene	8.52E-06	2.78E-02	4.83E-05	5.64E-11
10028-17-8	Tritium	6.61E-08	2.15E-04	3.74E-07	4.37E-13
100-40-3	4-Ethenylcyclohexene	3.23E-24	1.05E-20	1.83E-23	2.14E-29
100-41-4	Ethyl benzene	1.16E-23	3.79E-20	6.59E-23	7.70E-29
100-42-5	Styrene	3.84E-12	1.25E-08	2.18E-11	2.54E-17
100-44-7	Benzyl chloride	-	-	-	-
100-47-0	Benzonitrile	-	-	-	-
100-51-6	Benzyl alcohol	-	-	-	-
100-52-7	Benzaldehyde	-	-	-	-
10061-01-5	cis-1,3-Dichloropropene	2.04E-20	6.63E-17	1.15E-19	1.35E-25
10061-02-6	trans-1,3-Dichloropropene	1.91E-17	6.22E-14	1.08E-16	1.26E-22

Table A-11 Estimate of Organic Emission from the Pretreatment Feed (TCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
101-55-3	4-Bromophenylphenyl ether	1.66E-08	5.41E-05	9.41E-08	1.10E-13
101-77-9	4,4-Methylenedianiline	-	-	-	-
103-33-3	Azobenzene	-	-	-	-
103-65-1	n-Propyl benzene (Isocumene)	-	-	-	-
104-51-8	n-Butylbenzene	-	-	-	-
104-76-7	2-Ethyl-1-hexanol	1.07E-06	3.48E-03	6.06E-06	7.08E-12
105-67-9	2,4-Dimethylphenol	1.07E-03	3.50E+00	6.09E-03	7.12E-09
10595-95-6	n-Nitrosomethylethylamine	2.16E-04	7.03E-01	1.22E-03	1.43E-09
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	-	-	-	-
106-44-5	p-Cresol (4-methyl phenol)	-	-	-	-
106-46-7	1,4-Dichlorobenzene	2.17E-12	7.08E-09	1.23E-11	1.44E-17
106-47-8	p-Chloroaniline	1.79E-03	5.83E+00	1.01E-02	1.18E-08
106-49-0	p-Toluidine	-	-	-	-
106-51-4	Quinone	-	-	-	-
106-88-7	1,2-Epoxybutane	1.65E-09	5.38E-06	9.37E-09	1.09E-14
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	-	-	-	-
106-93-4	Ethylene dibromide	1.24E-17	4.05E-14	7.05E-17	8.24E-23
106-99-0	1,3-Butadiene	-	-	-	-
107-02-8	Acrolein	4.91E-12	1.60E-08	2.79E-11	3.25E-17
107-05-1	3-Chloropropene	1.74E-24	5.67E-21	9.87E-24	1.15E-29
107-06-2	1,2-Dichloroethane	1.90E-10	6.19E-07	1.08E-09	1.26E-15
107-12-0	Propionitrile	1.64E-09	5.35E-06	9.32E-09	1.09E-14

Table A-11 Estimate of Organic Emission from the Pretreatment Feed (TCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
107-13-1	Acrylonitrile	4.96E-07	1.62E-03	2.81E-06	3.29E-12
107-19-7	Propargyl alcohol	-	-	-	-
107-21-1	Ethylene glycol (1,2-ethanediol)	-	-	-	-
107-98-2	Propylene glycol monomethyl ether	-	-	-	-
108-05-4	Acetic acid vinyl ester	1.17E-11	3.81E-08	6.63E-11	7.74E-17
108-10-1	4-Methyl-2-pentanone	6.28E-13	2.05E-09	3.56E-12	4.16E-18
108-39-4	m-Cresol	6.23E-04	2.03E+00	3.53E-03	4.13E-09
108-60-1	bis (2-Chloroisopropyl)ether	-	-	-	-
108-67-8	1,3,5-Trimethylbenzene	-	-	-	-
108-86-1	Bromobenzene (Phenyl bromide)	-	-	-	-
108-87-2	Methylcyclohexane	-	-	-	-
108-88-3	Toluene	1.13E-13	3.68E-10	6.41E-13	7.49E-19
108-90-7	Chlorobenzene	1.11E-12	3.62E-09	6.30E-12	7.37E-18
108-94-1	Cyclohexanone	3.75E-07	1.22E-03	2.12E-06	2.48E-12
108-95-2	Phenol	9.40E-04	3.06E+00	5.33E-03	6.22E-09
109-74-0	n-Butanenitrile	1.72E-07	5.60E-04	9.75E-07	1.14E-12
109-75-1	3-Butenenitrile	-	-	-	-
109-77-3	Malononitrile	-	-	-	-
109-86-4	2-Methoxyethanol	-	-	-	-
109-99-9	Tetrahydrofuran	2.46E-11	8.01E-08	1.39E-10	1.63E-16
110-00-9	Furan	-	-	-	-
110-54-3	n-Hexane	-	-	-	-

Table A-11 Estimate of Organic Emission from the Pretreatment Feed (TCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
110-59-8	Pentanenitrile	5.91E-08	1.92E-04	3.35E-07	3.91E-13
110-80-5	2-Ethoxyethanol	2.98E-03	9.71E+00	1.69E-02	1.98E-08
110-82-7	Cyclohexane	-	-	-	-
110-83-8	Cyclohexene	-	-	-	-
110-86-1	Pyridine	9.32E-08	3.03E-04	5.28E-07	6.17E-13
111-15-9	Ethylene glycol monoethyl ether acetate	-	-	-	-
111-44-4	bis(2-Chloroethyl)ether	8.14E-06	2.65E-02	4.61E-05	5.39E-11
111-65-9	n-Octane	-	-	-	-
111-76-2	2-Butoxyethanol	1.28E-04	4.16E-01	7.25E-04	8.47E-10
111-84-2	n-Nonane	-	-	-	-
111-91-1	bis(2-Chloroethoxy)methane	9.28E-05	3.02E-01	5.26E-04	6.15E-10
1120-21-4	Undecane	-	-	-	-
1120-71-4	1,3-Propane sultone	-	-	-	-
112-30-1	1-Decanol	-	-	-	-
112-31-2	Decanal	-	-	-	-
112-40-3	Dodecane	-	-	-	-
117-81-7	Bis(2-ethylhexyl) phthalate	1.29E-02	4.20E+01	7.30E-02	8.53E-08
117-84-0	Di-n-octylphthalate	5.48E-07	1.79E-03	3.11E-06	3.63E-12
118-74-1	Hexachlorobenzene	2.88E-11	9.38E-08	1.63E-10	1.91E-16
119-90-4	3,3'-Dimethoxybenzidine	-	-	-	-
120-12-7	Anthracene	5.69E-07	1.85E-03	3.23E-06	3.77E-12
120-82-1	1,2,4-Trichlorobenzene	2.31E-17	7.51E-14	1.31E-16	1.53E-22

Table A-11 Estimate of Organic Emission from the Pretreatment Feed (TCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
120-83-2	2,4-Dichlorophenol	1.81E-15	5.90E-12	1.03E-14	1.20E-20
121-14-2	2,4-Dinitrotoluene	1.55E-02	5.06E+01	8.81E-02	1.03E-07
122-39-4	N,N-Diphenylamine	1.04E-07	3.40E-04	5.91E-07	6.91E-13
122-66-7	1,2-Diphenylhydrazine	-	-	-	-
123-33-1	Maleic hydrazide	-	-	-	-
123-38-6	Propionaldehyde	7.06E-11	2.30E-07	4.00E-10	4.67E-16
123-72-8	Butanal	1.10E-08	3.57E-05	6.22E-08	7.26E-14
123-91-1	1,4-Dioxan	1.02E-08	3.31E-05	5.76E-08	6.73E-14
124-18-5	Decane	-	-	-	-
124-38-9	Carbon dioxide	-	-	-	-
124-48-1	Chlorodibromomethane	4.41E-10	1.44E-06	2.50E-09	2.92E-15
126-73-8	Tributyl phosphate	2.38E-04	7.76E-01	1.35E-03	1.58E-09
126-98-7	2-Methyl-2-propenenitrile	1.40E-13	4.55E-10	7.92E-13	9.25E-19
127-18-4	1,1,2,2-Tetrachloroethene	-	-	-	-
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	9.10E-07	2.96E-03	5.16E-06	6.03E-12
129-00-0	Pyrene	7.76E-05	2.53E-01	4.40E-04	5.14E-10
131-11-3	Dimethyl Phthalate	1.03E-03	3.34E+00	5.82E-03	6.79E-09
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	-	-	-	-
132-64-9	Dibenzofuran	1.91E-08	6.22E-05	1.08E-07	1.27E-13
1330-20-7	Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations)	2.94E-13	9.57E-10	1.67E-12	1.95E-18
133-06-2	Captan	-	-	-	-
1336-36-3	Polychlorinated biphenyls (1254 Aroclor)	2.07E-09	6.74E-06	1.17E-08	1.37E-14

Table A-11 Estimate of Organic Emission from the Pretreatment Feed (TCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
134-32-7	alpha-Naphthylamine	2.45E-03	7.97E+00	1.39E-02	1.62E-08
135-98-8	sec-Butylbenzene	-	-	-	-
141-78-6	Acetic acid ethyl ester	2.27E-13	7.41E-10	1.29E-12	1.51E-18
145-73-3	Endothall	-	-	-	-
156-59-2	cis-1,2-Dichloroethene	-	-	-	-
156-60-5	1,2-trans-Dichloroethene	4.81E-19	1.57E-15	2.73E-18	3.19E-24
1634-04-4	Methyl tert-butyl ether	4.46E-12	1.45E-08	2.53E-11	2.95E-17
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1.10E-14	3.57E-11	6.21E-14	7.26E-20
189-55-9	Dibenzo[a,i]pyrene	4.04E-03	1.32E+01	2.29E-02	2.68E-08
189-64-0	Dibenzo[a,h]pyrene	4.04E-03	1.32E+01	2.29E-02	2.68E-08
191-24-2	Benzo(g,h,i)perylene	4.52E-03	1.47E+01	2.56E-02	2.99E-08
191-30-0	Dibenzo(a,l)pyrene	4.04E-03	1.32E+01	2.29E-02	2.68E-08
192-65-4	Dibenzo[a,e]pyrene	4.04E-03	1.32E+01	2.29E-02	2.68E-08
192-97-2	Benzo(e)pyrene	-	-	-	-
193-39-5	Indeno(1,2,3-cd)pyrene	1.02E-03	3.32E+00	5.77E-03	6.74E-09
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	9.66E-14	3.15E-10	5.47E-13	6.40E-19
205-82-3	Benzo[j]fluoranthene	-	-	-	-
205-99-2	Benzo(b)fluoranthene	7.19E-05	2.34E-01	4.07E-04	4.76E-10
206-44-0	Fluoranthene	3.02E-05	9.83E-02	1.71E-04	2.00E-10
207-08-9	Benzo(k)fluoranthene	1.88E-03	6.13E+00	1.07E-02	1.25E-08
208-96-8	Acenaphthylene	1.12E-07	3.65E-04	6.35E-07	7.42E-13
218-01-9	Chrysene	3.15E-07	1.03E-03	1.79E-06	2.09E-12

Table A-11 Estimate of Organic Emission from the Pretreatment Feed (TCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
224-42-0	Dibenz[a,j]acridine	5.14E-03	1.67E+01	2.91E-02	3.40E-08
2245-38-7	2,3,5-Trimethylnaphthalene	-	-	-	-
226-36-8	Dibenz[a,h]acridine	4.77E-03	1.55E+01	2.70E-02	3.16E-08
23950-58-5	Pronamide	-	-	-	-
27154-33-2	Trichlorofluoroethane	6.94E-19	2.26E-15	3.93E-18	4.59E-24
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	5.45E-15	1.77E-11	3.09E-14	3.61E-20
319-84-6	alpha-BHC	4.29E-10	1.40E-06	2.43E-09	2.84E-15
319-85-7	beta-BHC	5.91E-05	1.93E-01	3.35E-04	3.92E-10
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	6.73E-12	2.19E-08	3.81E-11	4.45E-17
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	4.41E-17	1.44E-13	2.50E-16	2.92E-22
3268-87-9	Octachlorodibenzo(p)dioxin	5.93E-12	1.93E-08	3.36E-11	3.93E-17
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	4.73E-14	1.54E-10	2.68E-13	3.13E-19
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	3.36E-13	1.09E-09	1.90E-12	2.22E-18
3697-24-3	5-Methylchrysene	2.36E-05	7.69E-02	1.34E-04	1.56E-10
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	8.02E-15	2.61E-11	4.54E-14	5.31E-20
39001-02-0	Octachlorodibenzofuran	4.99E-12	1.63E-08	2.83E-11	3.30E-17
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	5.87E-14	1.91E-10	3.33E-13	3.89E-19
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	4.14E-14	1.35E-10	2.35E-13	2.74E-19
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	6.60E-13	2.15E-09	3.74E-12	4.37E-18
4170-30-3	Crotonaldehyde (Propylene aldehyde)	6.24E-18	2.03E-14	3.54E-17	4.13E-23
41851-50-7	Chlorocyclopentadiene	-	-	-	-
460-19-5	Cyanogen (oxalonitrile)	-	-	-	-

Table A-11 Estimate of Organic Emission from the Pretreatment Feed (TCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
4786-20-3	2-Butenenitrile	-	-	-	-
50-00-0	Formaldehyde	9.30E-04	3.03E+00	5.27E-03	6.16E-09
50-32-8	Benzo(a)pyrene	2.35E-04	7.65E-01	1.33E-03	1.55E-09
506-68-3	Cyanogen bromide (bromocyanide)	-	-	-	-
506-77-4	Cyanogen chloride	-	-	-	-
510-15-6	Chlorobenzilate	-	-	-	-
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	2.24E-13	7.29E-10	1.27E-12	1.48E-18
51-28-5	2,4-Dinitrophenol	1.30E-02	4.23E+01	7.36E-02	8.60E-08
51-79-6	Ethyl carbamate (urethane)	-	-	-	-
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	4.90E-14	1.60E-10	2.78E-13	3.25E-19
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	-	-	-	-
532-27-4	2-Chloroacetophenone	-	-	-	-
534-52-1	4,6-Dinitro-o-cresol	3.04E-03	9.90E+00	1.72E-02	2.01E-08
53-70-3	Dibenz[a,h]anthracene	3.43E-03	1.12E+01	1.94E-02	2.27E-08
5385-75-1	Dibenzo(a,e)fluoranthene	-	-	-	-
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	7.54E-13	2.46E-09	4.28E-12	5.00E-18
540-73-8	1,2-Dimethylhydrazine	-	-	-	-
540-84-1	2,2,4-Trimethylpentane	-	-	-	-
541-73-1	1,3-Dichlorobenzene	1.15E-19	3.75E-16	6.52E-19	7.62E-25
542-75-6	1,3-Dichloropropene	-	-	-	-
542-88-1	bis(Chloromethyl)ether	-	-	-	-
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	4.89E-14	1.59E-10	2.77E-13	3.24E-19

Table A-11 Estimate of Organic Emission from the Pretreatment Feed (TCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
56-23-5	Carbon tetrachloride	2.73E-16	8.89E-13	1.55E-15	1.81E-21
56-49-5	3-Methylcholanthrene	2.57E-05	8.38E-02	1.46E-04	1.70E-10
56-55-3	Benzo(a)anthracene	2.22E-04	7.24E-01	1.26E-03	1.47E-09
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	7.82E-13	2.55E-09	4.43E-12	5.18E-18
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	5.30E-13	1.73E-09	3.01E-12	3.51E-18
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	1.76E-13	5.74E-10	9.99E-13	1.17E-18
57-24-9	Strychnine	-	-	-	-
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	2.25E-12	7.34E-09	1.28E-11	1.49E-17
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	6.41E-14	2.09E-10	3.63E-13	4.24E-19
57-74-9	Chlordane	-	-	-	-
581-42-0	2,6-Dimethylnaphthalene	-	-	-	-
584-84-9	2,4-Toluene diisocyanate	-	-	-	-
58-89-9	gamma-BHC (Lindane)	2.20E-09	7.16E-06	1.25E-08	1.46E-14
58-90-2	2,3,4,6-Tetrachlorophenol	1.01E-04	3.29E-01	5.73E-04	6.69E-10
589-38-8	3-Hexanone	7.24E-09	2.36E-05	4.11E-08	4.80E-14
591-50-4	Benzene, iodo-	-	-	-	-
591-78-6	2-Hexanone	3.86E-11	1.26E-07	2.19E-10	2.56E-16
593-60-2	Bromoethene (Vinyl bromide)	-	-	-	-
593-74-8	Dimethyl Mercury	4.56E-08	1.49E-04	2.58E-07	3.02E-13
59-50-7	4-Chloro-3-methylphenol	2.21E-04	7.18E-01	1.25E-03	1.46E-09
59-89-2	N-Nitrosomorpholine	1.06E-02	3.47E+01	6.04E-02	7.05E-08
60-11-7	Dimethyl aminoazobenzene	3.92E-19	1.28E-15	2.22E-18	2.60E-24

Table A-11 Estimate of Organic Emission from the Pretreatment Feed (TCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
602-87-9	5-Nitroacenaphthene	2.86E-04	9.32E-01	1.62E-03	1.90E-09
60-29-7	Ethyl ether	9.26E-17	3.01E-13	5.25E-16	6.13E-22
60-35-5	Acetamide	2.45E-03	7.99E+00	1.39E-02	1.62E-08
606-20-2	2,6-Dinitrotoluene	8.90E-04	2.90E+00	5.04E-03	5.89E-09
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	5.25E-14	1.71E-10	2.97E-13	3.48E-19
608-93-5	Pentachlorobenzene	-	-	-	-
61626-71-9	Dichloropentadiene	-	-	-	-
621-64-7	N-Nitroso-di-n-propylamine	2.38E-04	7.75E-01	1.35E-03	1.58E-09
624-83-9	Methyl isocyanate	-	-	-	-
62-50-0	Ethyl methanesulfonate	-	-	-	-
62-53-3	Aniline	-	-	-	-
62-75-9	N-Nitroso-N,N-dimethylamine	1.65E-06	5.36E-03	9.33E-06	1.09E-11
628-73-9	Hexanenitrile	2.07E-08	6.74E-05	1.17E-07	1.37E-13
630-20-6	1,1,1,2-Tetrachloroethane	5.32E-15	1.73E-11	3.01E-14	3.52E-20
64-18-6	Formic acid (methanoic acid)	-	-	-	-
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	1.14E-12	3.73E-09	6.49E-12	7.58E-18
65-85-0	Benzoic acid	-	-	-	-
67-56-1	Methyl alcohol	5.16E-05	1.68E-01	2.93E-04	3.42E-10
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	1.53E-13	4.97E-10	8.66E-13	1.01E-18
67-63-0	2-Propyl alcohol	1.27E-08	4.14E-05	7.21E-08	8.42E-14
67-64-1	2-Propanone (Acetone)	1.02E-05	3.33E-02	5.79E-05	6.77E-11
67-66-3	Chloroform	1.11E-12	3.62E-09	6.30E-12	7.37E-18

Table A-11 Estimate of Organic Emission from the Pretreatment Feed (TCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
67-72-1	Hexachloroethane	8.27E-18	2.69E-14	4.69E-17	5.48E-23
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	1.24E-13	4.05E-10	7.05E-13	8.23E-19
70-30-4	Hexachlorophene	-	-	-	-
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	3.11E-13	1.01E-09	1.77E-12	2.06E-18
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	6.46E-14	2.11E-10	3.66E-13	4.28E-19
71-36-3	n-Butyl alcohol	3.22E-07	1.05E-03	1.82E-06	2.13E-12
71-43-2	Benzene	2.17E-13	7.06E-10	1.23E-12	1.44E-18
71-55-6	1,1,1-Trichloroethane	-	-	-	-
72-43-5	Methoxychlor	-	-	-	-
72-55-9	4,4-DDE	3.64E-06	1.19E-02	2.06E-05	2.41E-11
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	3.20E-14	1.04E-10	1.82E-13	2.12E-19
7439-97-6	Mercury	-	-	-	-
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	1.13E-14	3.68E-11	6.41E-14	7.49E-20
74-83-9	Bromomethane	1.42E-13	4.61E-10	8.02E-13	9.38E-19
74-87-3	Chloromethane	3.59E-14	1.17E-10	2.03E-13	2.38E-19
74-88-4	Iodomethane	2.65E-13	8.62E-10	1.50E-12	1.75E-18
74-95-3	Methylene bromide	-	-	-	-
74-97-5	Bromochloromethane	-	-	-	-
75-00-3	Chloroethane	6.81E-24	2.22E-20	3.86E-23	4.51E-29
75-01-4	1-Chloroethene	-	-	-	-
75-02-5	Fluoroethene (vinyl fluoride)	-	-	-	-
75-05-8	Acetonitrile	1.32E-04	4.30E-01	7.49E-04	8.75E-10

Table A-11 Estimate of Organic Emission from the Pretreatment Feed (TCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
75-07-0	Acetaldehyde	5.54E-08	1.80E-04	3.14E-07	3.67E-13
75-09-2	Dichloromethane (Methylene Chloride)	2.22E-10	7.23E-07	1.26E-09	1.47E-15
75-15-0	Carbon disulfide	2.79E-16	9.10E-13	1.58E-15	1.85E-21
75-21-8	Ethylene oxide (Oxirane)	8.18E-12	2.66E-08	4.63E-11	5.41E-17
75-25-2	Bromoform	1.24E-25	4.05E-22	7.04E-25	8.23E-31
75-27-4	Bromodichloromethane	1.30E-13	4.24E-10	7.38E-13	8.62E-19
75-29-6	2-Chloropropane	-	-	-	-
75-34-3	1,1-Dichloroethane	5.35E-23	1.74E-19	3.03E-22	3.55E-28
75-35-4	1,1-Dichloroethene	-	-	-	-
75-44-5	Phosgene (hydrogen phosphide)	-	-	-	-
75-45-6	Chlorodifluoromethane	-	-	-	-
75-50-3	Trimethylamine	1.77E-08	5.78E-05	1.01E-07	1.18E-13
75-69-4	Trichlorofluoromethane	-	-	-	-
75-71-8	Dichlorodifluoromethane	-	-	-	-
76-01-7	Pentachloroethane	-	-	-	-
76-13-1	1,2,2-Trichlorotrifluoroethane	-	-	-	-
764-41-0	1,4-Dichloro-2-butene	-	-	-	-
76-44-8	Heptachlor	-	-	-	-
765-34-4	Glycidylaldehyde	-	-	-	-
7664-41-7	Ammonia/Ammonium	6.51E-03	2.12E+01	3.69E-02	4.31E-08
77-47-4	Hexachlorocyclopentadiene	1.43E-15	4.65E-12	8.10E-15	9.46E-21
77-78-1	Dimethyl sulfate	-	-	-	-

Table A-11 Estimate of Organic Emission from the Pretreatment Feed (TCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
78-83-1	2-Methylpropyl alcohol	1.56E-04	5.09E-01	8.86E-04	1.04E-09
78-87-5	1,2-Dichloropropane	4.50E-21	1.47E-17	2.55E-20	2.98E-26
78-93-3	2-Butanone	2.09E-06	6.81E-03	1.19E-05	1.38E-11
79-00-5	1,1,2-Trichloroethane	4.52E-18	1.47E-14	2.56E-17	2.99E-23
79-01-6	1,1,2-Trichloroethylene	2.18E-14	7.09E-11	1.23E-13	1.44E-19
79-10-7	2-Propenoic acid	1.35E-03	4.39E+00	7.65E-03	8.94E-09
79-34-5	1,1,2,2-Tetrachloroethane	9.27E-16	3.02E-12	5.25E-15	6.14E-21
79-46-9	2-Nitropropane	2.30E-11	7.50E-08	1.30E-10	1.52E-16
80-62-6	Methyl methacrylate	-	-	-	-
822-06-0	Hexamethylene-1,5-diisocyanate	-	-	-	-
823-40-5	Toluene-2,6-diamine	-	-	-	-
82-68-8	Pentachloronitrobenzene (PCNB)	1.48E-13	4.81E-10	8.38E-13	9.79E-19
832-69-9	1-Methylphenanthrene	-	-	-	-
83-32-9	Acenaphthene	5.23E-08	1.70E-04	2.96E-07	3.46E-13
84-66-2	Diethyl phthalate	2.24E-03	7.31E+00	1.27E-02	1.49E-08
84-74-2	Di-n-butylphthalate	5.50E-03	1.79E+01	3.12E-02	3.65E-08
85-01-8	Phenanthrene	7.58E-06	2.47E-02	4.30E-05	5.02E-11
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	-	-	-	-
85-68-7	Butylbenzylphthalate	2.31E-03	7.52E+00	1.31E-02	1.53E-08
86-73-7	Fluorene	7.21E-07	2.35E-03	4.09E-06	4.77E-12
87-61-6	1,2,3-Trichlorobenzene	-	-	-	-
87-68-3	Hexachlorobutadiene	2.99E-21	9.75E-18	1.70E-20	1.98E-26

Table A-11 Estimate of Organic Emission from the Pretreatment Feed (TCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
87-86-5	Pentachlorophenol	3.59E-05	1.17E-01	2.03E-04	2.38E-10
88-06-2	2,4,6-Trichlorophenol	4.10E-05	1.34E-01	2.33E-04	2.72E-10
88-74-4	o-Nitroaniline (2-nitroaniline)	1.40E-03	4.57E+00	7.96E-03	9.30E-09
88-75-5	2-Nitrophenol	9.37E-05	3.05E-01	5.31E-04	6.21E-10
90-04-0	o-Anisidine	-	-	-	-
90-12-0	1-Methylnaphthalene	-	-	-	-
91-20-3	Naphthalene	9.36E-08	3.05E-04	5.31E-07	6.20E-13
91-22-5	Quinoline	-	-	-	-
91-57-6	2-Methylnaphthalene	7.17E-07	2.34E-03	4.06E-06	4.75E-12
91-58-7	2-Chloronaphthalene	1.08E-10	3.52E-07	6.13E-10	7.17E-16
91-94-1	3,3'-Dichlorobenzidine	9.41E-03	3.07E+01	5.34E-02	6.24E-08
924-16-3	N-Nitroso-di-n-Buetylamine	-	-	-	-
92-52-4	1,1`-Biphenyl	3.01E-13	9.80E-10	1.71E-12	1.99E-18
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	-	-	-	-
94-75-7	2,4-D	-	-	-	-
95-48-7	o-Cresol	6.00E-04	1.95E+00	3.40E-03	3.97E-09
95-49-8	o-Chlorotoluene	-	-	-	-
95-50-1	1,2-Dichlorobenzene	4.77E-17	1.55E-13	2.70E-16	3.16E-22
95-53-4	o-Toluidine	-	-	-	-
95-57-8	2-Chlorophenol	1.30E-10	4.23E-07	7.35E-10	8.59E-16
95-63-6	1,2,4-Trimethyl benzene	-	-	-	-
95-94-3	1,2,4,5-Tetrachlorobenzene	-	-	-	-

Table A-11 Estimate of Organic Emission from the Pretreatment Feed (TCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction WF (mg/kg)	Weight Ratio WR (unitless)	Individual Organic Release R_{IO} (g/s)
95-95-4	2,4,5-Trichlorophenol	9.70E-05	3.16E-01	5.50E-04	6.42E-10
96-12-8	1,2-Dibromo-3-chloropropane	-	-	-	-
96-18-4	1,2,3-Trichloropropane	-	-	-	-
96-45-7	Ethylene thiourea	-	-	-	-
97-63-2	Ethyl methacrylate	-	-	-	-
98-01-1	Furfural	-	-	-	-
98-06-6	tert-Butyl benzene	-	-	-	-
98-07-7	Benzotrichloride	-	-	-	-
98-82-8	Cumene	-	-	-	-
98-83-9	Methyl styrene (mixed isomers)	-	-	-	-
98-86-2	Acetophenone	2.04E-08	6.64E-05	1.16E-07	1.35E-13
98-95-3	Nitrobenzene	4.42E-06	1.44E-02	2.51E-05	2.93E-11
99-35-4	1,3,5-Trinitrobenzene	-	-	-	-
99-65-0	1,3-Dinitrobenzene	-	-	-	-
99-87-6	p-Cymene	-	-	-	-
			Weight Fraction Sum = WF_s =	5.75E+02	
				Weight Ratio Sum = WR_s =	1.00E+00
					Feed Stream Sum = 1.17E-06

The following indicates the stream properties for feed into the Pretreatment Facility from the TLP feed used to calculate the weight fraction:

$$WF = \frac{(Q_m * 1000)}{\left(Q_v * \frac{\rho}{60 * 60}\right)}$$

Where:

Q_m = compound mass flow rate (g/s)
Q_v = volumetric flow rate (m^3/hr) = 7.52E-01
ρ = density (kg/m^3) = 1425

A "-" symbol indicates no data are available for approximating the emissions rate (no data were available, or the corresponding values were below the emissions model tolerance).

Table A-12 Estimate of Organic Emission from the Pretreatment Feed (TLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
100-02-7	p-Nitrophenol	2.73E-02	9.15E+01	1.52E-01	1.18E-06
100-21-0	Phthalic acid	1.02E-02	3.42E+01	5.68E-02	4.39E-07
100-25-4	1,4-Dinitrobenzene	8.66E-06	2.91E-02	4.83E-05	3.74E-10
10028-17-8	Tritium	6.68E-08	2.24E-04	3.72E-07	2.88E-12
100-40-3	4-Ethenylcyclohexene	1.42E-21	4.76E-18	7.90E-21	6.11E-26
100-41-4	Ethyl benzene	9.08E-22	3.05E-18	5.07E-21	3.92E-26
100-42-5	Styrene	1.05E-10	3.52E-07	5.85E-10	4.52E-15
100-44-7	Benzyl chloride	-	-	-	-
100-47-0	Benzonitrile	-	-	-	-
100-51-6	Benzyl alcohol	-	-	-	-
100-52-7	Benzaldehyde	-	-	-	-
10061-01-5	cis-1,3-Dichloropropene	5.59E-19	1.88E-15	3.12E-18	2.41E-23

Table A-12 Estimate of Organic Emission from the Pretreatment Feed (TLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
10061-02-6	trans-1,3-Dichloropropene	1.81E-16	6.09E-13	1.01E-15	7.82E-21
101-55-3	4-Bromophenylphenyl ether	3.58E-08	1.20E-04	2.00E-07	1.54E-12
101-77-9	4,4-Methylenedianiline	-	-	-	-
103-33-3	Azobenzene	-	-	-	-
103-65-1	n-Propyl benzene (Isocumene)	-	-	-	-
104-51-8	n-Butylbenzene	-	-	-	-
104-76-7	2-Ethyl-1-hexanol	1.36E-06	4.56E-03	7.58E-06	5.86E-11
105-67-9	2,4-Dimethylphenol	1.11E-03	3.72E+00	6.19E-03	4.78E-08
10595-95-6	n-Nitrosomethylethylamine	2.22E-04	7.44E-01	1.24E-03	9.55E-09
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	-	-	-	-
106-44-5	p-Cresol (4-methyl phenol)	-	-	-	-
106-46-7	1,4-Dichlorobenzene	5.31E-11	1.78E-07	2.96E-10	2.29E-15
106-47-8	p-Chloroaniline	1.83E-03	6.15E+00	1.02E-02	7.90E-08
106-49-0	p-Toluidine	-	-	-	-
106-51-4	Quinone	-	-	-	-
106-88-7	1,2-Epoxybutane	4.58E-09	1.54E-05	2.55E-08	1.97E-13
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	-	-	-	-
106-93-4	Ethylene dibromide	1.02E-16	3.44E-13	5.71E-16	4.41E-21
106-99-0	1,3-Butadiene	3.26E-26	1.10E-22	1.82E-25	1.41E-30
107-02-8	Acrolein	1.07E-11	3.60E-08	5.98E-11	4.62E-16
107-05-1	3-Chloropropene	1.96E-22	6.59E-19	1.09E-21	8.45E-27

Table A-12 Estimate of Organic Emission from the Pretreatment Feed (TLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
107-06-2	1,2-Dichloroethane	2.01E-09	6.75E-06	1.12E-08	8.66E-14
107-12-0	Propionitrile	2.26E-09	7.58E-06	1.26E-08	9.73E-14
107-13-1	Acrylonitrile	1.00E-06	3.36E-03	5.59E-06	4.32E-11
107-19-7	Propargyl alcohol	-	-	-	-
107-21-1	Ethylene glycol (1,2-ethanediol)	-	-	-	-
107-98-2	Propylene glycol monomethyl ether	-	-	-	-
108-05-4	Acetic acid vinyl ester	7.00E-11	2.35E-07	3.90E-10	3.02E-15
108-10-1	4-Methyl-2-pentanone	1.49E-12	4.99E-09	8.30E-12	6.41E-17
108-39-4	m-Cresol	6.36E-04	2.14E+00	3.55E-03	2.74E-08
108-60-1	bis (2-Chloroisopropyl)ether	-	-	-	-
108-67-8	1,3,5-Trimethylbenzene	-	-	-	-
108-86-1	Bromobenzene (Phenyl bromide)	-	-	-	-
108-87-2	Methylcyclohexane	-	-	-	-
108-88-3	Toluene	7.40E-12	2.48E-08	4.13E-11	3.19E-16
108-90-7	Chlorobenzene	4.13E-11	1.39E-07	2.30E-10	1.78E-15
108-94-1	Cyclohexanone	4.13E-07	1.39E-03	2.30E-06	1.78E-11
108-95-2	Phenol	9.56E-04	3.21E+00	5.33E-03	4.12E-08
109-74-0	n-Butanenitrile	2.62E-07	8.79E-04	1.46E-06	1.13E-11
109-75-1	3-Butenenitrile	-	-	-	-
109-77-3	Malononitrile	-	-	-	-
109-86-4	2-Methoxyethanol	-	-	-	-

Table A-12 Estimate of Organic Emission from the Pretreatment Feed (TLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
109-99-9	Tetrahydrofuran	4.18E-11	1.40E-07	2.33E-10	1.80E-15
110-00-9	Furan	-	-	-	-
110-54-3	n-Hexane	-	-	-	-
110-59-8	Pentanenitrile	1.01E-07	3.39E-04	5.63E-07	4.35E-12
110-80-5	2-Ethoxyethanol	3.03E-03	1.02E+01	1.69E-02	1.31E-07
110-82-7	Cyclohexane	-	-	-	-
110-83-8	Cyclohexene	6.23E-26	2.09E-22	3.48E-25	2.69E-30
110-86-1	Pyridine	1.02E-07	3.44E-04	5.71E-07	4.41E-12
111-15-9	Ethylene glycol monoethyl ether acetate	-	-	-	-
111-44-4	bis(2-Chloroethyl)ether	9.68E-06	3.25E-02	5.40E-05	4.17E-10
111-65-9	n-Octane	-	-	-	-
111-76-2	2-Butoxyethanol	1.32E-04	4.42E-01	7.34E-04	5.67E-09
111-84-2	n-Nonane	-	-	-	-
111-91-1	bis(2-Chloroethoxy)methane	9.75E-05	3.28E-01	5.44E-04	4.20E-09
1120-21-4	Undecane	-	-	-	-
1120-71-4	1,3-Propane sultone	-	-	-	-
112-30-1	1-Decanol	-	-	-	-
112-31-2	Decanal	-	-	-	-
112-40-3	Dodecane	-	-	-	-
117-81-7	Bis(2-ethylhexyl) phthalate	1.31E-02	4.39E+01	7.29E-02	5.63E-07
117-84-0	Di-n-octylphthalate	9.14E-07	3.07E-03	5.10E-06	3.94E-11

Table A-12 Estimate of Organic Emission from the Pretreatment Feed (TLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
118-74-1	Hexachlorobenzene	3.94E-10	1.32E-06	2.20E-09	1.70E-14
119-90-4	3,3'-Dimethoxybenzidine	-	-	-	-
120-12-7	Anthracene	9.37E-07	3.15E-03	5.23E-06	4.04E-11
120-82-1	1,2,4-Trichlorobenzene	3.38E-16	1.14E-12	1.89E-15	1.46E-20
120-83-2	2,4-Dichlorophenol	4.42E-14	1.48E-10	2.46E-13	1.90E-18
121-14-2	2,4-Dinitrotoluene	1.58E-02	5.29E+01	8.79E-02	6.79E-07
122-39-4	N,N-Diphenylamine	1.08E-07	3.64E-04	6.04E-07	4.67E-12
122-66-7	1,2-Diphenylhydrazine	-	-	-	-
123-33-1	Maleic hydrazide	-	-	-	-
123-38-6	Propionaldehyde	1.22E-10	4.10E-07	6.81E-10	5.26E-15
123-72-8	Butanal	2.34E-08	7.86E-05	1.31E-07	1.01E-12
123-91-1	1,4-Dioxan	1.08E-08	3.62E-05	6.01E-08	4.64E-13
124-18-5	Decane	-	-	-	-
124-38-9	Carbon dioxide	-	-	-	-
124-48-1	Chlorodibromomethane	3.81E-09	1.28E-05	2.13E-08	1.64E-13
126-73-8	Tributyl phosphate	2.45E-04	8.22E-01	1.37E-03	1.05E-08
126-98-7	2-Methyl-2-propenenitrile	4.78E-13	1.60E-09	2.67E-12	2.06E-17
127-18-4	1,1,2,2-Tetrachloroethene	4.73E-24	1.59E-20	2.64E-23	2.04E-28
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	9.58E-07	3.22E-03	5.35E-06	4.13E-11
129-00-0	Pyrene	8.70E-05	2.92E-01	4.85E-04	3.75E-09
131-11-3	Dimethyl Phthalate	1.04E-03	3.49E+00	5.80E-03	4.48E-08

Table A-12 Estimate of Organic Emission from the Pretreatment Feed (TLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	-	-	-	-
132-64-9	Dibenzofuran	5.91E-08	1.98E-04	3.29E-07	2.55E-12
1330-20-7	Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations)	1.52E-11	5.09E-08	8.45E-11	6.53E-16
133-06-2	Captan	-	-	-	-
1336-36-3	Polychlorinated biphenyls (1254 Aroclor)	5.93E-09	1.99E-05	3.31E-08	2.55E-13
134-32-7	alpha-Naphthylamine	2.48E-03	8.33E+00	1.38E-02	1.07E-07
135-98-8	sec-Butylbenzene	-	-	-	-
141-78-6	Acetic acid ethyl ester	5.28E-13	1.77E-09	2.94E-12	2.27E-17
145-73-3	Endothall	-	-	-	-
156-59-2	cis-1,2-Dichloroethene	-	-	-	-
156-60-5	1,2-trans-Dichloroethene	4.46E-17	1.50E-13	2.49E-16	1.92E-21
1634-04-4	Methyl tert-butyl ether	3.00E-11	1.01E-07	1.68E-10	1.29E-15
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1.46E-14	4.91E-11	8.16E-14	6.30E-19
189-55-9	Dibenzo[a,i]pyrene	4.10E-03	1.38E+01	2.29E-02	1.77E-07
189-64-0	Dibenzo[a,h]pyrene	4.10E-03	1.38E+01	2.29E-02	1.77E-07
191-24-2	Benzo(g,h,i)perylene	4.59E-03	1.54E+01	2.56E-02	1.98E-07
191-30-0	Dibenzo(a,l)pyrene	4.10E-03	1.38E+01	2.29E-02	1.77E-07
192-65-4	Dibenzo[a,e]pyrene	4.10E-03	1.38E+01	2.29E-02	1.77E-07
192-97-2	Benzo(e)pyrene	-	-	-	-
193-39-5	Indeno(1,2,3-cd)pyrene	1.05E-03	3.52E+00	5.84E-03	4.51E-08
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	1.08E-13	3.63E-10	6.04E-13	4.66E-18

Table A-12 Estimate of Organic Emission from the Pretreatment Feed (TLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
205-82-3	Benzo[j]fluoranthene	-	-	-	-
205-99-2	Benzo(b)fluoranthene	8.06E-05	2.71E-01	4.49E-04	3.47E-09
206-44-0	Fluoranthene	3.53E-05	1.18E-01	1.97E-04	1.52E-09
207-08-9	Benzo(k)fluoranthene	1.92E-03	6.46E+00	1.07E-02	8.29E-08
208-96-8	Acenaphthylene	2.38E-07	7.99E-04	1.33E-06	1.03E-11
218-01-9	Chrysene	6.12E-07	2.05E-03	3.41E-06	2.64E-11
224-42-0	Dibenz[a,j]acridine	5.20E-03	1.75E+01	2.90E-02	2.24E-07
2245-38-7	2,3,5-Trimethylnaphthalene	-	-	-	-
226-36-8	Dibenz[a,h]acridine	4.83E-03	1.62E+01	2.70E-02	2.08E-07
23950-58-5	Pronamide	-	-	-	-
27154-33-2	Trichlorofluoroethane	7.06E-17	2.37E-13	3.94E-16	3.04E-21
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	2.08E-14	6.99E-11	1.16E-13	8.97E-19
319-84-6	alpha-BHC	4.80E-10	1.61E-06	2.68E-09	2.07E-14
319-85-7	beta-BHC	5.99E-05	2.01E-01	3.34E-04	2.58E-09
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	7.43E-12	2.50E-08	4.15E-11	3.20E-16
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	4.00E-16	1.34E-12	2.23E-15	1.72E-20
3268-87-9	Octachlorodibenzo(p)dioxin	6.40E-12	2.15E-08	3.57E-11	2.76E-16
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	7.94E-14	2.67E-10	4.43E-13	3.42E-18
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	3.79E-13	1.27E-09	2.12E-12	1.63E-17
3697-24-3	5-Methylchrysene	2.52E-05	8.46E-02	1.41E-04	1.09E-09
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	1.93E-14	6.48E-11	1.08E-13	8.32E-19

Table A-12 Estimate of Organic Emission from the Pretreatment Feed (TLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
39001-02-0	Octachlorodibenzofuran	5.15E-12	1.73E-08	2.87E-11	2.22E-16
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	6.55E-14	2.20E-10	3.66E-13	2.83E-18
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	6.25E-14	2.10E-10	3.49E-13	2.69E-18
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	6.85E-13	2.30E-09	3.82E-12	2.95E-17
4170-30-3	Crotonaldehyde (Propylene aldehyde)	6.91E-18	2.32E-14	3.85E-17	2.98E-22
41851-50-7	Chlorocyclopentadiene	-	-	-	-
460-19-5	Cyanogen (oxalonitrile)	-	-	-	-
4786-20-3	2-Butenenitrile	-	-	-	-
50-00-0	Formaldehyde	9.45E-04	3.17E+00	5.27E-03	4.07E-08
50-32-8	Benzo(a)pyrene	2.46E-04	8.25E-01	1.37E-03	1.06E-08
506-68-3	Cyanogen bromide (bromocyanide)	-	-	-	-
506-77-4	Cyanogen chloride	-	-	-	-
510-15-6	Chlorobenzilate	-	-	-	-
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	2.58E-13	8.66E-10	1.44E-12	1.11E-17
51-28-5	2,4-Dinitrophenol	1.32E-02	4.43E+01	7.37E-02	5.69E-07
51-79-6	Ethyl carbamate (urethane)	-	-	-	-
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	8.24E-14	2.77E-10	4.60E-13	3.55E-18
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	-	-	-	-
532-27-4	2-Chloroacetophenone	-	-	-	-
534-52-1	4,6-Dinitro-o-cresol	3.12E-03	1.05E+01	1.74E-02	1.34E-07
53-70-3	Dibenz[a,h]anthracene	3.47E-03	1.17E+01	1.94E-02	1.50E-07

Table A-12 Estimate of Organic Emission from the Pretreatment Feed (TLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
5385-75-1	Dibenzo(a,e)fluoranthene	-	-	-	-
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	3.08E-11	1.03E-07	1.72E-10	1.33E-15
540-73-8	1,2-Dimethylhydrazine	-	-	-	-
540-84-1	2,2,4-Trimethylpentane	-	-	-	-
541-73-1	1,3-Dichlorobenzene	3.59E-18	1.21E-14	2.01E-17	1.55E-22
542-75-6	1,3-Dichloropropene	-	-	-	-
542-88-1	bis(Chloromethyl)ether	-	-	-	-
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	5.63E-14	1.89E-10	3.14E-13	2.43E-18
56-23-5	Carbon tetrachloride	8.01E-14	2.69E-10	4.47E-13	3.45E-18
56-49-5	3-Methylcholanthrene	2.74E-05	9.19E-02	1.53E-04	1.18E-09
56-55-3	Benzo(a)anthracene	2.33E-04	7.81E-01	1.30E-03	1.00E-08
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	8.30E-13	2.79E-09	4.63E-12	3.58E-17
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	5.63E-13	1.89E-09	3.14E-12	2.43E-17
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	1.91E-13	6.41E-10	1.07E-12	8.23E-18
57-24-9	Strychnine	-	-	-	-
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	2.49E-12	8.37E-09	1.39E-11	1.07E-16
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	7.37E-14	2.47E-10	4.11E-13	3.18E-18
57-74-9	Chlordane	-	-	-	-
581-42-0	2,6-Dimethylnaphthalene	-	-	-	-
584-84-9	2,4-Toluene diisocyanate	-	-	-	-
58-89-9	gamma-BHC (Lindane)	2.34E-09	7.84E-06	1.30E-08	1.01E-13

Table A-12 Estimate of Organic Emission from the Pretreatment Feed (TLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
58-90-2	2,3,4,6-Tetrachlorophenol	1.07E-04	3.58E-01	5.95E-04	4.60E-09
589-38-8	3-Hexanone	1.62E-08	5.43E-05	9.02E-08	6.97E-13
591-50-4	Benzene, iodo-	-	-	-	-
591-78-6	2-Hexanone	7.42E-11	2.49E-07	4.14E-10	3.20E-15
593-60-2	Bromoethene (Vinyl bromide)	-	-	-	-
593-74-8	Dimethyl Mercury	-	-	-	-
59-50-7	4-Chloro-3-methylphenol	2.29E-04	7.68E-01	1.28E-03	9.86E-09
59-89-2	N-Nitrosomorpholine	1.08E-02	3.62E+01	6.02E-02	4.65E-07
60-11-7	Dimethyl aminoazobenzene	3.97E-19	1.33E-15	2.21E-18	1.71E-23
602-87-9	5-Nitroacenaphthene	2.93E-04	9.84E-01	1.63E-03	1.26E-08
60-29-7	Ethyl ether	1.20E-15	4.04E-12	6.72E-15	5.19E-20
60-35-5	Acetamide	2.48E-03	8.34E+00	1.39E-02	1.07E-07
606-20-2	2,6-Dinitrotoluene	9.08E-04	3.05E+00	5.06E-03	3.91E-08
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	5.88E-14	1.97E-10	3.28E-13	2.53E-18
608-93-5	Pentachlorobenzene	-	-	-	-
61626-71-9	Dichloropentadiene	-	-	-	-
621-64-7	N-Nitroso-di-n-propylamine	2.46E-04	8.27E-01	1.37E-03	1.06E-08
624-83-9	Methyl isocyanate	-	-	-	-
62-50-0	Ethyl methanesulfonate	-	-	-	-
62-53-3	Aniline	-	-	-	-
62-75-9	N-Nitroso-N,N-dimethylamine	1.69E-06	5.68E-03	9.44E-06	7.30E-11

Table A-12 Estimate of Organic Emission from the Pretreatment Feed (TLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
628-73-9	Hexanenitrile	4.01E-08	1.35E-04	2.24E-07	1.73E-12
630-20-6	1,1,1,2-Tetrachloroethane	1.31E-13	4.39E-10	7.30E-13	5.64E-18
64-18-6	Formic acid (methanoic acid)	-	-	-	-
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	1.42E-12	4.78E-09	7.94E-12	6.13E-17
65-85-0	Benzoic acid	-	-	-	-
67-56-1	Methyl alcohol	5.46E-05	1.83E-01	3.05E-04	2.35E-09
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	1.76E-13	5.90E-10	9.80E-13	7.57E-18
67-63-0	2-Propyl alcohol	1.39E-08	4.66E-05	7.75E-08	5.99E-13
67-64-1	2-Propanone (Acetone)	1.42E-05	4.78E-02	7.94E-05	6.14E-10
67-66-3	Chloroform	4.13E-11	1.39E-07	2.30E-10	1.78E-15
67-72-1	Hexachloroethane	3.22E-16	1.08E-12	1.80E-15	1.39E-20
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	1.88E-13	6.30E-10	1.05E-12	8.09E-18
70-30-4	Hexachlorophene	-	-	-	-
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	3.84E-13	1.29E-09	2.14E-12	1.65E-17
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	7.45E-14	2.50E-10	4.16E-13	3.21E-18
71-36-3	n-Butyl alcohol	3.53E-07	1.19E-03	1.97E-06	1.52E-11
71-43-2	Benzene	1.21E-11	4.05E-08	6.73E-11	5.20E-16
71-55-6	1,1,1-Trichloroethane	6.72E-24	2.26E-20	3.75E-23	2.90E-28
72-43-5	Methoxychlor	-	-	-	-
72-55-9	4,4-DDE	4.43E-06	1.49E-02	2.47E-05	1.91E-10
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	3.59E-14	1.20E-10	2.00E-13	1.55E-18

Table A-12 Estimate of Organic Emission from the Pretreatment Feed (TLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
7439-97-6	Mercury	-	-	-	-
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	2.16E-14	7.24E-11	1.20E-13	9.29E-19
74-83-9	Bromomethane	8.75E-12	2.94E-08	4.88E-11	3.77E-16
74-87-3	Chloromethane	3.12E-12	1.05E-08	1.74E-11	1.35E-16
74-88-4	Iodomethane	1.38E-11	4.65E-08	7.73E-11	5.97E-16
74-95-3	Methylene bromide	-	-	-	-
74-97-5	Bromochloromethane	-	-	-	-
75-00-3	Chloroethane	5.91E-22	1.98E-18	3.30E-21	2.55E-26
75-01-4	1-Chloroethene	9.24E-25	3.10E-21	5.15E-24	3.98E-29
75-02-5	Fluoroethene (vinyl fluoride)	7.59E-24	2.55E-20	4.24E-23	3.27E-28
75-05-8	Acetonitrile	1.78E-04	5.99E-01	9.95E-04	7.69E-09
75-07-0	Acetaldehyde	9.87E-08	3.31E-04	5.51E-07	4.25E-12
75-09-2	Dichloromethane (Methylene Chloride)	4.99E-09	1.67E-05	2.78E-08	2.15E-13
75-15-0	Carbon disulfide	8.15E-14	2.74E-10	4.55E-13	3.51E-18
75-21-8	Ethylene oxide (Oxirane)	2.01E-11	6.74E-08	1.12E-10	8.66E-16
75-25-2	Bromoform	7.87E-21	2.64E-17	4.39E-20	3.39E-25
75-27-4	Bromodichloromethane	2.16E-12	7.26E-09	1.21E-11	9.32E-17
75-29-6	2-Chloropropane	-	-	-	-
75-34-3	1,1-Dichloroethane	2.98E-21	1.00E-17	1.66E-20	1.28E-25
75-35-4	1,1-Dichloroethene	7.17E-25	2.41E-21	4.00E-24	3.09E-29
75-44-5	Phosgene (hydrogen phosphide)	-	-	-	-

Table A-12 Estimate of Organic Emission from the Pretreatment Feed (TLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
75-45-6	Chlorodifluoromethane	1.22E-25	4.10E-22	6.82E-25	5.27E-30
75-50-3	Trimethylamine	3.60E-08	1.21E-04	2.01E-07	1.55E-12
75-69-4	Trichlorofluoromethane	-	-	-	-
75-71-8	Dichlorodifluoromethane	-	-	-	-
76-01-7	Pentachloroethane	-	-	-	-
76-13-1	1,2,2-Trichlorotrifluoroethane	-	-	-	-
764-41-0	1,4-Dichloro-2-butene	-	-	-	-
76-44-8	Heptachlor	-	-	-	-
765-34-4	Glycidylaldehyde	-	-	-	-
7664-41-7	Ammonia/Ammonium	6.59E-03	2.21E+01	3.68E-02	2.84E-07
77-47-4	Hexachlorocyclopentadiene	3.78E-13	1.27E-09	2.11E-12	1.63E-17
77-78-1	Dimethyl sulfate	-	-	-	-
78-83-1	2-Methylpropyl alcohol	1.73E-04	5.82E-01	9.67E-04	7.47E-09
78-87-5	1,2-Dichloropropane	1.27E-19	4.28E-16	7.11E-19	5.49E-24
78-93-3	2-Butanone	3.26E-06	1.09E-02	1.82E-05	1.40E-10
79-00-5	1,1,2-Trichloroethane	4.47E-17	1.50E-13	2.49E-16	1.93E-21
79-01-6	1,1,2-Trichloroethylene	2.14E-12	7.20E-09	1.20E-11	9.24E-17
79-10-7	2-Propenoic acid	1.37E-03	4.61E+00	7.65E-03	5.91E-08
79-34-5	1,1,2,2-Tetrachloroethane	4.01E-15	1.35E-11	2.24E-14	1.73E-19
79-46-9	2-Nitropropane	5.01E-11	1.68E-07	2.79E-10	2.16E-15
80-62-6	Methyl methacrylate	-	-	-	-

Table A-12 Estimate of Organic Emission from the Pretreatment Feed (TLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
822-06-0	Hexamethylene-1,5-diisocyanate	-	-	-	-
823-40-5	Toluene-2,6-diamine	-	-	-	-
82-68-8	Pentachloronitrobenzene (PCNB)	6.97E-13	2.34E-09	3.89E-12	3.01E-17
832-69-9	1-Methylphenanthrene	-	-	-	-
83-32-9	Acenaphthene	1.34E-07	4.51E-04	7.50E-07	5.79E-12
84-66-2	Diethyl phthalate	2.28E-03	7.67E+00	1.27E-02	9.84E-08
84-74-2	Di-n-butylphthalate	5.67E-03	1.90E+01	3.16E-02	2.44E-07
85-01-8	Phenanthrene	9.38E-06	3.15E-02	5.23E-05	4.04E-10
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	-	-	-	-
85-68-7	Butylbenzylphthalate	2.37E-03	7.95E+00	1.32E-02	1.02E-07
86-73-7	Fluorene	1.18E-06	3.96E-03	6.58E-06	5.08E-11
87-61-6	1,2,3-Trichlorobenzene	-	-	-	-
87-68-3	Hexachlorobutadiene	2.40E-19	8.04E-16	1.34E-18	1.03E-23
87-86-5	Pentachlorophenol	3.64E-05	1.22E-01	2.03E-04	1.57E-09
88-06-2	2,4,6-Trichlorophenol	4.47E-05	1.50E-01	2.49E-04	1.93E-09
88-74-4	o-Nitroaniline (2-nitroaniline)	1.42E-03	4.78E+00	7.94E-03	6.14E-08
88-75-5	2-Nitrophenol	1.04E-04	3.48E-01	5.78E-04	4.46E-09
90-04-0	o-Anisidine	-	-	-	-
90-12-0	1-Methylnaphthalene	-	-	-	-
91-20-3	Naphthalene	5.33E-07	1.79E-03	2.97E-06	2.30E-11
91-22-5	Quinoline	-	-	-	-

Table A-12 Estimate of Organic Emission from the Pretreatment Feed (TLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
91-57-6	2-Methylnaphthalene	1.09E-06	3.66E-03	6.08E-06	4.69E-11
91-58-7	2-Chloronaphthalene	4.41E-10	1.48E-06	2.46E-09	1.90E-14
91-94-1	3,3'-Dichlorobenzidine	9.54E-03	3.20E+01	5.32E-02	4.11E-07
924-16-3	N-Nitroso-di-n-Buetylamine	-	-	-	-
92-52-4	1,1`-Biphenyl	1.21E-12	4.06E-09	6.75E-12	5.21E-17
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	-	-	-	-
94-75-7	2,4-D	-	-	-	-
95-48-7	o-Cresol	6.15E-04	2.06E+00	3.43E-03	2.65E-08
95-49-8	o-Chlorotoluene	-	-	-	-
95-50-1	1,2-Dichlorobenzene	9.31E-16	3.13E-12	5.20E-15	4.01E-20
95-53-4	o-Toluidine	-	-	-	-
95-57-8	2-Chlorophenol	6.26E-10	2.10E-06	3.49E-09	2.70E-14
95-63-6	1,2,4-Trimethyl benzene	-	-	-	-
95-94-3	1,2,4,5-Tetrachlorobenzene	-	-	-	-
95-95-4	2,4,5-Trichlorophenol	1.02E-04	3.44E-01	5.71E-04	4.41E-09
96-12-8	1,2-Dibromo-3-chloropropane	-	-	-	-
96-18-4	1,2,3-Trichloropropane	-	-	-	-
96-45-7	Ethylene thiourea	-	-	-	-
97-63-2	Ethyl methacrylate	-	-	-	-
98-01-1	Furfural	-	-	-	-
98-06-6	tert-Butyl benzene	-	-	-	-

Table A-12 Estimate of Organic Emission from the Pretreatment Feed (TLP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction WF (mg/kg)	Weight Ratio WR (unitless)	Individual Organic Release R_{IO} (g/s)
98-07-7	Benzotrichloride	-	-	-	-
98-82-8	Cumene	-	-	-	-
98-83-9	Methyl styrene (mixed isomers)	-	-	-	-
98-86-2	Acetophenone	2.28E-08	7.65E-05	1.27E-07	9.82E-13
98-95-3	Nitrobenzene	5.51E-06	1.85E-02	3.08E-05	2.38E-10
99-35-4	1,3,5-Trinitrobenzene	-	-	-	-
99-65-0	1,3-Dinitrobenzene	-	-	-	-
99-87-6	p-Cymene	-	-	-	-
			Weight Fraction Sum = WF_s =	6.02E+02	
				Weight Ratio Sum = WR_s =	1.00E+00
					Feed Stream Sum = 7.73E-06

The following indicates the stream properties for feed into the Pretreatment Facility from the UFP feed used to calculate the weight fraction:

$$WF = \frac{(Q_m * 1000)}{\left(Q_v * \frac{\rho}{60 * 60}\right)}$$

Where:

Q_m = compound mass flow rate (g/s)
Q_v = volumetric flow rate (m^3/hr) = 5.23
ρ = density (kg/m^3) = 1246.656

A "-" symbol indicates no data are available for approximating the emissions rate (no data were available, or the corresponding values were below the emissions model tolerance).

Table A-13 Estimate of Organic Emission from the Pretreatment Feed (UFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
100-02-7	p-Nitrophenol	2.19E-02	1.21E+01	6.29E-02	3.23E-06
100-21-0	Phthalic acid	8.87E-03	4.90E+00	2.55E-02	1.31E-06
100-25-4	1,4-Dinitrobenzene	2.76E-05	1.52E-02	7.91E-05	4.06E-09
10028-17-8	Tritium	7.11E-07	3.92E-04	2.04E-06	1.05E-10
100-40-3	4-Ethenylcyclohexene	2.22E-12	1.23E-09	6.37E-12	3.27E-16
100-41-4	Ethyl benzene	1.04E-14	5.71E-12	2.97E-14	1.53E-18
100-42-5	Styrene	2.98E-12	1.65E-09	8.56E-12	4.39E-16
100-44-7	Benzyl chloride	-	-	-	-
100-47-0	Benzonitrile	-	-	-	-
100-51-6	Benzyl alcohol	-	-	-	-
100-52-7	Benzaldehyde	-	-	-	-
10061-01-5	cis-1,3-Dichloropropene	4.11E-13	2.27E-10	1.18E-12	6.06E-17

Table A-13 Estimate of Organic Emission from the Pretreatment Feed (UFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
10061-02-6	trans-1,3-Dichloropropene	1.06E-11	5.87E-09	3.05E-11	1.57E-15
101-55-3	4-Bromophenylphenyl ether	4.49E-05	2.48E-02	1.29E-04	6.62E-09
101-77-9	4,4-Methylenedianiline	-	-	-	-
103-33-3	Azobenzene	-	-	-	-
103-65-1	n-Propyl benzene (Isocumene)	-	-	-	-
104-51-8	n-Butylbenzene	-	-	-	-
104-76-7	2-Ethyl-1-hexanol	3.65E-04	2.01E-01	1.05E-03	5.37E-08
105-67-9	2,4-Dimethylphenol	7.58E-04	4.19E-01	2.18E-03	1.12E-07
10595-95-6	n-Nitrosomethylethylamine	3.37E-03	1.86E+00	9.68E-03	4.97E-07
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	-	-	-	-
106-44-5	p-Cresol (4-methyl phenol)	-	-	-	-
106-46-7	1,4-Dichlorobenzene	1.02E-10	5.62E-08	2.92E-10	1.50E-14
106-47-8	p-Chloroaniline	1.22E-03	6.74E-01	3.50E-03	1.80E-07
106-49-0	p-Toluidine	-	-	-	-
106-51-4	Quinone	-	-	-	-
106-88-7	1,2-Epoxybutane	1.55E-05	8.56E-03	4.45E-05	2.29E-09
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	-	-	-	-
106-93-4	Ethylene dibromide	4.31E-12	2.38E-09	1.24E-11	6.36E-16
106-99-0	1,3-Butadiene	2.21E-16	1.22E-13	6.35E-16	3.26E-20
107-02-8	Acrolein	1.97E-08	1.09E-05	5.66E-08	2.91E-12
107-05-1	3-Chloropropene	6.16E-15	3.40E-12	1.77E-14	9.08E-19
107-06-2	1,2-Dichloroethane	2.43E-10	1.34E-07	6.99E-10	3.59E-14

Table A-13 Estimate of Organic Emission from the Pretreatment Feed (UFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
107-12-0	Propionitrile	8.92E-07	4.93E-04	2.56E-06	1.32E-10
107-13-1	Acrylonitrile	6.06E-07	3.34E-04	1.74E-06	8.93E-11
107-19-7	Propargyl alcohol	-	-	-	-
107-21-1	Ethylene glycol (1,2-ethanediol)	-	-	-	-
107-98-2	Propylene glycol monomethyl ether	-	-	-	-
108-05-4	Acetic acid vinyl ester	1.43E-06	7.88E-04	4.10E-06	2.10E-10
108-10-1	4-Methyl-2-pentanone	3.41E-09	1.89E-06	9.81E-09	5.03E-13
108-39-4	m-Cresol	6.50E-03	3.59E+00	1.87E-02	9.58E-07
108-60-1	bis (2-Chloroisopropyl)ether	-	-	-	-
108-67-8	1,3,5-Trimethylbenzene	-	-	-	-
108-86-1	Bromobenzene (Phenyl bromide)	-	-	-	-
108-87-2	Methylcyclohexane	1.41E-19	7.79E-17	4.05E-19	2.08E-23
108-88-3	Toluene	7.90E-14	4.36E-11	2.27E-13	1.17E-17
108-90-7	Chlorobenzene	6.93E-13	3.83E-10	1.99E-12	1.02E-16
108-94-1	Cyclohexanone	3.48E-05	1.92E-02	9.99E-05	5.13E-09
108-95-2	Phenol	6.17E-04	3.41E-01	1.77E-03	9.09E-08
109-74-0	n-Butanenitrile	1.58E-04	8.70E-02	4.52E-04	2.32E-08
109-75-1	3-Butenenitrile	-	-	-	-
109-77-3	Malononitrile	-	-	-	-
109-86-4	2-Methoxyethanol	-	-	-	-
109-99-9	Tetrahydrofuran	3.73E-08	2.06E-05	1.07E-07	5.50E-12
110-00-9	Furan	-	-	-	-

Table A-13 Estimate of Organic Emission from the Pretreatment Feed (UFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
110-54-3	n-Hexane	8.85E-20	4.88E-17	2.54E-19	1.30E-23
110-59-8	Pentanenitrile	9.08E-05	5.01E-02	2.61E-04	1.34E-08
110-80-5	2-Ethoxyethanol	2.08E-02	1.15E+01	5.99E-02	3.07E-06
110-82-7	Cyclohexane	2.89E-18	1.59E-15	8.29E-18	4.26E-22
110-83-8	Cyclohexene	1.02E-16	5.65E-14	2.94E-16	1.51E-20
110-86-1	Pyridine	8.48E-06	4.68E-03	2.43E-05	1.25E-09
111-15-9	Ethylene glycol monoethyl ether acetate	-	-	-	-
111-44-4	bis(2-Chloroethyl)ether	6.90E-06	3.81E-03	1.98E-05	1.02E-09
111-65-9	n-Octane	3.57E-21	1.97E-18	1.03E-20	5.26E-25
111-76-2	2-Butoxyethanol	2.18E-03	1.20E+00	6.25E-03	3.21E-07
111-84-2	n-Nonane	2.02E-21	1.11E-18	5.79E-21	2.97E-25
111-91-1	bis(2-Chloroethoxy)methane	6.84E-05	3.77E-02	1.96E-04	1.01E-08
1120-21-4	Undecane	-	-	-	-
1120-71-4	1,3-Propane sultone	-	-	-	-
112-30-1	1-Decanol	-	-	-	-
112-31-2	Decanal	-	-	-	-
112-40-3	Dodecane	-	-	-	-
117-81-7	Bis(2-ethylhexyl) phthalate	9.73E-03	5.37E+00	2.79E-02	1.43E-06
117-84-0	Di-n-octylphthalate	4.35E-04	2.40E-01	1.25E-03	6.41E-08
118-74-1	Hexachlorobenzene	2.52E-11	1.39E-08	7.25E-11	3.72E-15
119-90-4	3,3'-Dimethoxybenzidine	-	-	-	-
120-12-7	Anthracene	8.22E-05	4.54E-02	2.36E-04	1.21E-08

Table A-13 Estimate of Organic Emission from the Pretreatment Feed (UFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
120-82-1	1,2,4-Trichlorobenzene	5.43E-11	3.00E-08	1.56E-10	8.01E-15
120-83-2	2,4-Dichlorophenol	2.43E-08	1.34E-05	6.98E-08	3.59E-12
121-14-2	2,4-Dinitrotoluene	2.07E-02	1.14E+01	5.95E-02	3.05E-06
122-39-4	N,N-Diphenylamine	1.93E-06	1.06E-03	5.54E-06	2.84E-10
122-66-7	1,2-Diphenylhydrazine	-	-	-	-
123-33-1	Maleic hydrazide	-	-	-	-
123-38-6	Propionaldehyde	1.13E-07	6.26E-05	3.26E-07	1.67E-11
123-72-8	Butanal	4.04E-05	2.23E-02	1.16E-04	5.96E-09
123-91-1	1,4-Dioxan	4.85E-07	2.68E-04	1.39E-06	7.15E-11
124-18-5	Decane	-	-	-	-
124-38-9	Carbon dioxide	-	-	-	-
124-48-1	Chlorodibromomethane	5.93E-10	3.28E-07	1.70E-09	8.75E-14
126-73-8	Tributyl phosphate	2.37E-03	1.31E+00	6.81E-03	3.50E-07
126-98-7	2-Methyl-2-propenenitrile	2.70E-09	1.49E-06	7.74E-09	3.97E-13
127-18-4	1,1,2,2-Tetrachloroethene	5.31E-16	2.93E-13	1.53E-15	7.83E-20
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	2.55E-05	1.41E-02	7.33E-05	3.76E-09
129-00-0	Pyrene	3.05E-03	1.68E+00	8.76E-03	4.50E-07
131-11-3	Dimethyl Phthalate	4.09E-04	2.26E-01	1.18E-03	6.03E-08
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	-	-	-	-
132-64-9	Dibenzofuran	1.88E-08	1.04E-05	5.41E-08	2.78E-12
1330-20-7	Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations)	6.18E-12	3.41E-09	1.77E-11	9.11E-16
133-06-2	Captan	-	-	-	-

Table A-13 Estimate of Organic Emission from the Pretreatment Feed (UFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
1336-36-3	Polychlorinated biphenyls (1254 Aroclor)	2.19E-05	1.21E-02	6.28E-05	3.22E-09
134-32-7	alpha-Naphthylamine	4.24E-03	2.34E+00	1.22E-02	6.25E-07
135-98-8	sec-Butylbenzene	-	-	-	-
141-78-6	Acetic acid ethyl ester	1.14E-09	6.29E-07	3.27E-09	1.68E-13
145-73-3	Endothall	-	-	-	-
156-59-2	cis-1,2-Dichloroethene	-	-	-	-
156-60-5	1,2-trans-Dichloroethene	8.16E-10	4.50E-07	2.34E-09	1.20E-13
1634-04-4	Methyl tert-butyl ether	8.03E-07	4.43E-04	2.31E-06	1.18E-10
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	7.94E-15	4.39E-12	2.28E-14	1.17E-18
189-55-9	Dibenzo[a,i]pyrene	4.25E-03	2.35E+00	1.22E-02	6.26E-07
189-64-0	Dibenzo[a,h]pyrene	4.25E-03	2.35E+00	1.22E-02	6.26E-07
191-24-2	Benzo(g,h,i)perylene	4.23E-03	2.34E+00	1.22E-02	6.24E-07
191-30-0	Dibenzo(a,l)pyrene	4.25E-03	2.35E+00	1.22E-02	6.26E-07
192-65-4	Dibenzo[a,e]pyrene	4.25E-03	2.35E+00	1.22E-02	6.26E-07
192-97-2	Benzo(e)pyrene	-	-	-	-
193-39-5	Indeno(1,2,3-cd)pyrene	2.08E-03	1.15E+00	5.97E-03	3.06E-07
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	8.99E-14	4.97E-11	2.58E-13	1.33E-17
205-82-3	Benzo[j]fluoranthene	-	-	-	-
205-99-2	Benzo(b)fluoranthene	4.43E-05	2.45E-02	1.27E-04	6.53E-09
206-44-0	Fluoranthene	2.28E-03	1.26E+00	6.54E-03	3.36E-07
207-08-9	Benzo(k)fluoranthene	9.28E-04	5.12E-01	2.66E-03	1.37E-07
208-96-8	Acenaphthylene	2.91E-05	1.60E-02	8.34E-05	4.28E-09

Table A-13 Estimate of Organic Emission from the Pretreatment Feed (UFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
218-01-9	Chrysene	2.20E-07	1.22E-04	6.33E-07	3.25E-11
224-42-0	Dibenz[a,j]acridine	5.04E-03	2.78E+00	1.45E-02	7.43E-07
2245-38-7	2,3,5-Trimethylnaphthalene	-	-	-	-
226-36-8	Dibenz[a,h]acridine	4.84E-03	2.67E+00	1.39E-02	7.14E-07
23950-58-5	Pronamide	-	-	-	-
27154-33-2	Trichlorofluoroethane	9.65E-10	5.33E-07	2.77E-09	1.42E-13
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	5.52E-15	3.05E-12	1.59E-14	8.14E-19
319-84-6	alpha-BHC	3.54E-08	1.95E-05	1.02E-07	5.22E-12
319-85-7	beta-BHC	2.95E-05	1.63E-02	8.47E-05	4.35E-09
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	4.58E-12	2.53E-09	1.32E-11	6.76E-16
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	4.16E-17	2.29E-14	1.19E-16	6.13E-21
3268-87-9	Octachlorodibenzo(p)dioxin	4.18E-12	2.31E-09	1.20E-11	6.16E-16
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	3.65E-14	2.02E-11	1.05E-13	5.38E-18
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	3.55E-13	1.96E-10	1.02E-12	5.23E-17
3697-24-3	5-Methylchrysene	9.11E-04	5.03E-01	2.62E-03	1.34E-07
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	7.33E-15	4.05E-12	2.10E-14	1.08E-18
39001-02-0	Octachlorodibenzofuran	3.19E-12	1.76E-09	9.17E-12	4.71E-16
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	1.13E-13	6.24E-11	3.24E-13	1.67E-17
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	3.02E-14	1.67E-11	8.68E-14	4.46E-18
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	8.88E-13	4.90E-10	2.55E-12	1.31E-16
4170-30-3	Crotonaldehyde (Propylene aldehyde)	1.30E-13	7.17E-11	3.73E-13	1.92E-17
41851-50-7	Chlorocyclopentadiene	-	-	-	-

Table A-13 Estimate of Organic Emission from the Pretreatment Feed (UFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
460-19-5	Cyanogen (oxalonitrile)	-	-	-	-
4786-20-3	2-Butenenitrile	-	-	-	-
50-00-0	Formaldehyde	5.49E-03	3.03E+00	1.58E-02	8.09E-07
50-32-8	Benzo(a)pyrene	1.46E-04	8.08E-02	4.20E-04	2.16E-08
506-68-3	Cyanogen bromide (bromocyanide)	-	-	-	-
506-77-4	Cyanogen chloride	-	-	-	-
510-15-6	Chlorobenzilate	-	-	-	-
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	2.15E-13	1.19E-10	6.18E-13	3.17E-17
51-28-5	2,4-Dinitrophenol	6.58E-03	3.63E+00	1.89E-02	9.70E-07
51-79-6	Ethyl carbamate (urethane)	-	-	-	-
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	3.80E-14	2.10E-11	1.09E-13	5.60E-18
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	-	-	-	-
532-27-4	2-Chloroacetophenone	-	-	-	-
534-52-1	4,6-Dinitro-o-cresol	1.84E-03	1.02E+00	5.29E-03	2.72E-07
53-70-3	Dibenz[a,h]anthracene	5.79E-04	3.19E-01	1.66E-03	8.53E-08
5385-75-1	Dibenzo(a,e)fluoranthene	-	-	-	-
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	3.95E-13	2.18E-10	1.13E-12	5.82E-17
540-73-8	1,2-Dimethylhydrazine	-	-	-	-
540-84-1	2,2,4-Trimethylpentane	-	-	-	-
541-73-1	1,3-Dichlorobenzene	3.67E-12	2.02E-09	1.05E-11	5.41E-16
542-75-6	1,3-Dichloropropene	-	-	-	-
542-88-1	bis(Chloromethyl)ether	-	-	-	-

Table A-13 Estimate of Organic Emission from the Pretreatment Feed (UFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	3.70E-14	2.04E-11	1.06E-13	5.46E-18
56-23-5	Carbon tetrachloride	1.92E-16	1.06E-13	5.50E-16	2.83E-20
56-49-5	3-Methylcholanthrene	9.36E-04	5.17E-01	2.69E-03	1.38E-07
56-55-3	Benzo(a)anthracene	1.35E-04	7.47E-02	3.89E-04	1.99E-08
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	4.96E-13	2.74E-10	1.42E-12	7.31E-17
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	4.24E-13	2.34E-10	1.22E-12	6.24E-17
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	1.30E-13	7.16E-11	3.72E-13	1.91E-17
57-24-9	Strychnine	-	-	-	-
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	1.40E-12	7.73E-10	4.02E-12	2.06E-16
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	6.97E-14	3.85E-11	2.00E-13	1.03E-17
57-74-9	Chlordane	-	-	-	-
581-42-0	2,6-Dimethylnaphthalene	-	-	-	-
584-84-9	2,4-Toluene diisocyanate	-	-	-	-
58-89-9	gamma-BHC (Lindane)	7.34E-08	4.05E-05	2.11E-07	1.08E-11
58-90-2	2,3,4,6-Tetrachlorophenol	3.07E-03	1.69E+00	8.81E-03	4.52E-07
589-38-8	3-Hexanone	3.15E-05	1.74E-02	9.06E-05	4.65E-09
591-50-4	Benzene, iodo-	-	-	-	-
591-78-6	2-Hexanone	9.53E-08	5.26E-05	2.74E-07	1.40E-11
593-60-2	Bromoethene (Vinyl bromide)	-	-	-	-
593-74-8	Dimethyl Mercury	1.84E-07	1.02E-04	5.29E-07	2.72E-11
59-50-7	4-Chloro-3-methylphenol	5.48E-03	3.03E+00	1.57E-02	8.08E-07
59-89-2	N-Nitrosomorpholine	3.35E-02	1.85E+01	9.62E-02	4.94E-06

Table A-13 Estimate of Organic Emission from the Pretreatment Feed (UFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
60-11-7	Dimethyl aminoazobenzene	-	-	-	-
602-87-9	5-Nitroacenaphthene	2.33E-03	1.29E+00	6.69E-03	3.43E-07
60-29-7	Ethyl ether	1.46E-10	8.07E-08	4.20E-10	2.15E-14
60-35-5	Acetamide	7.19E-03	3.97E+00	2.06E-02	1.06E-06
606-20-2	2,6-Dinitrotoluene	4.94E-04	2.73E-01	1.42E-03	7.28E-08
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	3.73E-14	2.06E-11	1.07E-13	5.49E-18
608-93-5	Pentachlorobenzene	-	-	-	-
61626-71-9	Dichloropentadiene	-	-	-	-
621-64-7	N-Nitroso-di-n-propylamine	5.47E-03	3.02E+00	1.57E-02	8.06E-07
624-83-9	Methyl isocyanate	-	-	-	-
62-50-0	Ethyl methanesulfonate	-	-	-	-
62-53-3	Aniline	-	-	-	-
62-75-9	N-Nitroso-N,N-dimethylamine	3.11E-05	1.72E-02	8.93E-05	4.58E-09
628-73-9	Hexanenitrile	5.29E-05	2.92E-02	1.52E-04	7.79E-09
630-20-6	1,1,1,2-Tetrachloroethane	7.34E-08	4.05E-05	2.11E-07	1.08E-11
64-18-6	Formic acid (methanoic acid)	-	-	-	-
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	9.86E-11	5.44E-08	2.83E-10	1.45E-14
65-85-0	Benzoic acid	-	-	-	-
67-56-1	Methyl alcohol	2.42E-03	1.34E+00	6.96E-03	3.57E-07
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	1.14E-13	6.32E-11	3.29E-13	1.69E-17
67-63-0	2-Propyl alcohol	1.05E-06	5.82E-04	3.03E-06	1.55E-10
67-64-1	2-Propanone (Acetone)	1.37E-05	7.57E-03	3.94E-05	2.02E-09

Table A-13 Estimate of Organic Emission from the Pretreatment Feed (UFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
67-66-3	Chloroform	6.95E-13	3.84E-10	2.00E-12	1.02E-16
67-72-1	Hexachloroethane	5.78E-10	3.19E-07	1.66E-09	8.52E-14
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	9.07E-14	5.01E-11	2.60E-13	1.34E-17
70-30-4	Hexachlorophene	-	-	-	-
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	2.10E-13	1.16E-10	6.02E-13	3.09E-17
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	8.50E-14	4.69E-11	2.44E-13	1.25E-17
71-36-3	n-Butyl alcohol	2.91E-05	1.61E-02	8.36E-05	4.29E-09
71-43-2	Benzene	1.25E-13	6.88E-11	3.58E-13	1.84E-17
71-55-6	1,1,1-Trichloroethane	6.40E-16	3.53E-13	1.84E-15	9.44E-20
72-43-5	Methoxychlor	-	-	-	-
72-55-9	4,4-DDE	6.49E-04	3.58E-01	1.86E-03	9.57E-08
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	2.18E-14	1.20E-11	6.25E-14	3.21E-18
7439-97-6	Mercury	-	-	-	-
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	9.42E-15	5.20E-12	2.71E-14	1.39E-18
74-83-9	Bromomethane	7.19E-14	3.97E-11	2.07E-13	1.06E-17
74-87-3	Chloromethane	2.56E-14	1.42E-11	7.36E-14	3.78E-18
74-88-4	Iodomethane	1.07E-13	5.90E-11	3.07E-13	1.58E-17
74-95-3	Methylene bromide	-	-	-	-
74-97-5	Bromochloromethane	-	-	-	-
75-00-3	Chloroethane	9.01E-15	4.98E-12	2.59E-14	1.33E-18
75-01-4	1-Chloroethene	3.32E-16	1.83E-13	9.53E-16	4.89E-20
75-02-5	Fluoroethene (vinyl fluoride)	2.09E-13	1.15E-10	6.00E-13	3.08E-17

Table A-13 Estimate of Organic Emission from the Pretreatment Feed (UFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
75-05-8	Acetonitrile	1.21E-04	6.67E-02	3.47E-04	1.78E-08
75-07-0	Acetaldehyde	1.01E-04	5.58E-02	2.90E-04	1.49E-08
75-09-2	Dichloromethane (Methylene Chloride)	3.42E-10	1.89E-07	9.81E-10	5.04E-14
75-15-0	Carbon disulfide	4.17E-18	2.30E-15	1.20E-17	6.15E-22
75-21-8	Ethylene oxide (Oxirane)	5.04E-08	2.78E-05	1.45E-07	7.42E-12
75-25-2	Bromoform	-	-	-	-
75-27-4	Bromodichloromethane	4.67E-07	2.58E-04	1.34E-06	6.88E-11
75-29-6	2-Chloropropane	-	-	-	-
75-34-3	1,1-Dichloroethane	1.36E-14	7.50E-12	3.90E-14	2.00E-18
75-35-4	1,1-Dichloroethene	2.31E-16	1.27E-13	6.63E-16	3.40E-20
75-44-5	Phosgene (hydrogen phosphide)	-	-	-	-
75-45-6	Chlorodifluoromethane	1.44E-16	7.93E-14	4.12E-16	2.12E-20
75-50-3	Trimethylamine	5.39E-05	2.98E-02	1.55E-04	7.94E-09
75-69-4	Trichlorofluoromethane	8.78E-18	4.85E-15	2.52E-17	1.29E-21
75-71-8	Dichlorodifluoromethane	2.03E-19	1.12E-16	5.83E-19	2.99E-23
76-01-7	Pentachloroethane	-	-	-	-
76-13-1	1,2,2-Trichlorotrifluoroethane	5.57E-20	3.07E-17	1.60E-19	8.21E-24
764-41-0	1,4-Dichloro-2-butene	-	-	-	-
76-44-8	Heptachlor	2.26E-21	1.25E-18	6.49E-21	3.33E-25
765-34-4	Glycidylaldehyde	-	-	-	-
7664-41-7	Ammonia/Ammonium	1.34E-02	7.41E+00	3.85E-02	1.98E-06
77-47-4	Hexachlorocyclopentadiene	5.55E-17	3.06E-14	1.59E-16	8.18E-21

Table A-13 Estimate of Organic Emission from the Pretreatment Feed (UFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
77-78-1	Dimethyl sulfate	-	-	-	-
78-83-1	2-Methylpropyl alcohol	1.59E-02	8.78E+00	4.57E-02	2.35E-06
78-87-5	1,2-Dichloropropane	1.01E-13	5.60E-11	2.91E-13	1.50E-17
78-93-3	2-Butanone	2.69E-06	1.48E-03	7.71E-06	3.96E-10
79-00-5	1,1,2-Trichloroethane	2.87E-12	1.58E-09	8.23E-12	4.23E-16
79-01-6	1,1,2-Trichloroethylene	7.28E-15	4.02E-12	2.09E-14	1.07E-18
79-10-7	2-Propenoic acid	8.25E-03	4.56E+00	2.37E-02	1.22E-06
79-34-5	1,1,2,2-Tetrachloroethane	3.91E-11	2.16E-08	1.12E-10	5.76E-15
79-46-9	2-Nitropropane	9.10E-08	5.02E-05	2.61E-07	1.34E-11
80-62-6	Methyl methacrylate	-	-	-	-
822-06-0	Hexamethylene-1,5-diisocyanate	-	-	-	-
823-40-5	Toluene-2,6-diamine	-	-	-	-
82-68-8	Pentachloronitrobenzene (PCNB)	5.86E-09	3.24E-06	1.68E-08	8.64E-13
832-69-9	1-Methylphenanthrene	-	-	-	-
83-32-9	Acenaphthene	7.01E-05	3.87E-02	2.01E-04	1.03E-08
84-66-2	Diethyl phthalate	4.44E-03	2.45E+00	1.27E-02	6.54E-07
84-74-2	Di-n-butylphthalate	4.47E-02	2.47E+01	1.28E-01	6.59E-06
85-01-8	Phenanthrene	3.36E-04	1.86E-01	9.65E-04	4.95E-08
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	-	-	-	-
85-68-7	Butylbenzylphthalate	1.63E-02	9.02E+00	4.69E-02	2.41E-06
86-73-7	Fluorene	8.49E-05	4.69E-02	2.44E-04	1.25E-08
87-61-6	1,2,3-Trichlorobenzene	-	-	-	-

Table A-13 Estimate of Organic Emission from the Pretreatment Feed (UFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
87-68-3	Hexachlorobutadiene	2.92E-12	1.61E-09	8.39E-12	4.30E-16
87-86-5	Pentachlorophenol	3.95E-05	2.18E-02	1.14E-04	5.83E-09
88-06-2	2,4,6-Trichlorophenol	3.26E-03	1.80E+00	9.35E-03	4.80E-07
88-74-4	o-Nitroaniline (2-nitroaniline)	5.63E-04	3.11E-01	1.62E-03	8.30E-08
88-75-5	2-Nitrophenol	3.00E-03	1.66E+00	8.61E-03	4.42E-07
90-04-0	o-Anisidine	-	-	-	-
90-12-0	1-Methylnaphthalene	-	-	-	-
91-20-3	Naphthalene	4.68E-06	2.59E-03	1.35E-05	6.90E-10
91-22-5	Quinoline	-	-	-	-
91-57-6	2-Methylnaphthalene	1.26E-07	6.94E-05	3.61E-07	1.85E-11
91-58-7	2-Chloronaphthalene	3.74E-06	2.06E-03	1.07E-05	5.51E-10
91-94-1	3,3'-Dichlorobenzidine	3.20E-03	1.77E+00	9.19E-03	4.72E-07
924-16-3	N-Nitroso-di-n-Buetylamine	-	-	-	-
92-52-4	1,1`-Biphenyl	9.93E-09	5.48E-06	2.85E-08	1.46E-12
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	-	-	-	-
94-75-7	2,4-D	-	-	-	-
95-48-7	o-Cresol	8.05E-03	4.45E+00	2.31E-02	1.19E-06
95-49-8	o-Chlorotoluene	-	-	-	-
95-50-1	1,2-Dichlorobenzene	2.98E-10	1.64E-07	8.55E-10	4.39E-14
95-53-4	o-Toluidine	-	-	-	-
95-57-8	2-Chlorophenol	7.84E-06	4.33E-03	2.25E-05	1.15E-09
95-63-6	1,2,4-Trimethyl benzene	-	-	-	-

Table A-13 Estimate of Organic Emission from the Pretreatment Feed (UFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction WF (mg/kg)	Weight Ratio WR (unitless)	Individual Organic Release R_{IO} (g/s)
95-94-3	1,2,4,5-Tetrachlorobenzene	-	-	-	-
95-95-4	2,4,5-Trichlorophenol	4.17E-03	2.30E+00	1.20E-02	6.15E-07
96-12-8	1,2-Dibromo-3-chloropropane	-	-	-	-
96-18-4	1,2,3-Trichloropropane	-	-	-	-
96-45-7	Ethylene thiourea	-	-	-	-
97-63-2	Ethyl methacrylate	-	-	-	-
98-01-1	Furfural	-	-	-	-
98-06-6	tert-Butyl benzene	-	-	-	-
98-07-7	Benzotrichloride	-	-	-	-
98-82-8	Cumene	1.15E-16	6.36E-14	3.31E-16	1.70E-20
98-83-9	Methyl styrene (mixed isomers)	-	-	-	-
98-86-2	Acetophenone	2.16E-06	1.19E-03	6.21E-06	3.19E-10
98-95-3	Nitrobenzene	7.48E-06	4.13E-03	2.15E-05	1.10E-09
99-35-4	1,3,5-Trinitrobenzene	-	-	-	-
99-65-0	1,3-Dinitrobenzene	-	-	-	-
99-87-6	p-Cymene	-	-	-	-
			Weight Fraction Sum = WF_s =	1.92E+02	
				Weight Ratio Sum = WR_s =	1.00E+00
					Feed Stream Sum = 5.13E-05

The following indicates the stream properties for feed into the LAW Facility from the LCP feed used to calculate the weight fraction:

$$WF = \frac{(Q_m * 1000)}{\left(Q_v * \frac{\rho}{60 * 60}\right)}$$

Where:

Q_m = compound mass flow rate (g/s)
Q_v = volumetric flow rate (m^3/hr) = 4.58E-01
ρ = density (kg/m^3) = 1338.36

A "-" symbol indicates no data are available for approximating the emissions rate (no data were available, or the corresponding values were below the emissions model tolerance).

Table A-14 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
100-02-7	p-Nitrophenol	2.71E-02	1.59E+02	1.47E-01	6.96E-06
100-21-0	Phthalic acid	1.01E-02	5.95E+01	5.50E-02	2.60E-06
100-25-4	1,4-Dinitrobenzene	9.08E-06	5.33E-02	4.92E-05	2.33E-09
10028-17-8	Tritium	7.56E-08	4.44E-04	4.10E-07	1.94E-11
100-40-3	4-Ethenylcyclohexene	9.26E-21	5.43E-17	5.02E-20	2.38E-24
100-41-4	Ethyl benzene	6.81E-21	3.99E-17	3.69E-20	1.75E-24
100-42-5	Styrene	1.41E-10	8.26E-07	7.63E-10	3.62E-14
100-44-7	Benzyl chloride	-	-	-	-
100-47-0	Benzonitrile	-	-	-	-
100-51-6	Benzyl alcohol	-	-	-	-
100-52-7	Benzaldehyde	-	-	-	-
10061-01-5	cis-1,3-Dichloropropene	3.37E-18	1.98E-14	1.83E-17	8.65E-22

Table A-14 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
10061-02-6	trans-1,3-Dichloropropene	1.11E-15	6.53E-12	6.03E-15	2.86E-19
101-55-3	4-Bromophenylphenyl ether	1.41E-07	8.29E-04	7.67E-07	3.63E-11
101-77-9	4,4-Methylenedianiline	-	-	-	-
103-33-3	Azobenzene	-	-	-	-
103-65-1	n-Propyl benzene (Isocumene)	-	-	-	-
104-51-8	n-Butylbenzene	-	-	-	-
104-76-7	2-Ethyl-1-hexanol	4.32E-06	2.54E-02	2.35E-05	1.11E-09
105-67-9	2,4-Dimethylphenol	1.25E-03	7.33E+00	6.77E-03	3.21E-07
10595-95-6	n-Nitrosomethylethylamine	2.78E-04	1.63E+00	1.51E-03	7.14E-08
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	-	-	-	-
106-44-5	p-Cresol (4-methyl phenol)	-	-	-	-
106-46-7	1,4-Dichlorobenzene	7.94E-11	4.66E-07	4.30E-10	2.04E-14
106-47-8	p-Chloroaniline	1.97E-03	1.16E+01	1.07E-02	5.07E-07
106-49-0	p-Toluidine	-	-	-	-
106-51-4	Quinone	-	-	-	-
106-88-7	1,2-Epoxybutane	2.75E-08	1.61E-04	1.49E-07	7.07E-12
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	-	-	-	-
106-93-4	Ethylene dibromide	6.40E-16	3.75E-12	3.47E-15	1.64E-19
106-99-0	1,3-Butadiene	1.85E-25	1.08E-21	1.00E-24	4.75E-29
107-02-8	Acrolein	5.83E-11	3.42E-07	3.16E-10	1.50E-14
107-05-1	3-Chloropropene	1.53E-21	8.95E-18	8.27E-21	3.92E-25

Table A-14 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
107-06-2	1,2-Dichloroethane	5.32E-09	3.12E-05	2.88E-08	1.37E-12
107-12-0	Propionitrile	8.18E-09	4.80E-05	4.44E-08	2.10E-12
107-13-1	Acrylonitrile	2.98E-06	1.75E-02	1.61E-05	7.65E-10
107-19-7	Propargyl alcohol	-	-	-	-
107-21-1	Ethylene glycol (1,2-ethanediol)	-	-	-	-
107-98-2	Propylene glycol monomethyl ether	-	-	-	-
108-05-4	Acetic acid vinyl ester	4.51E-10	2.64E-06	2.44E-09	1.16E-13
108-10-1	4-Methyl-2-pentanone	8.43E-12	4.94E-08	4.57E-11	2.16E-15
108-39-4	m-Cresol	7.38E-04	4.33E+00	4.00E-03	1.90E-07
108-60-1	bis (2-Chloroisopropyl)ether	-	-	-	-
108-67-8	1,3,5-Trimethylbenzene	-	-	-	-
108-86-1	Bromobenzene (Phenyl bromide)	-	-	-	-
108-87-2	Methylcyclohexane	-	-	-	-
108-88-3	Toluene	3.31E-12	1.94E-08	1.79E-11	8.50E-16
108-90-7	Chlorobenzene	3.98E-11	2.34E-07	2.16E-10	1.02E-14
108-94-1	Cyclohexanone	8.73E-07	5.12E-03	4.73E-06	2.24E-10
108-95-2	Phenol	9.86E-04	5.79E+00	5.35E-03	2.53E-07
109-74-0	n-Butanenitrile	1.08E-06	6.33E-03	5.85E-06	2.77E-10
109-75-1	3-Butenenitrile	-	-	-	-
109-77-3	Malononitrile	-	-	-	-
109-86-4	2-Methoxyethanol	-	-	-	-

Table A-14 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
109-99-9	Tetrahydrofuran	1.92E-10	1.13E-06	1.04E-09	4.94E-14
110-00-9	Furan	-	-	-	-
110-54-3	n-Hexane	-	-	-	-
110-59-8	Pentanenitrile	4.66E-07	2.73E-03	2.52E-06	1.20E-10
110-80-5	2-Ethoxyethanol	3.31E-03	1.94E+01	1.79E-02	8.50E-07
110-82-7	Cyclohexane	-	-	-	-
110-83-8	Cyclohexene	4.06E-25	2.38E-21	2.20E-24	1.04E-28
110-86-1	Pyridine	2.15E-07	1.26E-03	1.17E-06	5.53E-11
111-15-9	Ethylene glycol monoethyl ether acetate	-	-	-	-
111-44-4	bis(2-Chloroethyl)ether	1.75E-05	1.03E-01	9.49E-05	4.50E-09
111-65-9	n-Octane	-	-	-	-
111-76-2	2-Butoxyethanol	1.68E-04	9.87E-01	9.13E-04	4.32E-08
111-84-2	n-Nonane	9.41E-21	5.52E-17	5.10E-20	2.42E-24
111-91-1	bis(2-Chloroethoxy)methane	1.20E-04	7.02E-01	6.49E-04	3.07E-08
1120-21-4	Undecane	-	-	-	-
1120-71-4	1,3-Propane sultone	-	-	-	-
112-30-1	1-Decanol	-	-	-	-
112-31-2	Decanal	-	-	-	-
112-40-3	Dodecane	-	-	-	-
117-81-7	Bis(2-ethylhexyl) phthalate	1.30E-02	7.65E+01	7.07E-02	3.35E-06
117-84-0	Di-n-octylphthalate	2.60E-06	1.52E-02	1.41E-05	6.67E-10

Table A-14 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
118-74-1	Hexachlorobenzene	6.53E-10	3.83E-06	3.54E-09	1.68E-13
119-90-4	3,3'-Dimethoxybenzidine	-	-	-	-
120-12-7	Anthracene	2.13E-06	1.25E-02	1.16E-05	5.48E-10
120-82-1	1,2,4-Trichlorobenzene	1.98E-15	1.16E-11	1.07E-14	5.08E-19
120-83-2	2,4-Dichlorophenol	2.62E-13	1.54E-09	1.42E-12	6.73E-17
121-14-2	2,4-Dinitrotoluene	1.58E-02	9.24E+01	8.55E-02	4.05E-06
122-39-4	N,N-Diphenylamine	1.38E-07	8.11E-04	7.49E-07	3.55E-11
122-66-7	1,2-Diphenylhydrazine	-	-	-	-
123-33-1	Maleic hydrazide	-	-	-	-
123-38-6	Propionaldehyde	5.68E-10	3.33E-06	3.08E-09	1.46E-13
123-72-8	Butanal	1.26E-07	7.37E-04	6.82E-07	3.23E-11
123-91-1	1,4-Dioxan	1.84E-08	1.08E-04	1.00E-07	4.74E-12
124-18-5	Decane	-	-	-	-
124-38-9	Carbon dioxide	-	-	-	-
124-48-1	Chlorodibromomethane	1.10E-08	6.46E-05	5.97E-08	2.83E-12
126-73-8	Tributyl phosphate	2.79E-04	1.64E+00	1.51E-03	7.16E-08
126-98-7	2-Methyl-2-propenenitrile	3.03E-12	1.78E-08	1.64E-11	7.77E-16
127-18-4	1,1,2,2-Tetrachloroethene	3.69E-23	2.16E-19	2.00E-22	9.47E-27
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	1.38E-06	8.08E-03	7.47E-06	3.54E-10
129-00-0	Pyrene	1.36E-04	7.97E-01	7.37E-04	3.49E-08
131-11-3	Dimethyl Phthalate	1.04E-03	6.09E+00	5.62E-03	2.66E-07

Table A-14 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	-	-	-	-
132-64-9	Dibenzofuran	1.45E-07	8.49E-04	7.85E-07	3.72E-11
1330-20-7	Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations)	9.59E-12	5.63E-08	5.20E-11	2.46E-15
133-06-2	Captan	-	-	-	-
1336-36-3	Polychlorinated biphenyls (1254 Aroclor)	1.25E-08	7.33E-05	6.77E-08	3.21E-12
134-32-7	alpha-Naphthylamine	2.48E-03	1.46E+01	1.35E-02	6.37E-07
135-98-8	sec-Butylbenzene	-	-	-	-
141-78-6	Acetic acid ethyl ester	2.96E-12	1.73E-08	1.60E-11	7.59E-16
145-73-3	Endothall	-	-	-	-
156-59-2	cis-1,2-Dichloroethene	-	-	-	-
156-60-5	1,2-trans-Dichloroethene	3.43E-16	2.01E-12	1.86E-15	8.81E-20
1634-04-4	Methyl tert-butyl ether	1.92E-10	1.13E-06	1.04E-09	4.93E-14
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	2.60E-14	1.53E-10	1.41E-13	6.68E-18
189-55-9	Dibenzo[a,i]pyrene	4.07E-03	2.39E+01	2.21E-02	1.05E-06
189-64-0	Dibenzo[a,h]pyrene	4.07E-03	2.39E+01	2.21E-02	1.05E-06
191-24-2	Benzo(g,h,i)perylene	4.59E-03	2.69E+01	2.49E-02	1.18E-06
191-30-0	Dibenzo(a,l)pyrene	4.07E-03	2.39E+01	2.21E-02	1.05E-06
192-65-4	Dibenzo[a,e]pyrene	4.07E-03	2.39E+01	2.21E-02	1.05E-06
192-97-2	Benzo(e)pyrene	-	-	-	-
193-39-5	Indeno(1,2,3-cd)pyrene	1.09E-03	6.42E+00	5.94E-03	2.81E-07
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	1.01E-13	5.95E-10	5.50E-13	2.61E-17

Table A-14 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
205-82-3	Benzo[j]fluoranthene	-	-	-	-
205-99-2	Benzo(b)fluoranthene	1.02E-04	5.98E-01	5.52E-04	2.62E-08
206-44-0	Fluoranthene	6.48E-05	3.80E-01	3.51E-04	1.66E-08
207-08-9	Benzo(k)fluoranthene	1.94E-03	1.14E+01	1.05E-02	4.99E-07
208-96-8	Acenaphthylene	5.88E-07	3.45E-03	3.19E-06	1.51E-10
218-01-9	Chrysene	1.17E-06	6.88E-03	6.36E-06	3.01E-10
224-42-0	Dibenz[a,j]acridine	5.17E-03	3.03E+01	2.80E-02	1.33E-06
2245-38-7	2,3,5-Trimethylnaphthalene	-	-	-	-
226-36-8	Dibenz[a,h]acridine	4.80E-03	2.82E+01	2.60E-02	1.23E-06
23950-58-5	Pronamide	-	-	-	-
27154-33-2	Trichlorofluoroethane	3.15E-16	1.85E-12	1.71E-15	8.10E-20
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	5.10E-14	2.99E-10	2.76E-13	1.31E-17
319-84-6	alpha-BHC	8.93E-10	5.24E-06	4.85E-09	2.29E-13
319-85-7	beta-BHC	6.18E-05	3.63E-01	3.35E-04	1.59E-08
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	3.56E-11	2.09E-07	1.93E-10	9.15E-15
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	8.14E-16	4.78E-12	4.42E-15	2.09E-19
3268-87-9	Octachlorodibenzo(p)dioxin	7.55E-12	4.43E-08	4.09E-11	1.94E-15
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	1.65E-13	9.70E-10	8.97E-13	4.25E-17
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	5.61E-13	3.29E-09	3.05E-12	1.44E-16
3697-24-3	5-Methylchrysene	3.81E-05	2.23E-01	2.06E-04	9.78E-09
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	4.56E-14	2.68E-10	2.47E-13	1.17E-17

Table A-14 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
39001-02-0	Octachlorodibenzofuran	5.37E-12	3.15E-08	2.91E-11	1.38E-15
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	1.08E-13	6.33E-10	5.85E-13	2.77E-17
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	1.22E-13	7.14E-10	6.60E-13	3.12E-17
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	8.35E-13	4.90E-09	4.53E-12	2.14E-16
4170-30-3	Crotonaldehyde (Propylene aldehyde)	3.39E-17	1.99E-13	1.84E-16	8.70E-21
41851-50-7	Chlorocyclopentadiene	-	-	-	-
460-19-5	Cyanogen (oxalonitrile)	-	-	-	-
4786-20-3	2-Butenenitrile	-	-	-	-
50-00-0	Formaldehyde	1.01E-03	5.91E+00	5.46E-03	2.59E-07
50-32-8	Benzo(a)pyrene	2.66E-04	1.56E+00	1.44E-03	6.83E-08
506-68-3	Cyanogen bromide (bromocyanide)	-	-	-	-
506-77-4	Cyanogen chloride	-	-	-	-
510-15-6	Chlorobenzilate	-	-	-	-
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	3.94E-13	2.31E-09	2.14E-12	1.01E-16
51-28-5	2,4-Dinitrophenol	1.33E-02	7.82E+01	7.23E-02	3.42E-06
51-79-6	Ethyl carbamate (urethane)	-	-	-	-
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	4.47E-12	2.63E-08	2.43E-11	1.15E-15
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	-	-	-	-
532-27-4	2-Chloroacetophenone	-	-	-	-
534-52-1	4,6-Dinitro-o-cresol	3.26E-03	1.92E+01	1.77E-02	8.39E-07
53-70-3	Dibenz[a,h]anthracene	3.43E-03	2.01E+01	1.86E-02	8.81E-07

Table A-14 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
5385-75-1	Dibenzo(a,e)fluoranthene	-	-	-	-
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	2.65E-11	1.55E-07	1.44E-10	6.80E-15
540-73-8	1,2-Dimethylhydrazine	-	-	-	-
540-84-1	2,2,4-Trimethylpentane	-	-	-	-
541-73-1	1,3-Dichlorobenzene	2.22E-17	1.30E-13	1.20E-16	5.69E-21
542-75-6	1,3-Dichloropropene	-	-	-	-
542-88-1	bis(Chloromethyl)ether	-	-	-	-
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	8.18E-14	4.80E-10	4.44E-13	2.10E-17
56-23-5	Carbon tetrachloride	1.83E-15	1.07E-11	9.91E-15	4.69E-19
56-49-5	3-Methylcholanthrene	4.07E-05	2.39E-01	2.21E-04	1.05E-08
56-55-3	Benzo(a)anthracene	2.52E-04	1.48E+00	1.37E-03	6.47E-08
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	9.36E-13	5.49E-09	5.08E-12	2.40E-16
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	6.43E-13	3.78E-09	3.49E-12	1.65E-16
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	2.43E-13	1.42E-09	1.32E-12	6.23E-17
57-24-9	Strychnine	-	-	-	-
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	3.30E-12	1.93E-08	1.79E-11	8.47E-16
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	1.15E-13	6.73E-10	6.22E-13	2.95E-17
57-74-9	Chlordane	-	-	-	-
581-42-0	2,6-Dimethylnaphthalene	-	-	-	-
584-84-9	2,4-Toluene diisocyanate	-	-	-	-
58-89-9	gamma-BHC (Lindane)	4.11E-09	2.41E-05	2.23E-08	1.06E-12

Table A-14 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
58-90-2	2,3,4,6-Tetrachlorophenol	1.52E-04	8.90E-01	8.23E-04	3.90E-08
589-38-8	3-Hexanone	8.89E-08	5.21E-04	4.82E-07	2.28E-11
591-50-4	Benzene, iodo-	-	-	-	-
591-78-6	2-Hexanone	3.74E-10	2.19E-06	2.03E-09	9.60E-14
593-60-2	Bromoethene (Vinyl bromide)	-	-	-	-
593-74-8	Dimethyl Mercury	6.77E-07	3.98E-03	3.67E-06	1.74E-10
59-50-7	4-Chloro-3-methylphenol	3.23E-04	1.89E+00	1.75E-03	8.29E-08
59-89-2	N-Nitrosomorpholine	1.10E-02	6.46E+01	5.97E-02	2.83E-06
60-11-7	Dimethyl aminoazobenzene	3.92E-19	2.30E-15	2.13E-18	1.01E-22
602-87-9	5-Nitroacenaphthene	3.22E-04	1.89E+00	1.75E-03	8.28E-08
60-29-7	Ethyl ether	7.13E-15	4.18E-11	3.87E-14	1.83E-18
60-35-5	Acetamide	2.52E-03	1.48E+01	1.37E-02	6.48E-07
606-20-2	2,6-Dinitrotoluene	9.28E-04	5.44E+00	5.03E-03	2.38E-07
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	8.01E-14	4.70E-10	4.34E-13	2.06E-17
608-93-5	Pentachlorobenzene	-	-	-	-
61626-71-9	Dichloropentadiene	-	-	-	-
621-64-7	N-Nitroso-di-n-propylamine	3.40E-04	2.00E+00	1.85E-03	8.74E-08
624-83-9	Methyl isocyanate	-	-	-	-
62-50-0	Ethyl methanesulfonate	-	-	-	-
62-53-3	Aniline	-	-	-	-
62-75-9	N-Nitroso-N,N-dimethylamine	2.23E-06	1.31E-02	1.21E-05	5.73E-10

Table A-14 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
628-73-9	Hexanenitrile	2.03E-07	1.19E-03	1.10E-06	5.22E-11
630-20-6	1,1,1,2-Tetrachloroethane	7.76E-13	4.55E-09	4.21E-12	1.99E-16
64-18-6	Formic acid (methanoic acid)	-	-	-	-
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	1.53E-10	9.00E-07	8.32E-10	3.94E-14
65-85-0	Benzoic acid	-	-	-	-
67-56-1	Methyl alcohol	7.49E-05	4.39E-01	4.06E-04	1.92E-08
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	2.55E-13	1.50E-09	1.38E-12	6.56E-17
67-63-0	2-Propyl alcohol	2.77E-08	1.63E-04	1.50E-07	7.12E-12
67-64-1	2-Propanone (Acetone)	3.25E-05	1.91E-01	1.76E-04	8.35E-09
67-66-3	Chloroform	3.98E-11	2.34E-07	2.16E-10	1.02E-14
67-72-1	Hexachloroethane	2.08E-15	1.22E-11	1.13E-14	5.35E-19
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	3.67E-13	2.15E-09	1.99E-12	9.42E-17
70-30-4	Hexachlorophene	-	-	-	-
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	6.16E-13	3.62E-09	3.34E-12	1.58E-16
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	1.41E-13	8.25E-10	7.63E-13	3.61E-17
71-36-3	n-Butyl alcohol	7.42E-07	4.35E-03	4.02E-06	1.91E-10
71-43-2	Benzene	6.86E-12	4.02E-08	3.72E-11	1.76E-15
71-55-6	1,1,1-Trichloroethane	5.22E-23	3.07E-19	2.83E-22	1.34E-26
72-43-5	Methoxychlor	-	-	-	-
72-55-9	4,4-DDE	1.01E-05	5.94E-02	5.49E-05	2.60E-09
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	4.86E-14	2.85E-10	2.64E-13	1.25E-17

Table A-14 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
7439-97-6	Mercury	-	-	-	-
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	4.79E-14	2.81E-10	2.60E-13	1.23E-17
74-83-9	Bromomethane	4.26E-12	2.50E-08	2.31E-11	1.09E-15
74-87-3	Chloromethane	8.76E-13	5.14E-09	4.75E-12	2.25E-16
74-88-4	Iodomethane	8.59E-12	5.04E-08	4.66E-11	2.21E-15
74-95-3	Methylene bromide	-	-	-	-
74-97-5	Bromochloromethane	-	-	-	-
75-00-3	Chloroethane	4.49E-21	2.63E-17	2.43E-20	1.15E-24
75-01-4	1-Chloroethene	6.81E-24	4.00E-20	3.70E-23	1.75E-27
75-02-5	Fluoroethene (vinyl fluoride)	3.79E-23	2.22E-19	2.05E-22	9.73E-27
75-05-8	Acetonitrile	3.92E-04	2.30E+00	2.13E-03	1.01E-07
75-07-0	Acetaldehyde	4.71E-07	2.76E-03	2.55E-06	1.21E-10
75-09-2	Dichloromethane (Methylene Chloride)	8.03E-09	4.71E-05	4.35E-08	2.06E-12
75-15-0	Carbon disulfide	9.21E-16	5.40E-12	4.99E-15	2.36E-19
75-21-8	Ethylene oxide (Oxirane)	1.15E-10	6.77E-07	6.26E-10	2.96E-14
75-25-2	Bromoform	-	-	-	-
75-27-4	Bromodichloromethane	1.26E-11	7.38E-08	6.82E-11	3.23E-15
75-29-6	2-Chloropropane	-	-	-	-
75-34-3	1,1-Dichloroethane	2.08E-20	1.22E-16	1.13E-19	5.35E-24
75-35-4	1,1-Dichloroethene	5.32E-24	3.12E-20	2.89E-23	1.37E-27
75-44-5	Phosgene (hydrogen phosphide)	-	-	-	-

Table A-14 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
75-45-6	Chlorodifluoromethane	8.19E-25	4.81E-21	4.44E-24	2.10E-28
75-50-3	Trimethylamine	1.88E-07	1.10E-03	1.02E-06	4.82E-11
75-69-4	Trichlorofluoromethane	-	-	-	-
75-71-8	Dichlorodifluoromethane	-	-	-	-
76-01-7	Pentachloroethane	-	-	-	-
76-13-1	1,2,2-Trichlorotrifluoroethane	-	-	-	-
764-41-0	1,4-Dichloro-2-butene	-	-	-	-
76-44-8	Heptachlor	-	-	-	-
765-34-4	Glycidylaldehyde	-	-	-	-
7664-41-7	Ammonia/Ammonium	8.33E-03	4.89E+01	4.52E-02	2.14E-06
77-47-4	Hexachlorocyclopentadiene	1.10E-14	6.46E-11	5.97E-14	2.83E-18
77-78-1	Dimethyl sulfate	-	-	-	-
78-83-1	2-Methylpropyl alcohol	3.77E-04	2.21E+00	2.05E-03	9.70E-08
78-87-5	1,2-Dichloropropane	7.72E-19	4.53E-15	4.19E-18	1.98E-22
78-93-3	2-Butanone	8.30E-06	4.87E-02	4.50E-05	2.13E-09
79-00-5	1,1,2-Trichloroethane	2.73E-16	1.60E-12	1.48E-15	7.00E-20
79-01-6	1,1,2-Trichloroethylene	4.84E-13	2.84E-09	2.62E-12	1.24E-16
79-10-7	2-Propenoic acid	1.47E-03	8.64E+00	7.98E-03	3.78E-07
79-34-5	1,1,2,2-Tetrachloroethane	2.61E-14	1.53E-10	1.41E-13	6.70E-18
79-46-9	2-Nitropropane	2.71E-10	1.59E-06	1.47E-09	6.97E-14
80-62-6	Methyl methacrylate	-	-	-	-

Table A-14 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
822-06-0	Hexamethylene-1,5-diisocyanate	-	-	-	-
823-40-5	Toluene-2,6-diamine	-	-	-	-
82-68-8	Pentachloronitrobenzene (PCNB)	3.26E-12	1.91E-08	1.77E-11	8.38E-16
832-69-9	1-Methylphenanthrene	-	-	-	-
83-32-9	Acenaphthene	3.88E-07	2.28E-03	2.10E-06	9.96E-11
84-66-2	Diethyl phthalate	2.33E-03	1.37E+01	1.26E-02	5.98E-07
84-74-2	Di-n-butylphthalate	6.43E-03	3.78E+01	3.49E-02	1.65E-06
85-01-8	Phenanthrene	1.67E-05	9.78E-02	9.04E-05	4.28E-09
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	-	-	-	-
85-68-7	Butylbenzylphthalate	2.61E-03	1.53E+01	1.42E-02	6.70E-07
86-73-7	Fluorene	2.64E-06	1.55E-02	1.43E-05	6.78E-10
87-61-6	1,2,3-Trichlorobenzene	-	-	-	-
87-68-3	Hexachlorobutadiene	1.80E-18	1.06E-14	9.78E-18	4.63E-22
87-86-5	Pentachlorophenol	3.62E-05	2.12E-01	1.96E-04	9.30E-09
88-06-2	2,4,6-Trichlorophenol	8.98E-05	5.27E-01	4.87E-04	2.31E-08
88-74-4	o-Nitroaniline (2-nitroaniline)	1.42E-03	8.33E+00	7.70E-03	3.65E-07
88-75-5	2-Nitrophenol	1.77E-04	1.04E+00	9.58E-04	4.54E-08
90-04-0	o-Anisidine	-	-	-	-
90-12-0	1-Methylnaphthalene	-	-	-	-
91-20-3	Naphthalene	1.72E-06	1.01E-02	9.35E-06	4.43E-10
91-22-5	Quinoline	-	-	-	-

Table A-14 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
91-57-6	2-Methylnaphthalene	2.37E-06	1.39E-02	1.29E-05	6.10E-10
91-58-7	2-Chloronaphthalene	2.85E-09	1.68E-05	1.55E-08	7.33E-13
91-94-1	3,3'-Dichlorobenzidine	9.47E-03	5.56E+01	5.14E-02	2.43E-06
924-16-3	N-Nitroso-di-n-Buetylamine	-	-	-	-
92-52-4	1,1`-Biphenyl	7.82E-12	4.59E-08	4.24E-11	2.01E-15
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	-	-	-	-
94-75-7	2,4-D	-	-	-	-
95-48-7	o-Cresol	7.48E-04	4.39E+00	4.06E-03	1.92E-07
95-49-8	o-Chlorotoluene	-	-	-	-
95-50-1	1,2-Dichlorobenzene	5.45E-15	3.20E-11	2.96E-14	1.40E-18
95-53-4	o-Toluidine	-	-	-	-
95-57-8	2-Chlorophenol	4.08E-09	2.39E-05	2.21E-08	1.05E-12
95-63-6	1,2,4-Trimethyl benzene	-	-	-	-
95-94-3	1,2,4,5-Tetrachlorobenzene	-	-	-	-
95-95-4	2,4,5-Trichlorophenol	1.69E-04	9.94E-01	9.19E-04	4.35E-08
96-12-8	1,2-Dibromo-3-chloropropane	-	-	-	-
96-18-4	1,2,3-Trichloropropane	-	-	-	-
96-45-7	Ethylene thiourea	-	-	-	-
97-63-2	Ethyl methacrylate	-	-	-	-
98-01-1	Furfural	-	-	-	-
98-06-6	tert-Butyl benzene	-	-	-	-

Table A-14 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction WF (mg/kg)	Weight Ratio WR (unitless)	Individual Organic Release R_{IO} (g/s)
98-07-7	Benzotrichloride	-	-	-	-
98-82-8	Cumene	-	-	-	-
98-83-9	Methyl styrene (mixed isomers)	-	-	-	-
98-86-2	Acetophenone	1.22E-07	7.15E-04	6.61E-07	3.13E-11
98-95-3	Nitrobenzene	1.10E-05	6.43E-02	5.95E-05	2.82E-09
99-35-4	1,3,5-Trinitrobenzene	-	-	-	-
99-65-0	1,3-Dinitrobenzene	-	-	-	-
99-87-6	p-Cymene	-	-	-	-
			Weight Fraction Sum = WF_s =	1.08E+03	
				Weight Ratio Sum = WR_s =	1.00E+00
					Feed Stream Sum = 4.74E-05

The following indicates the stream properties for feed into the LAW Facility from the LFP feed used to calculate the weight fraction:

$$WF = \frac{(Q_m * 1000)}{\left(Q_v * \frac{\rho}{60 * 60}\right)}$$

Where:

Q_m = compound mass flow rate (g/s)
Q_v = volumetric flow rate (m^3/hr) = 7.56E-1
ρ = density (kg/m^3) = 1697.361

A "-" symbol indicates no data are available for approximating the emissions rate (no data were available, or the corresponding values were below the emissions model tolerance).

Table A-15 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
100-02-7	p-Nitrophenol	2.71E-02	7.60E+01	1.47E-01	6.96E-06
100-21-0	Phthalic acid	1.01E-02	2.84E+01	5.50E-02	2.60E-06
100-25-4	1,4-Dinitrobenzene	9.07E-06	2.55E-02	4.92E-05	2.33E-09
10028-17-8	Tritium	7.56E-08	2.12E-04	4.09E-07	1.94E-11
100-40-3	4-Ethenylcyclohexene	2.24E-22	6.28E-19	1.21E-21	5.75E-26
100-41-4	Ethyl benzene	1.78E-21	4.98E-18	9.63E-21	4.56E-25
100-42-5	Styrene	7.99E-11	2.24E-07	4.33E-10	2.05E-14
100-44-7	Benzyl chloride	-	-	-	-
100-47-0	Benzonitrile	-	-	-	-
100-51-6	Benzyl alcohol	-	-	-	-
100-52-7	Benzaldehyde	-	-	-	-

Table A-15 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
10061-01-5	cis-1,3-Dichloropropene	1.91E-18	5.36E-15	1.04E-17	4.90E-22
10061-02-6	trans-1,3-Dichloropropene	9.10E-16	2.55E-12	4.94E-15	2.34E-19
101-55-3	4-Bromophenylphenyl ether	1.37E-07	3.86E-04	7.45E-07	3.53E-11
101-77-9	4,4-Methylenedianiline	-	-	-	-
103-33-3	Azobenzene	-	-	-	-
103-65-1	n-Propyl benzene (Isocumene)	-	-	-	-
104-51-8	n-Butylbenzene	-	-	-	-
104-76-7	2-Ethyl-1-hexanol	4.30E-06	1.21E-02	2.33E-05	1.10E-09
105-67-9	2,4-Dimethylphenol	1.25E-03	3.50E+00	6.77E-03	3.21E-07
10595-95-6	n-Nitrosomethylethylamine	2.78E-04	7.79E-01	1.51E-03	7.14E-08
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	-	-	-	-
106-44-5	p-Cresol (4-methyl phenol)	-	-	-	-
106-46-7	1,4-Dichlorobenzene	4.76E-11	1.34E-07	2.58E-10	1.22E-14
106-47-8	p-Chloroaniline	1.97E-03	5.54E+00	1.07E-02	5.07E-07
106-49-0	p-Toluidine	-	-	-	-
106-51-4	Quinone	-	-	-	-
106-88-7	1,2-Epoxybutane	2.63E-08	7.39E-05	1.43E-07	6.77E-12
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	-	-	-	-
106-93-4	Ethylene dibromide	5.39E-16	1.51E-12	2.92E-15	1.38E-19
106-99-0	1,3-Butadiene	-	-	-	-
107-02-8	Acrolein	5.67E-11	1.59E-07	3.07E-10	1.46E-14

Table A-15 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
107-05-1	3-Chloropropene	2.68E-22	7.51E-19	1.45E-21	6.88E-26
107-06-2	1,2-Dichloroethane	4.25E-09	1.19E-05	2.30E-08	1.09E-12
107-12-0	Propionitrile	8.11E-09	2.27E-05	4.40E-08	2.08E-12
107-13-1	Acrylonitrile	2.90E-06	8.15E-03	1.58E-05	7.46E-10
107-19-7	Propargyl alcohol	-	-	-	-
107-21-1	Ethylene glycol (1,2-ethanediol)	-	-	-	-
107-98-2	Propylene glycol monomethyl ether	-	-	-	-
108-05-4	Acetic acid vinyl ester	4.00E-10	1.12E-06	2.17E-09	1.03E-13
108-10-1	4-Methyl-2-pentanone	8.15E-12	2.29E-08	4.42E-11	2.09E-15
108-39-4	m-Cresol	7.38E-04	2.07E+00	4.00E-03	1.90E-07
108-60-1	bis (2-Chloroisopropyl)ether	-	-	-	-
108-67-8	1,3,5-Trimethylbenzene	-	-	-	-
108-86-1	Bromobenzene (Phenyl bromide)	-	-	-	-
108-87-2	Methylcyclohexane	-	-	-	-
108-88-3	Toluene	1.02E-12	2.86E-09	5.54E-12	2.62E-16
108-90-7	Chlorobenzene	1.90E-11	5.32E-08	1.03E-10	4.87E-15
108-94-1	Cyclohexanone	8.71E-07	2.44E-03	4.73E-06	2.24E-10
108-95-2	Phenol	9.86E-04	2.77E+00	5.35E-03	2.53E-07
109-74-0	n-Butanenitrile	1.06E-06	2.99E-03	5.77E-06	2.74E-10
109-75-1	3-Butenenitrile	-	-	-	-
109-77-3	Malononitrile	-	-	-	-

Table A-15 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
109-86-4	2-Methoxyethanol	-	-	-	-
109-99-9	Tetrahydrofuran	1.89E-10	5.30E-07	1.03E-09	4.86E-14
110-00-9	Furan	-	-	-	-
110-54-3	n-Hexane	-	-	-	-
110-59-8	Pentanenitrile	4.58E-07	1.28E-03	2.48E-06	1.18E-10
110-80-5	2-Ethoxyethanol	3.31E-03	9.28E+00	1.79E-02	8.50E-07
110-82-7	Cyclohexane	-	-	-	-
110-83-8	Cyclohexene	-	-	-	-
110-86-1	Pyridine	2.15E-07	6.03E-04	1.17E-06	5.52E-11
111-15-9	Ethylene glycol monoethyl ether acetate	-	-	-	-
111-44-4	bis(2-Chloroethyl)ether	1.74E-05	4.89E-02	9.45E-05	4.48E-09
111-65-9	n-Octane	-	-	-	-
111-76-2	2-Butoxyethanol	1.68E-04	4.72E-01	9.12E-04	4.32E-08
111-84-2	n-Nonane	-	-	-	-
111-91-1	bis(2-Chloroethoxy)methane	1.19E-04	3.35E-01	6.48E-04	3.07E-08
1120-21-4	Undecane	-	-	-	-
1120-71-4	1,3-Propane sultone	-	-	-	-
112-30-1	1-Decanol	-	-	-	-
112-31-2	Decanal	-	-	-	-
112-40-3	Dodecane	-	-	-	-
117-81-7	Bis(2-ethylhexyl) phthalate	1.30E-02	3.66E+01	7.07E-02	3.35E-06

Table A-15 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
117-84-0	Di-n-octylphthalate	2.56E-06	7.17E-03	1.39E-05	6.57E-10
118-74-1	Hexachlorobenzene	4.87E-10	1.37E-06	2.64E-09	1.25E-13
119-90-4	3,3'-Dimethoxybenzidine	-	-	-	-
120-12-7	Anthracene	2.10E-06	5.90E-03	1.14E-05	5.40E-10
120-82-1	1,2,4-Trichlorobenzene	1.45E-15	4.05E-12	7.84E-15	3.71E-19
120-83-2	2,4-Dichlorophenol	1.57E-13	4.41E-10	8.52E-13	4.04E-17
121-14-2	2,4-Dinitrotoluene	1.58E-02	4.42E+01	8.55E-02	4.05E-06
122-39-4	N,N-Diphenylamine	1.38E-07	3.87E-04	7.49E-07	3.55E-11
122-66-7	1,2-Diphenylhydrazine	-	-	-	-
123-33-1	Maleic hydrazide	-	-	-	-
123-38-6	Propionaldehyde	5.58E-10	1.56E-06	3.02E-09	1.43E-13
123-72-8	Butanal	1.22E-07	3.43E-04	6.63E-07	3.14E-11
123-91-1	1,4-Dioxan	1.84E-08	5.17E-05	9.99E-08	4.73E-12
124-18-5	Decane	-	-	-	-
124-38-9	Carbon dioxide	-	-	-	-
124-48-1	Chlorodibromomethane	9.18E-09	2.57E-05	4.98E-08	2.36E-12
126-73-8	Tributyl phosphate	2.79E-04	7.82E-01	1.51E-03	7.16E-08
126-98-7	2-Methyl-2-propenenitrile	2.85E-12	8.00E-09	1.55E-11	7.33E-16
127-18-4	1,1,2,2-Tetrachloroethene	3.64E-24	1.02E-20	1.97E-23	9.35E-28
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	1.38E-06	3.86E-03	7.46E-06	3.53E-10
129-00-0	Pyrene	1.35E-04	3.80E-01	7.35E-04	3.48E-08

Table A-15 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
131-11-3	Dimethyl Phthalate	1.04E-03	2.91E+00	5.63E-03	2.66E-07
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	-	-	-	-
132-64-9	Dibenzofuran	1.37E-07	3.86E-04	7.46E-07	3.53E-11
1330-20-7	Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations)	3.61E-12	1.01E-08	1.96E-11	9.28E-16
133-06-2	Captan	-	-	-	-
1336-36-3	Polychlorinated biphenyls (1254 Aroclor)	1.19E-08	3.35E-05	6.47E-08	3.07E-12
134-32-7	alpha-Naphthylamine	2.48E-03	6.96E+00	1.35E-02	6.37E-07
135-98-8	sec-Butylbenzene	-	-	-	-
141-78-6	Acetic acid ethyl ester	2.86E-12	8.03E-09	1.55E-11	7.35E-16
145-73-3	Endothall	-	-	-	-
156-59-2	cis-1,2-Dichloroethene	-	-	-	-
156-60-5	1,2-trans-Dichloroethene	7.49E-17	2.10E-13	4.06E-16	1.92E-20
1634-04-4	Methyl tert-butyl ether	1.67E-10	4.70E-07	9.08E-10	4.30E-14
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	2.58E-14	7.24E-11	1.40E-13	6.63E-18
189-55-9	Dibenzo[a,i]pyrene	4.07E-03	1.14E+01	2.21E-02	1.05E-06
189-64-0	Dibenzo[a,h]pyrene	4.07E-03	1.14E+01	2.21E-02	1.05E-06
191-24-2	Benzo(g,h,i)perylene	4.59E-03	1.29E+01	2.49E-02	1.18E-06
191-30-0	Dibenzo(a,l)pyrene	4.07E-03	1.14E+01	2.21E-02	1.05E-06
192-65-4	Dibenzo[a,e]pyrene	4.07E-03	1.14E+01	2.21E-02	1.05E-06
192-97-2	Benzo(e)pyrene	-	-	-	-
193-39-5	Indeno(1,2,3-cd)pyrene	1.09E-03	3.07E+00	5.93E-03	2.81E-07

Table A-15 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	1.01E-13	2.84E-10	5.49E-13	2.60E-17
205-82-3	Benzo[j]fluoranthene	-	-	-	-
205-99-2	Benzo(b)fluoranthene	1.02E-04	2.85E-01	5.51E-04	2.61E-08
206-44-0	Fluoranthene	6.46E-05	1.81E-01	3.50E-04	1.66E-08
207-08-9	Benzo(k)fluoranthene	1.94E-03	5.45E+00	1.05E-02	4.99E-07
208-96-8	Acenaphthylene	5.72E-07	1.60E-03	3.10E-06	1.47E-10
218-01-9	Chrysene	1.15E-06	3.22E-03	6.22E-06	2.94E-10
224-42-0	Dibenz[a,j]acridine	5.17E-03	1.45E+01	2.80E-02	1.33E-06
2245-38-7	2,3,5-Trimethylnaphthalene	-	-	-	-
226-36-8	Dibenz[a,h]acridine	4.80E-03	1.35E+01	2.60E-02	1.23E-06
23950-58-5	Pronamide	-	-	-	-
27154-33-2	Trichlorofluoroethane	6.21E-17	1.74E-13	3.37E-16	1.60E-20
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	4.76E-14	1.33E-10	2.58E-13	1.22E-17
319-84-6	alpha-BHC	8.91E-10	2.50E-06	4.83E-09	2.29E-13
319-85-7	beta-BHC	6.18E-05	1.73E-01	3.35E-04	1.59E-08
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	3.55E-11	9.97E-08	1.93E-10	9.13E-15
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	6.73E-16	1.89E-12	3.65E-15	1.73E-19
3268-87-9	Octachlorodibenzo(p)dioxin	7.53E-12	2.11E-08	4.09E-11	1.94E-15
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	1.63E-13	4.56E-10	8.82E-13	4.18E-17
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	5.60E-13	1.57E-09	3.04E-12	1.44E-16
3697-24-3	5-Methylchrysene	3.80E-05	1.07E-01	2.06E-04	9.77E-09

Table A-15 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	4.41E-14	1.24E-10	2.39E-13	1.13E-17
39001-02-0	Octachlorodibenzofuran	5.37E-12	1.51E-08	2.91E-11	1.38E-15
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	1.08E-13	3.02E-10	5.83E-13	2.76E-17
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	1.20E-13	3.37E-10	6.52E-13	3.09E-17
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	8.34E-13	2.34E-09	4.53E-12	2.14E-16
4170-30-3	Crotonaldehyde (Propylene aldehyde)	3.38E-17	9.48E-14	1.83E-16	8.68E-21
41851-50-7	Chlorocyclopentadiene	-	-	-	-
460-19-5	Cyanogen (oxalonitrile)	-	-	-	-
4786-20-3	2-Butenenitrile	-	-	-	-
50-00-0	Formaldehyde	1.01E-03	2.83E+00	5.46E-03	2.59E-07
50-32-8	Benzo(a)pyrene	2.66E-04	7.46E-01	1.44E-03	6.83E-08
506-68-3	Cyanogen bromide (bromocyanide)	-	-	-	-
506-77-4	Cyanogen chloride	-	-	-	-
510-15-6	Chlorobenzilate	-	-	-	-
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	3.93E-13	1.10E-09	2.13E-12	1.01E-16
51-28-5	2,4-Dinitrophenol	1.33E-02	3.74E+01	7.23E-02	3.42E-06
51-79-6	Ethyl carbamate (urethane)	-	-	-	-
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	4.40E-12	1.23E-08	2.39E-11	1.13E-15
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	-	-	-	-
532-27-4	2-Chloroacetophenone	-	-	-	-
534-52-1	4,6-Dinitro-o-cresol	3.26E-03	9.16E+00	1.77E-02	8.39E-07

Table A-15 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
53-70-3	Dibenz[a,h]anthracene	3.43E-03	9.62E+00	1.86E-02	8.81E-07
5385-75-1	Dibenzo(a,e)fluoranthene	-	-	-	-
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	1.18E-11	3.32E-08	6.42E-11	3.04E-15
540-73-8	1,2-Dimethylhydrazine	-	-	-	-
540-84-1	2,2,4-Trimethylpentane	-	-	-	-
541-73-1	1,3-Dichlorobenzene	1.17E-17	3.28E-14	6.35E-17	3.01E-21
542-75-6	1,3-Dichloropropene	-	-	-	-
542-88-1	bis(Chloromethyl)ether	-	-	-	-
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	8.15E-14	2.29E-10	4.42E-13	2.09E-17
56-23-5	Carbon tetrachloride	8.50E-17	2.38E-13	4.61E-16	2.18E-20
56-49-5	3-Methylcholanthrene	4.07E-05	1.14E-01	2.21E-04	1.05E-08
56-55-3	Benzo(a)anthracene	2.52E-04	7.07E-01	1.37E-03	6.47E-08
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	9.35E-13	2.62E-09	5.07E-12	2.40E-16
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	6.43E-13	1.80E-09	3.49E-12	1.65E-16
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	2.42E-13	6.80E-10	1.31E-12	6.22E-17
57-24-9	Strychnine	-	-	-	-
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	3.29E-12	9.23E-09	1.78E-11	8.45E-16
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	1.14E-13	3.21E-10	6.20E-13	2.94E-17
57-74-9	Chlordane	-	-	-	-
581-42-0	2,6-Dimethylnaphthalene	-	-	-	-
584-84-9	2,4-Toluene diisocyanate	-	-	-	-

Table A-15 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
58-89-9	gamma-BHC (Lindane)	4.10E-09	1.15E-05	2.23E-08	1.05E-12
58-90-2	2,3,4,6-Tetrachlorophenol	1.52E-04	4.25E-01	8.22E-04	3.89E-08
589-38-8	3-Hexanone	8.62E-08	2.42E-04	4.68E-07	2.22E-11
591-50-4	Benzene, iodo-	-	-	-	-
591-78-6	2-Hexanone	3.65E-10	1.02E-06	1.98E-09	9.38E-14
593-60-2	Bromoethene (Vinyl bromide)	-	-	-	-
593-74-8	Dimethyl Mercury	6.46E-07	1.81E-03	3.50E-06	1.66E-10
59-50-7	4-Chloro-3-methylphenol	3.23E-04	9.05E-01	1.75E-03	8.29E-08
59-89-2	N-Nitrosomorpholine	1.10E-02	3.09E+01	5.97E-02	2.83E-06
60-11-7	Dimethyl aminoazobenzene	3.92E-19	1.10E-15	2.13E-18	1.01E-22
602-87-9	5-Nitroacenaphthene	3.22E-04	9.05E-01	1.75E-03	8.28E-08
60-29-7	Ethyl ether	5.40E-15	1.51E-11	2.93E-14	1.39E-18
60-35-5	Acetamide	2.52E-03	7.07E+00	1.37E-02	6.48E-07
606-20-2	2,6-Dinitrotoluene	9.27E-04	2.60E+00	5.03E-03	2.38E-07
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	7.99E-14	2.24E-10	4.33E-13	2.05E-17
608-93-5	Pentachlorobenzene	-	-	-	-
61626-71-9	Dichloropentadiene	-	-	-	-
621-64-7	N-Nitroso-di-n-propylamine	3.40E-04	9.54E-01	1.85E-03	8.74E-08
624-83-9	Methyl isocyanate	-	-	-	-
62-50-0	Ethyl methanesulfonate	-	-	-	-
62-53-3	Aniline	-	-	-	-

Table A-15 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
62-75-9	N-Nitroso-N,N-dimethylamine	2.23E-06	6.26E-03	1.21E-05	5.73E-10
628-73-9	Hexanenitrile	1.99E-07	5.57E-04	1.08E-06	5.10E-11
630-20-6	1,1,1,2-Tetrachloroethane	4.64E-13	1.30E-09	2.52E-12	1.19E-16
64-18-6	Formic acid (methanoic acid)	-	-	-	-
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	1.52E-10	4.28E-07	8.27E-10	3.92E-14
65-85-0	Benzoic acid	-	-	-	-
67-56-1	Methyl alcohol	7.48E-05	2.10E-01	4.06E-04	1.92E-08
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	2.54E-13	7.14E-10	1.38E-12	6.54E-17
67-63-0	2-Propyl alcohol	2.76E-08	7.76E-05	1.50E-07	7.10E-12
67-64-1	2-Propanone (Acetone)	3.22E-05	9.04E-02	1.75E-04	8.28E-09
67-66-3	Chloroform	1.90E-11	5.32E-08	1.03E-10	4.87E-15
67-72-1	Hexachloroethane	9.61E-16	2.70E-12	5.21E-15	2.47E-19
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	3.62E-13	1.02E-09	1.97E-12	9.31E-17
70-30-4	Hexachlorophene	-	-	-	-
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	6.13E-13	1.72E-09	3.33E-12	1.58E-16
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	1.40E-13	3.93E-10	7.60E-13	3.60E-17
71-36-3	n-Butyl alcohol	7.40E-07	2.08E-03	4.02E-06	1.90E-10
71-43-2	Benzene	2.43E-12	6.83E-09	1.32E-11	6.25E-16
71-55-6	1,1,1-Trichloroethane	5.58E-24	1.56E-20	3.03E-23	1.43E-27
72-43-5	Methoxychlor	-	-	-	-
72-55-9	4,4-DDE	1.01E-05	2.83E-02	5.47E-05	2.59E-09

Table A-15 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	4.85E-14	1.36E-10	2.63E-13	1.25E-17
7439-97-6	Mercury	-	-	-	-
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	4.69E-14	1.31E-10	2.54E-13	1.20E-17
74-83-9	Bromomethane	1.38E-12	3.87E-09	7.49E-12	3.55E-16
74-87-3	Chloromethane	2.05E-13	5.74E-10	1.11E-12	5.26E-17
74-88-4	Iodomethane	3.20E-12	8.99E-09	1.74E-11	8.23E-16
74-95-3	Methylene bromide	-	-	-	-
74-97-5	Bromochloromethane	-	-	-	-
75-00-3	Chloroethane	1.05E-21	2.95E-18	5.70E-21	2.70E-25
75-01-4	1-Chloroethene	3.73E-25	1.05E-21	2.02E-24	9.59E-29
75-02-5	Fluoroethene (vinyl fluoride)	1.62E-25	4.53E-22	8.76E-25	4.15E-29
75-05-8	Acetonitrile	3.89E-04	1.09E+00	2.11E-03	9.98E-08
75-07-0	Acetaldehyde	4.62E-07	1.30E-03	2.50E-06	1.19E-10
75-09-2	Dichloromethane (Methylene Chloride)	5.00E-09	1.40E-05	2.71E-08	1.29E-12
75-15-0	Carbon disulfide	4.31E-17	1.21E-13	2.34E-16	1.11E-20
75-21-8	Ethylene oxide (Oxirane)	1.11E-10	3.12E-07	6.04E-10	2.86E-14
75-25-2	Bromoform	-	-	-	-
75-27-4	Bromodichloromethane	8.83E-12	2.48E-08	4.79E-11	2.27E-15
75-29-6	2-Chloropropane	-	-	-	-
75-34-3	1,1-Dichloroethane	7.38E-21	2.07E-17	4.01E-20	1.90E-24
75-35-4	1,1-Dichloroethene	3.09E-25	8.67E-22	1.68E-24	7.94E-29

Table A-15 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
75-44-5	Phosgene (hydrogen phosphide)	-	-	-	-
75-45-6	Chlorodifluoromethane	-	-	-	-
75-50-3	Trimethylamine	1.83E-07	5.13E-04	9.92E-07	4.70E-11
75-69-4	Trichlorofluoromethane	-	-	-	-
75-71-8	Dichlorodifluoromethane	-	-	-	-
76-01-7	Pentachloroethane	-	-	-	-
76-13-1	1,2,2-Trichlorotrifluoroethane	-	-	-	-
764-41-0	1,4-Dichloro-2-butene	-	-	-	-
76-44-8	Heptachlor	-	-	-	-
765-34-4	Glycidylaldehyde	-	-	-	-
7664-41-7	Ammonia/Ammonium	8.33E-03	2.34E+01	4.52E-02	2.14E-06
77-47-4	Hexachlorocyclopentadiene	6.03E-16	1.69E-12	3.27E-15	1.55E-19
77-78-1	Dimethyl sulfate	-	-	-	-
78-83-1	2-Methylpropyl alcohol	3.77E-04	1.06E+00	2.04E-03	9.67E-08
78-87-5	1,2-Dichloropropane	4.30E-19	1.21E-15	2.33E-18	1.11E-22
78-93-3	2-Butanone	8.19E-06	2.30E-02	4.44E-05	2.10E-09
79-00-5	1,1,2-Trichloroethane	2.21E-16	6.21E-13	1.20E-15	5.68E-20
79-01-6	1,1,2-Trichloroethylene	9.88E-14	2.77E-10	5.36E-13	2.54E-17
79-10-7	2-Propenoic acid	1.47E-03	4.13E+00	7.98E-03	3.78E-07
79-34-5	1,1,2,2-Tetrachloroethane	2.40E-14	6.75E-11	1.30E-13	6.18E-18
79-46-9	2-Nitropropane	2.64E-10	7.40E-07	1.43E-09	6.78E-14

Table A-15 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
80-62-6	Methyl methacrylate	-	-	-	-
822-06-0	Hexamethylene-1,5-diisocyanate	-	-	-	-
823-40-5	Toluene-2,6-diamine	-	-	-	-
82-68-8	Pentachloronitrobenzene (PCNB)	2.98E-12	8.36E-09	1.62E-11	7.66E-16
832-69-9	1-Methylphenanthrene	-	-	-	-
83-32-9	Acenaphthene	3.73E-07	1.05E-03	2.02E-06	9.59E-11
84-66-2	Diethyl phthalate	2.33E-03	6.53E+00	1.26E-02	5.98E-07
84-74-2	Di-n-butylphthalate	6.43E-03	1.80E+01	3.49E-02	1.65E-06
85-01-8	Phenanthrene	1.66E-05	4.65E-02	8.99E-05	4.26E-09
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	-	-	-	-
85-68-7	Butylbenzylphthalate	2.61E-03	7.32E+00	1.41E-02	6.70E-07
86-73-7	Fluorene	2.60E-06	7.29E-03	1.41E-05	6.68E-10
87-61-6	1,2,3-Trichlorobenzene	-	-	-	-
87-68-3	Hexachlorobutadiene	4.59E-19	1.29E-15	2.49E-18	1.18E-22
87-86-5	Pentachlorophenol	3.62E-05	1.02E-01	1.96E-04	9.30E-09
88-06-2	2,4,6-Trichlorophenol	8.97E-05	2.52E-01	4.86E-04	2.30E-08
88-74-4	o-Nitroaniline (2-nitroaniline)	1.42E-03	3.98E+00	7.70E-03	3.65E-07
88-75-5	2-Nitrophenol	1.76E-04	4.94E-01	9.56E-04	4.53E-08
90-04-0	o-Anisidine	-	-	-	-
90-12-0	1-Methylnaphthalene	-	-	-	-
91-20-3	Naphthalene	1.54E-06	4.32E-03	8.35E-06	3.95E-10

Table A-15 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
91-22-5	Quinoline	-	-	-	-
91-57-6	2-Methylnaphthalene	2.34E-06	6.58E-03	1.27E-05	6.02E-10
91-58-7	2-Chloronaphthalene	2.65E-09	7.43E-06	1.44E-08	6.81E-13
91-94-1	3,3'-Dichlorobenzidine	9.47E-03	2.66E+01	5.14E-02	2.43E-06
924-16-3	N-Nitroso-di-n-Buetylamine	-	-	-	-
92-52-4	1,1`-Biphenyl	7.27E-12	2.04E-08	3.94E-11	1.87E-15
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	-	-	-	-
94-75-7	2,4-D	-	-	-	-
95-48-7	o-Cresol	7.48E-04	2.10E+00	4.06E-03	1.92E-07
95-49-8	o-Chlorotoluene	-	-	-	-
95-50-1	1,2-Dichlorobenzene	3.60E-15	1.01E-11	1.95E-14	9.25E-19
95-53-4	o-Toluidine	-	-	-	-
95-57-8	2-Chlorophenol	3.72E-09	1.04E-05	2.02E-08	9.55E-13
95-63-6	1,2,4-Trimethyl benzene	-	-	-	-
95-94-3	1,2,4,5-Tetrachlorobenzene	-	-	-	-
95-95-4	2,4,5-Trichlorophenol	1.69E-04	4.75E-01	9.18E-04	4.35E-08
96-12-8	1,2-Dibromo-3-chloropropane	-	-	-	-
96-18-4	1,2,3-Trichloropropane	-	-	-	-
96-45-7	Ethylene thiourea	-	-	-	-
97-63-2	Ethyl methacrylate	-	-	-	-
98-01-1	Furfural	-	-	-	-

Table A-15 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction WF (mg/kg)	Weight Ratio WR (unitless)	Individual Organic Release R_{IO} (g/s)
98-06-6	tert-Butyl benzene	-	-	-	-
98-07-7	Benzotrichloride	-	-	-	-
98-82-8	Cumene	-	-	-	-
98-83-9	Methyl styrene (mixed isomers)	-	-	-	-
98-86-2	Acetophenone	1.21E-07	3.41E-04	6.59E-07	3.12E-11
98-95-3	Nitrobenzene	1.09E-05	3.06E-02	5.91E-05	2.80E-09
99-35-4	1,3,5-Trinitrobenzene	-	-	-	-
99-65-0	1,3-Dinitrobenzene	-	-	-	-
99-87-6	p-Cymene	-	-	-	-
			Weight Fraction Sum = WF_s =	5.17E+02	
				Weight Ratio Sum = WR_s =	1.00E+00
					Feed Stream Sum = 4.04E-05

The following indicates the stream properties for feed into the LAW Facility from the RLD feed used to calculate the weight fraction:

$$WF = \frac{(Q_m * 1000)}{\left(Q_v * \frac{\rho}{60 * 60}\right)}$$

Where:

Q_m = compound mass flow rate (g/s)
Q_v = volumetric flow rate (m^3/hr) = 8.72E-01
ρ = density (kg/m^3) = 1006.142

A "-" symbol indicates no data are available for approximating the emissions rate (no data were available, or the corresponding values were below the emissions model tolerance).

Table A-16 Estimate of Organic Emission from the LAW Feed (RLD21)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
100-02-7	p-Nitrophenol	2.79E-02	1.15E+02	9.64E-02	4.08E-07
100-21-0	Phthalic acid	1.01E-02	4.16E+01	3.50E-02	1.48E-07
100-25-4	1,4-Dinitrobenzene	8.52E-06	3.49E-02	2.94E-05	1.24E-10
10028-17-8	Tritium	5.70E-08	2.34E-04	1.97E-07	8.33E-13
100-40-3	4-Ethenylcyclohexene	2.82E-26	1.16E-22	9.74E-26	4.12E-31
100-41-4	Ethyl benzene	1.27E-24	5.20E-21	4.38E-24	1.85E-29
100-42-5	Styrene	1.17E-05	4.79E-02	4.03E-05	1.70E-10
100-44-7	Benzyl chloride	-	-	-	-
100-47-0	Benzonitrile	-	-	-	-
100-51-6	Benzyl alcohol	-	-	-	-
100-52-7	Benzaldehyde	-	-	-	-
10061-01-5	cis-1,3-Dichloropropene	3.97E-21	1.63E-17	1.37E-20	5.79E-26
10061-02-6	trans-1,3-Dichloropropene	5.86E-18	2.40E-14	2.02E-17	8.55E-23

Table A-16 Estimate of Organic Emission from the LAW Feed (RLD21)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
101-55-3	4-Bromophenylphenyl ether	6.32E-09	2.59E-05	2.18E-08	9.23E-14
101-77-9	4,4-Methylenedianiline	-	-	-	-
103-33-3	Azobenzene	-	-	-	-
103-65-1	n-Propyl benzene (Isocumene)	-	-	-	-
104-51-8	n-Butylbenzene	-	-	-	-
104-76-7	2-Ethyl-1-hexanol	7.55E-07	3.10E-03	2.61E-06	1.10E-11
105-67-9	2,4-Dimethylphenol	6.05E-03	2.48E+01	2.09E-02	8.82E-08
10595-95-6	n-Nitrosomethylethylamine	2.21E-04	9.08E-01	7.64E-04	3.23E-09
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	-	-	-	-
106-44-5	p-Cresol (4-methyl phenol)	-	-	-	-
106-46-7	1,4-Dichlorobenzene	4.70E-06	1.93E-02	1.62E-05	6.86E-11
106-47-8	p-Chloroaniline	6.93E-03	2.84E+01	2.39E-02	1.01E-07
106-49-0	p-Toluidine	-	-	-	-
106-51-4	Quinone	-	-	-	-
106-88-7	1,2-Epoxybutane	8.00E-10	3.28E-06	2.76E-09	1.17E-14
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	-	-	-	-
106-93-4	Ethylene dibromide	4.07E-18	1.67E-14	1.41E-17	5.95E-23
106-99-0	1,3-Butadiene	-	-	-	-
107-02-8	Acrolein	2.55E-12	1.04E-08	8.79E-12	3.71E-17
107-05-1	3-Chloropropene	1.32E-25	5.41E-22	4.56E-25	1.93E-30
107-06-2	1,2-Dichloroethane	3.20E-05	1.31E-01	1.11E-04	4.67E-10
107-12-0	Propionitrile	1.07E-09	4.40E-06	3.70E-09	1.57E-14

Table A-16 Estimate of Organic Emission from the LAW Feed (RLD21)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
107-13-1	Acrylonitrile	3.60E-04	1.48E+00	1.24E-03	5.25E-09
107-19-7	Propargyl alcohol	-	-	-	-
107-21-1	Ethylene glycol (1,2-ethanediol)	-	-	-	-
107-98-2	Propylene glycol monomethyl ether	-	-	-	-
108-05-4	Acetic acid vinyl ester	4.38E-12	1.80E-08	1.51E-11	6.39E-17
108-10-1	4-Methyl-2-pentanone	3.17E-13	1.30E-09	1.10E-12	4.63E-18
108-39-4	m-Cresol	6.40E-04	2.62E+00	2.21E-03	9.33E-09
108-60-1	bis (2-Chloroisopropyl)ether	-	-	-	-
108-67-8	1,3,5-Trimethylbenzene	-	-	-	-
108-86-1	Bromobenzene (Phenyl bromide)	-	-	-	-
108-87-2	Methylcyclohexane	-	-	-	-
108-88-3	Toluene	4.78E-06	1.96E-02	1.65E-05	6.97E-11
108-90-7	Chlorobenzene	8.51E-06	3.49E-02	2.94E-05	1.24E-10
108-94-1	Cyclohexanone	3.36E-07	1.38E-03	1.16E-06	4.90E-12
108-95-2	Phenol	2.20E-03	9.01E+00	7.58E-03	3.21E-08
109-74-0	n-Butanenitrile	1.04E-07	4.26E-04	3.58E-07	1.51E-12
109-75-1	3-Butenenitrile	-	-	-	-
109-77-3	Malononitrile	-	-	-	-
109-86-4	2-Methoxyethanol	-	-	-	-
109-99-9	Tetrahydrofuran	1.40E-11	5.75E-08	4.84E-11	2.04E-16
110-00-9	Furan	-	-	-	-
110-54-3	n-Hexane	-	-	-	-

Table A-16 Estimate of Organic Emission from the LAW Feed (RLD21)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
110-59-8	Pentanenitrile	3.35E-08	1.37E-04	1.16E-07	4.88E-13
110-80-5	2-Ethoxyethanol	3.05E-03	1.25E+01	1.05E-02	4.46E-08
110-82-7	Cyclohexane	-	-	-	-
110-83-8	Cyclohexene	-	-	-	-
110-86-1	Pyridine	8.37E-08	3.43E-04	2.89E-07	1.22E-12
111-15-9	Ethylene glycol monoethyl ether acetate	-	-	-	-
111-44-4	bis(2-Chloroethyl)ether	4.00E-04	1.64E+00	1.38E-03	5.83E-09
111-65-9	n-Octane	-	-	-	-
111-76-2	2-Butoxyethanol	1.31E-04	5.38E-01	4.53E-04	1.91E-09
111-84-2	n-Nonane	-	-	-	-
111-91-1	bis(2-Chloroethoxy)methane	8.95E-04	3.67E+00	3.09E-03	1.31E-08
1120-21-4	Undecane	-	-	-	-
1120-71-4	1,3-Propane sultone	-	-	-	-
112-30-1	1-Decanol	-	-	-	-
112-31-2	Decanal	-	-	-	-
112-40-3	Dodecane	-	-	-	-
117-81-7	Bis(2-ethylhexyl) phthalate	1.53E-02	6.29E+01	5.30E-02	2.24E-07
117-84-0	Di-n-octylphthalate	2.15E-07	8.82E-04	7.43E-07	3.14E-12
118-74-1	Hexachlorobenzene	7.58E-06	3.11E-02	2.62E-05	1.11E-10
119-90-4	3,3'-Dimethoxybenzidine	-	-	-	-
120-12-7	Anthracene	1.07E-04	4.39E-01	3.69E-04	1.56E-09
120-82-1	1,2,4-Trichlorobenzene	5.80E-18	2.38E-14	2.00E-17	8.47E-23

Table A-16 Estimate of Organic Emission from the LAW Feed (RLD21)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
120-83-2	2,4-Dichlorophenol	3.69E-16	1.51E-12	1.27E-15	5.38E-21
121-14-2	2,4-Dinitrotoluene	1.60E-02	6.58E+01	5.54E-02	2.34E-07
122-39-4	N,N-Diphenylamine	9.35E-08	3.83E-04	3.23E-07	1.36E-12
122-66-7	1,2-Diphenylhydrazine	-	-	-	-
123-33-1	Maleic hydrazide	-	-	-	-
123-38-6	Propionaldehyde	3.98E-11	1.63E-07	1.38E-10	5.81E-16
123-72-8	Butanal	5.72E-09	2.35E-05	1.98E-08	8.35E-14
123-91-1	1,4-Dioxan	9.95E-09	4.08E-05	3.44E-08	1.45E-13
124-18-5	Decane	-	-	-	-
124-38-9	Carbon dioxide	-	-	-	-
124-48-1	Chlorodibromomethane	4.00E-05	1.64E-01	1.38E-04	5.84E-10
126-73-8	Tributyl phosphate	2.23E-04	9.15E-01	7.70E-04	3.26E-09
126-98-7	2-Methyl-2-propenenitrile	6.37E-14	2.61E-10	2.20E-13	9.30E-19
127-18-4	1,1,2,2-Tetrachloroethene	-	-	-	-
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	7.95E-07	3.26E-03	2.75E-06	1.16E-11
129-00-0	Pyrene	5.41E-04	2.22E+00	1.87E-03	7.89E-09
131-11-3	Dimethyl Phthalate	1.31E-03	5.38E+00	4.53E-03	1.92E-08
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	-	-	-	-
132-64-9	Dibenzofuran	4.54E-05	1.86E-01	1.57E-04	6.62E-10
1330-20-7	Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations)	6.08E-06	2.49E-02	2.10E-05	8.87E-11
133-06-2	Captan	-	-	-	-
1336-36-3	Polychlorinated biphenyls (1254 Aroclor)	3.44E-10	1.41E-06	1.19E-09	5.02E-15

Table A-16 Estimate of Organic Emission from the LAW Feed (RLD21)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
134-32-7	alpha-Naphthylamine	2.43E-03	9.98E+00	8.40E-03	3.55E-08
135-98-8	sec-Butylbenzene	-	-	-	-
141-78-6	Acetic acid ethyl ester	1.16E-13	4.74E-10	3.99E-13	1.69E-18
145-73-3	Endothall	-	-	-	-
156-59-2	cis-1,2-Dichloroethene	-	-	-	-
156-60-5	1,2-trans-Dichloroethene	4.49E-20	1.84E-16	1.55E-19	6.56E-25
1634-04-4	Methyl tert-butyl ether	1.59E-12	6.53E-09	5.50E-12	2.32E-17
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	8.45E-13	3.46E-09	2.92E-12	1.23E-17
189-55-9	Dibenzo[a,i]pyrene	4.05E-03	1.66E+01	1.40E-02	5.91E-08
189-64-0	Dibenzo[a,h]pyrene	4.05E-03	1.66E+01	1.40E-02	5.91E-08
191-24-2	Benzo(g,h,i)perylene	5.23E-03	2.14E+01	1.81E-02	7.63E-08
191-30-0	Dibenzo(a,l)pyrene	4.05E-03	1.66E+01	1.40E-02	5.91E-08
192-65-4	Dibenzo[a,e]pyrene	4.05E-03	1.66E+01	1.40E-02	5.91E-08
192-97-2	Benzo(e)pyrene	-	-	-	-
193-39-5	Indeno(1,2,3-cd)pyrene	2.47E-03	1.01E+01	8.53E-03	3.60E-08
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	1.55E-12	6.37E-09	5.37E-12	2.27E-17
205-82-3	Benzo[j]fluoranthene	-	-	-	-
205-99-2	Benzo(b)fluoranthene	1.16E-03	4.75E+00	4.00E-03	1.69E-08
206-44-0	Fluoranthene	3.83E-04	1.57E+00	1.32E-03	5.59E-09
207-08-9	Benzo(k)fluoranthene	3.51E-03	1.44E+01	1.21E-02	5.12E-08
208-96-8	Acenaphthylene	6.29E-05	2.58E-01	2.17E-04	9.18E-10
218-01-9	Chrysene	1.13E-04	4.63E-01	3.90E-04	1.65E-09

Table A-16 Estimate of Organic Emission from the LAW Feed (RLD21)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
224-42-0	Dibenz[a,j]acridine	5.16E-03	2.12E+01	1.78E-02	7.53E-08
2245-38-7	2,3,5-Trimethylnaphthalene	-	-	-	-
226-36-8	Dibenz[a,h]acridine	4.79E-03	1.96E+01	1.65E-02	6.99E-08
23950-58-5	Pronamide	-	-	-	-
27154-33-2	Trichlorofluoroethane	3.39E-20	1.39E-16	1.17E-19	4.95E-25
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	2.62E-11	1.08E-07	9.06E-11	3.83E-16
319-84-6	alpha-BHC	3.02E-10	1.24E-06	1.04E-09	4.41E-15
319-85-7	beta-BHC	6.10E-05	2.50E-01	2.11E-04	8.91E-10
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	1.00E-10	4.11E-07	3.46E-10	1.46E-15
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	3.27E-12	1.34E-08	1.13E-11	4.77E-17
3268-87-9	Octachlorodibenzo(p)dioxin	5.63E-11	2.31E-07	1.94E-10	8.21E-16
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	1.15E-11	4.72E-08	3.97E-11	1.68E-16
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	7.20E-12	2.95E-08	2.49E-11	1.05E-16
3697-24-3	5-Methylchrysene	1.93E-05	7.94E-02	6.68E-05	2.82E-10
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	7.95E-12	3.26E-08	2.75E-11	1.16E-16
39001-02-0	Octachlorodibenzofuran	1.54E-11	6.32E-08	5.32E-11	2.25E-16
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	1.09E-12	4.49E-09	3.78E-12	1.60E-17
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	6.12E-12	2.51E-08	2.11E-11	8.93E-17
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	4.46E-12	1.83E-08	1.54E-11	6.50E-17
4170-30-3	Crotonaldehyde (Propylene aldehyde)	1.24E-17	5.10E-14	4.30E-17	1.82E-22
41851-50-7	Chlorocyclopentadiene	-	-	-	-
460-19-5	Cyanogen (oxalonitrile)	-	-	-	-

Table A-16 Estimate of Organic Emission from the LAW Feed (RLD21)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
4786-20-3	2-Butenenitrile	-	-	-	-
50-00-0	Formaldehyde	9.50E-04	3.90E+00	3.28E-03	1.39E-08
50-32-8	Benzo(a)pyrene	1.17E-03	4.79E+00	4.04E-03	1.71E-08
506-68-3	Cyanogen bromide (bromocyanide)	-	-	-	-
506-77-4	Cyanogen chloride	-	-	-	-
510-15-6	Chlorobenzilate	-	-	-	-
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	5.93E-12	2.43E-08	2.05E-11	8.66E-17
51-28-5	2,4-Dinitrophenol	2.25E-02	9.23E+01	7.77E-02	3.28E-07
51-79-6	Ethyl carbamate (urethane)	-	-	-	-
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	1.12E-11	4.60E-08	3.87E-11	1.64E-16
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	-	-	-	-
532-27-4	2-Chloroacetophenone	-	-	-	-
534-52-1	4,6-Dinitro-o-cresol	9.40E-03	3.86E+01	3.25E-02	1.37E-07
53-70-3	Dibenz[a,h]anthracene	3.40E-03	1.39E+01	1.17E-02	4.96E-08
5385-75-1	Dibenzo(a,e)fluoranthene	-	-	-	-
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	7.72E-06	3.17E-02	2.67E-05	1.13E-10
540-73-8	1,2-Dimethylhydrazine	-	-	-	-
540-84-1	2,2,4-Trimethylpentane	-	-	-	-
541-73-1	1,3-Dichlorobenzene	2.13E-20	8.72E-17	7.35E-20	3.10E-25
542-75-6	1,3-Dichloropropene	-	-	-	-
542-88-1	bis(Chloromethyl)ether	-	-	-	-
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	1.26E-12	5.18E-09	4.36E-12	1.84E-17

Table A-16 Estimate of Organic Emission from the LAW Feed (RLD21)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
56-23-5	Carbon tetrachloride	1.05E-06	4.31E-03	3.63E-06	1.53E-11
56-49-5	3-Methylcholanthrene	2.17E-05	8.88E-02	7.48E-05	3.16E-10
56-55-3	Benzo(a)anthracene	1.11E-03	4.55E+00	3.83E-03	1.62E-08
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	5.52E-12	2.27E-08	1.91E-11	8.06E-17
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	3.74E-12	1.53E-08	1.29E-11	5.45E-17
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	2.23E-12	9.16E-09	7.71E-12	3.26E-17
57-24-9	Strychnine	-	-	-	-
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	3.75E-11	1.54E-07	1.29E-10	5.47E-16
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	1.65E-12	6.76E-09	5.70E-12	2.41E-17
57-74-9	Chlordane	-	-	-	-
581-42-0	2,6-Dimethylnaphthalene	-	-	-	-
584-84-9	2,4-Toluene diisocyanate	-	-	-	-
58-89-9	gamma-BHC (Lindane)	2.15E-09	8.81E-06	7.42E-09	3.13E-14
58-90-2	2,3,4,6-Tetrachlorophenol	8.53E-05	3.50E-01	2.95E-04	1.24E-09
589-38-8	3-Hexanone	3.72E-09	1.53E-05	1.29E-08	5.43E-14
591-50-4	Benzene, iodo-	-	-	-	-
591-78-6	2-Hexanone	2.09E-11	8.55E-08	7.20E-11	3.04E-16
593-60-2	Bromoethene (Vinyl bromide)	-	-	-	-
593-74-8	Dimethyl Mercury	3.93E-07	1.61E-03	1.36E-06	5.75E-12
59-50-7	4-Chloro-3-methylphenol	2.25E-04	9.23E-01	7.77E-04	3.28E-09
59-89-2	N-Nitrosomorpholine	1.10E-02	4.50E+01	3.79E-02	1.60E-07
60-11-7	Dimethyl aminoazobenzene	-	-	-	-

Table A-16 Estimate of Organic Emission from the LAW Feed (RLD21)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
602-87-9	5-Nitroacenaphthene	2.69E-04	1.10E+00	9.30E-04	3.93E-09
60-29-7	Ethyl ether	2.46E-17	1.01E-13	8.51E-17	3.60E-22
60-35-5	Acetamide	2.52E-03	1.03E+01	8.70E-03	3.68E-08
606-20-2	2,6-Dinitrotoluene	1.92E-03	7.87E+00	6.62E-03	2.80E-08
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	1.03E-12	4.21E-09	3.55E-12	1.50E-17
608-93-5	Pentachlorobenzene	-	-	-	-
61626-71-9	Dichloropentadiene	-	-	-	-
621-64-7	N-Nitroso-di-n-propylamine	2.43E-04	9.98E-01	8.40E-04	3.55E-09
624-83-9	Methyl isocyanate	-	-	-	-
62-50-0	Ethyl methanesulfonate	-	-	-	-
62-53-3	Aniline	-	-	-	-
62-75-9	N-Nitroso-N,N-dimethylamine	1.69E-06	6.93E-03	5.83E-06	2.46E-11
628-73-9	Hexanenitrile	1.11E-08	4.57E-05	3.85E-08	1.63E-13
630-20-6	1,1,1,2-Tetrachloroethane	1.08E-15	4.43E-12	3.73E-15	1.58E-20
64-18-6	Formic acid (methanoic acid)	-	-	-	-
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	2.20E-11	9.02E-08	7.60E-11	3.21E-16
65-85-0	Benzoic acid	-	-	-	-
67-56-1	Methyl alcohol	4.14E-05	1.70E-01	1.43E-04	6.04E-10
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	3.96E-12	1.62E-08	1.37E-11	5.78E-17
67-63-0	2-Propyl alcohol	1.14E-08	4.66E-05	3.92E-08	1.66E-13
67-64-1	2-Propanone (Acetone)	1.42E-03	5.83E+00	4.91E-03	2.08E-08
67-66-3	Chloroform	8.51E-06	3.49E-02	2.94E-05	1.24E-10

Table A-16 Estimate of Organic Emission from the LAW Feed (RLD21)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
67-72-1	Hexachloroethane	1.39E-18	5.71E-15	4.81E-18	2.03E-23
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	1.85E-11	7.58E-08	6.39E-11	2.70E-16
70-30-4	Hexachlorophene	-	-	-	-
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	1.44E-11	5.89E-08	4.96E-11	2.10E-16
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	2.40E-12	9.84E-09	8.28E-12	3.50E-17
71-36-3	n-Butyl alcohol	2.89E-07	1.19E-03	9.99E-07	4.22E-12
71-43-2	Benzene	5.63E-06	2.31E-02	1.94E-05	8.21E-11
71-55-6	1,1,1-Trichloroethane	-	-	-	-
72-43-5	Methoxychlor	-	-	-	-
72-55-9	4,4-DDE	2.14E-06	8.78E-03	7.39E-06	3.12E-11
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	6.26E-13	2.57E-09	2.16E-12	9.14E-18
7439-97-6	Mercury	-	-	-	-
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	4.67E-12	1.91E-08	1.61E-11	6.81E-17
74-83-9	Bromomethane	5.06E-06	2.07E-02	1.75E-05	7.38E-11
74-87-3	Chloromethane	3.58E-06	1.47E-02	1.24E-05	5.22E-11
74-88-4	Iodomethane	5.71E-06	2.34E-02	1.97E-05	8.34E-11
74-95-3	Methylene bromide	-	-	-	-
74-97-5	Bromochloromethane	-	-	-	-
75-00-3	Chloroethane	6.73E-25	2.76E-21	2.33E-24	9.83E-30
75-01-4	1-Chloroethene	-	-	-	-
75-02-5	Fluoroethene (vinyl fluoride)	-	-	-	-
75-05-8	Acetonitrile	1.55E-02	6.34E+01	5.34E-02	2.26E-07

Table A-16 Estimate of Organic Emission from the LAW Feed (RLD21)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
75-07-0	Acetaldehyde	3.08E-08	1.26E-04	1.06E-07	4.50E-13
75-09-2	Dichloromethane (Methylene Chloride)	3.73E-04	1.53E+00	1.29E-03	5.44E-09
75-15-0	Carbon disulfide	1.06E-06	4.34E-03	3.65E-06	1.54E-11
75-21-8	Ethylene oxide (Oxirane)	4.09E-12	1.68E-08	1.41E-11	5.97E-17
75-25-2	Bromoform	4.83E-09	1.98E-05	1.67E-08	7.04E-14
75-27-4	Bromodichloromethane	3.10E-14	1.27E-10	1.07E-13	4.53E-19
75-29-6	2-Chloropropane	-	-	-	-
75-34-3	1,1-Dichloroethane	7.44E-24	3.05E-20	2.57E-23	1.09E-28
75-35-4	1,1-Dichloroethene	-	-	-	-
75-44-5	Phosgene (hydrogen phosphide)	-	-	-	-
75-45-6	Chlorodifluoromethane	-	-	-	-
75-50-3	Trimethylamine	9.41E-09	3.86E-05	3.25E-08	1.37E-13
75-69-4	Trichlorofluoromethane	-	-	-	-
75-71-8	Dichlorodifluoromethane	-	-	-	-
76-01-7	Pentachloroethane	-	-	-	-
76-13-1	1,2,2-Trichlorotrifluoroethane	-	-	-	-
764-41-0	1,4-Dichloro-2-butene	-	-	-	-
76-44-8	Heptachlor	-	-	-	-
765-34-4	Glycidylaldehyde	-	-	-	-
7664-41-7	Ammonia/Ammonium	4.57E-02	1.87E+02	1.58E-01	6.67E-07
77-47-4	Hexachlorocyclopentadiene	4.02E-06	1.65E-02	1.39E-05	5.86E-11
77-78-1	Dimethyl sulfate	-	-	-	-

Table A-16 Estimate of Organic Emission from the LAW Feed (RLD21)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
78-83-1	2-Methylpropyl alcohol	1.38E-04	5.65E-01	4.76E-04	2.01E-09
78-87-5	1,2-Dichloropropane	8.65E-22	3.55E-18	2.99E-21	1.26E-26
78-93-3	2-Butanone	5.12E-04	2.10E+00	1.77E-03	7.47E-09
79-00-5	1,1,2-Trichloroethane	1.36E-18	5.59E-15	4.71E-18	1.99E-23
79-01-6	1,1,2-Trichloroethylene	3.15E-06	1.29E-02	1.09E-05	4.60E-11
79-10-7	2-Propenoic acid	1.38E-03	5.67E+00	4.77E-03	2.02E-08
79-34-5	1,1,2,2-Tetrachloroethane	3.93E-16	1.61E-12	1.36E-15	5.73E-21
79-46-9	2-Nitropropane	1.19E-11	4.89E-08	4.12E-11	1.74E-16
80-62-6	Methyl methacrylate	-	-	-	-
822-06-0	Hexamethylene-1,5-diisocyanate	-	-	-	-
823-40-5	Toluene-2,6-diamine	-	-	-	-
82-68-8	Pentachloronitrobenzene (PCNB)	4.36E-14	1.79E-10	1.51E-13	6.36E-19
832-69-9	1-Methylphenanthrene	-	-	-	-
83-32-9	Acenaphthene	4.85E-05	1.99E-01	1.68E-04	7.08E-10
84-66-2	Diethyl phthalate	3.14E-03	1.29E+01	1.08E-02	4.58E-08
84-74-2	Di-n-butylphthalate	1.08E-02	4.42E+01	3.72E-02	1.57E-07
85-01-8	Phenanthrene	2.82E-04	1.15E+00	9.72E-04	4.11E-09
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	-	-	-	-
85-68-7	Butylbenzylphthalate	3.37E-03	1.38E+01	1.16E-02	4.92E-08
86-73-7	Fluorene	1.36E-04	5.57E-01	4.69E-04	1.98E-09
87-61-6	1,2,3-Trichlorobenzene	-	-	-	-
87-68-3	Hexachlorobutadiene	3.19E-22	1.31E-18	1.10E-21	4.66E-27

Table A-16 Estimate of Organic Emission from the LAW Feed (RLD21)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
87-86-5	Pentachlorophenol	3.60E-05	1.48E-01	1.24E-04	5.26E-10
88-06-2	2,4,6-Trichlorophenol	3.76E-05	1.54E-01	1.30E-04	5.49E-10
88-74-4	o-Nitroaniline (2-nitroaniline)	1.80E-03	7.40E+00	6.23E-03	2.63E-08
88-75-5	2-Nitrophenol	1.52E-03	6.23E+00	5.25E-03	2.22E-08
90-04-0	o-Anisidine	-	-	-	-
90-12-0	1-Methylnaphthalene	-	-	-	-
91-20-3	Naphthalene	2.30E-03	9.43E+00	7.94E-03	3.35E-08
91-22-5	Quinoline	-	-	-	-
91-57-6	2-Methylnaphthalene	1.55E-04	6.37E-01	5.37E-04	2.27E-09
91-58-7	2-Chloronaphthalene	4.68E-11	1.92E-07	1.62E-10	6.82E-16
91-94-1	3,3'-Dichlorobenzidine	1.08E-02	4.45E+01	3.74E-02	1.58E-07
924-16-3	N-Nitroso-di-n-Buetylamine	-	-	-	-
92-52-4	1,1`-Biphenyl	1.31E-13	5.36E-10	4.51E-13	1.91E-18
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	-	-	-	-
94-75-7	2,4-D	-	-	-	-
95-48-7	o-Cresol	6.16E-04	2.53E+00	2.13E-03	9.00E-09
95-49-8	o-Chlorotoluene	-	-	-	-
95-50-1	1,2-Dichlorobenzene	1.07E-17	4.37E-14	3.68E-17	1.56E-22
95-53-4	o-Toluidine	-	-	-	-
95-57-8	2-Chlorophenol	5.29E-11	2.17E-07	1.83E-10	7.72E-16
95-63-6	1,2,4-Trimethyl benzene	-	-	-	-
95-94-3	1,2,4,5-Tetrachlorobenzene	-	-	-	-

Table A-16 Estimate of Organic Emission from the LAW Feed (RLD21)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction WF (mg/kg)	Weight Ratio WR (unitless)	Individual Organic Release R_{IO} (g/s)
95-95-4	2,4,5-Trichlorophenol	9.58E-05	3.93E-01	3.31E-04	1.40E-09
96-12-8	1,2-Dibromo-3-chloropropane	-	-	-	-
96-18-4	1,2,3-Trichloropropane	-	-	-	-
96-45-7	Ethylene thiourea	-	-	-	-
97-63-2	Ethyl methacrylate	-	-	-	-
98-01-1	Furfural	-	-	-	-
98-06-6	tert-Butyl benzene	-	-	-	-
98-07-7	Benzotrichloride	-	-	-	-
98-82-8	Cumene	-	-	-	-
98-83-9	Methyl styrene (mixed isomers)	-	-	-	-
98-86-2	Acetophenone	4.20E-08	1.72E-04	1.45E-07	6.12E-13
98-95-3	Nitrobenzene	3.12E-04	1.28E+00	1.08E-03	4.55E-09
99-35-4	1,3,5-Trinitrobenzene	-	-	-	-
99-65-0	1,3-Dinitrobenzene	-	-	-	-
99-87-6	p-Cymene	-	-	-	-
			Weight Fraction Sum = WF_s =	1.19E+03	
				Weight Ratio Sum = WR_s =	1.00E+00
					Feed Stream Sum = 3.82E-06

The following indicates the stream properties for feed into the HLW Facility from the HCP feed used to calculate the weight fraction:

$$WF = \frac{(Q_m * 1000)}{\left(Q_v * \frac{\rho}{60 * 60}\right)}$$

Where:

Q_m = compound mass flow rate (g/s)
Q_v = volumetric flow rate (m^3/hr) = 8.69E-01
ρ = density (kg/m^3) = 1084.409

A "-" symbol indicates no data are available for approximating the emissions rate (no data were available, or the corresponding values were below the emissions model tolerance).

Table A-17 Estimate of Organic Emission from the HLW Feed (HCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
100-02-7	p-Nitrophenol	2.88E-03	1.10E+01	2.41E-02	7.03E-10
100-21-0	Phthalic acid	1.20E-03	4.57E+00	9.98E-03	2.92E-10
100-25-4	1,4-Dinitrobenzene	5.24E-06	2.00E-02	4.37E-05	1.28E-12
10028-17-8	Tritium	8.48E-08	3.24E-04	7.10E-07	2.07E-14
100-40-3	4-Ethenylcyclohexene	2.66E-04	1.02E+00	2.22E-03	6.50E-11
100-41-4	Ethyl benzene	7.27E-09	2.78E-05	6.07E-08	1.77E-15
100-42-5	Styrene	3.49E-09	1.33E-05	2.91E-08	8.51E-16
100-44-7	Benzyl chloride	-	-	-	-
100-47-0	Benzonitrile	-	-	-	-
100-51-6	Benzyl alcohol	-	-	-	-
100-52-7	Benzaldehyde	-	-	-	-
10061-01-5	cis-1,3-Dichloropropene	1.29E-08	4.91E-05	1.07E-07	3.14E-15

Table A-17 Estimate of Organic Emission from the HLW Feed (HCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
10061-02-6	trans-1,3-Dichloropropene	1.34E-08	5.13E-05	1.12E-07	3.28E-15
101-55-3	4-Bromophenylphenyl ether	4.09E-04	1.56E+00	3.42E-03	9.99E-11
101-77-9	4,4-Methylenedianiline	-	-	-	-
103-33-3	Azobenzene	-	-	-	-
103-65-1	n-Propyl benzene (Isocumene)	-	-	-	-
104-51-8	n-Butylbenzene	-	-	-	-
104-76-7	2-Ethyl-1-hexanol	3.30E-04	1.26E+00	2.75E-03	8.04E-11
105-67-9	2,4-Dimethylphenol	1.04E-03	3.97E+00	8.67E-03	2.54E-10
10595-95-6	n-Nitrosomethylethylamine	1.04E-03	3.96E+00	8.66E-03	2.53E-10
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	-	-	-	-
106-44-5	p-Cresol (4-methyl phenol)	-	-	-	-
106-46-7	1,4-Dichlorobenzene	2.21E-06	8.43E-03	1.84E-05	5.38E-13
106-47-8	p-Chloroaniline	1.18E-03	4.50E+00	9.83E-03	2.88E-10
106-49-0	p-Toluidine	-	-	-	-
106-51-4	Quinone	-	-	-	-
106-88-7	1,2-Epoxybutane	3.55E-04	1.36E+00	2.97E-03	8.67E-11
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	-	-	-	-
106-93-4	Ethylene dibromide	3.48E-09	1.33E-05	2.91E-08	8.50E-16
106-99-0	1,3-Butadiene	1.17E-07	4.47E-04	9.76E-07	2.85E-14
107-02-8	Acrolein	1.89E-07	7.22E-04	1.58E-06	4.61E-14
107-05-1	3-Chloropropene	1.29E-08	4.91E-05	1.07E-07	3.14E-15

Table A-17 Estimate of Organic Emission from the HLW Feed (HCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
107-06-2	1,2-Dichloroethane	4.54E-09	1.73E-05	3.79E-08	1.11E-15
107-12-0	Propionitrile	1.19E-06	4.56E-03	9.96E-06	2.91E-13
107-13-1	Acrylonitrile	1.96E-06	7.51E-03	1.64E-05	4.80E-13
107-19-7	Propargyl alcohol	-	-	-	-
107-21-1	Ethylene glycol (1,2-ethanediol)	-	-	-	-
107-98-2	Propylene glycol monomethyl ether	-	-	-	-
108-05-4	Acetic acid vinyl ester	4.24E-04	1.62E+00	3.54E-03	1.04E-10
108-10-1	4-Methyl-2-pentanone	4.53E-08	1.73E-04	3.78E-07	1.11E-14
108-39-4	m-Cresol	1.83E-03	6.99E+00	1.53E-02	4.47E-10
108-60-1	bis (2-Chloroisopropyl)ether	-	-	-	-
108-67-8	1,3,5-Trimethylbenzene	-	-	-	-
108-86-1	Bromobenzene (Phenyl bromide)	-	-	-	-
108-87-2	Methylcyclohexane	1.48E-08	5.65E-05	1.24E-07	3.61E-15
108-88-3	Toluene	1.82E-08	6.94E-05	1.52E-07	4.43E-15
108-90-7	Chlorobenzene	4.19E-09	1.60E-05	3.50E-08	1.02E-15
108-94-1	Cyclohexanone	1.49E-05	5.71E-02	1.25E-04	3.65E-12
108-95-2	Phenol	3.26E-04	1.25E+00	2.72E-03	7.96E-11
109-74-0	n-Butanenitrile	3.42E-04	1.31E+00	2.85E-03	8.35E-11
109-75-1	3-Butenenitrile	-	-	-	-
109-77-3	Malononitrile	-	-	-	-
109-86-4	2-Methoxyethanol	-	-	-	-

Table A-17 Estimate of Organic Emission from the HLW Feed (HCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
109-99-9	Tetrahydrofuran	1.40E-07	5.36E-04	1.17E-06	3.42E-14
110-00-9	Furan	-	-	-	-
110-54-3	n-Hexane	6.78E-07	2.59E-03	5.66E-06	1.66E-13
110-59-8	Pentanenitrile	3.28E-04	1.25E+00	2.74E-03	8.01E-11
110-80-5	2-Ethoxyethanol	5.15E-03	1.97E+01	4.30E-02	1.26E-09
110-82-7	Cyclohexane	1.29E-08	4.91E-05	1.07E-07	3.14E-15
110-83-8	Cyclohexene	1.29E-08	4.91E-05	1.07E-07	3.14E-15
110-86-1	Pyridine	3.62E-06	1.38E-02	3.02E-05	8.83E-13
111-15-9	Ethylene glycol monoethyl ether acetate	-	-	-	-
111-44-4	bis(2-Chloroethyl)ether	2.62E-05	1.00E-01	2.18E-04	6.39E-12
111-65-9	n-Octane	1.55E-07	5.92E-04	1.29E-06	3.78E-14
111-76-2	2-Butoxyethanol	6.83E-04	2.61E+00	5.70E-03	1.67E-10
111-84-2	n-Nonane	1.04E-07	3.97E-04	8.67E-07	2.54E-14
111-91-1	bis(2-Chloroethoxy)methane	1.40E-04	5.36E-01	1.17E-03	3.42E-11
1120-21-4	Undecane	-	-	-	-
1120-71-4	1,3-Propane sultone	-	-	-	-
112-30-1	1-Decanol	-	-	-	-
112-31-2	Decanal	-	-	-	-
112-40-3	Dodecane	-	-	-	-
117-81-7	Bis(2-ethylhexyl) phthalate	1.65E-03	6.31E+00	1.38E-02	4.03E-10
117-84-0	Di-n-octylphthalate	1.41E-03	5.37E+00	1.17E-02	3.43E-10

Table A-17 Estimate of Organic Emission from the HLW Feed (HCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
118-74-1	Hexachlorobenzene	7.34E-09	2.80E-05	6.13E-08	1.79E-15
119-90-4	3,3'-Dimethoxybenzidine	-	-	-	-
120-12-7	Anthracene	2.53E-04	9.65E-01	2.11E-03	6.17E-11
120-82-1	1,2,4-Trichlorobenzene	2.58E-07	9.85E-04	2.15E-06	6.29E-14
120-83-2	2,4-Dichlorophenol	5.35E-04	2.05E+00	4.47E-03	1.31E-10
121-14-2	2,4-Dinitrotoluene	3.25E-03	1.24E+01	2.72E-02	7.94E-10
122-39-4	N,N-Diphenylamine	6.19E-07	2.37E-03	5.17E-06	1.51E-13
122-66-7	1,2-Diphenylhydrazine	-	-	-	-
123-33-1	Maleic hydrazide	-	-	-	-
123-38-6	Propionaldehyde	4.29E-07	1.64E-03	3.58E-06	1.05E-13
123-72-8	Butanal	3.55E-04	1.36E+00	2.97E-03	8.67E-11
123-91-1	1,4-Dioxan	1.77E-07	6.78E-04	1.48E-06	4.33E-14
124-18-5	Decane	-	-	-	-
124-38-9	Carbon dioxide	-	-	-	-
124-48-1	Chlorodibromomethane	1.18E-09	4.52E-06	9.87E-09	2.88E-16
126-73-8	Tributyl phosphate	6.71E-04	2.56E+00	5.60E-03	1.64E-10
126-98-7	2-Methyl-2-propenenitrile	1.29E-07	4.91E-04	1.07E-06	3.14E-14
127-18-4	1,1,2,2-Tetrachloroethene	4.24E-09	1.62E-05	3.54E-08	1.03E-15
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	9.00E-06	3.44E-02	7.51E-05	2.20E-12
129-00-0	Pyrene	1.46E-03	5.57E+00	1.22E-02	3.56E-10
131-11-3	Dimethyl Phthalate	8.63E-05	3.30E-01	7.20E-04	2.11E-11

Table A-17 Estimate of Organic Emission from the HLW Feed (HCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	-	-	-	-
132-64-9	Dibenzofuran	4.80E-08	1.83E-04	4.00E-07	1.17E-14
1330-20-7	Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations)	1.24E-06	4.75E-03	1.04E-05	3.03E-13
133-06-2	Captan	-	-	-	-
1336-36-3	Polychlorinated biphenyls (1254 Aroclor)	5.65E-04	2.16E+00	4.72E-03	1.38E-10
134-32-7	alpha-Naphthylamine	6.27E-04	2.40E+00	5.24E-03	1.53E-10
135-98-8	sec-Butylbenzene	-	-	-	-
141-78-6	Acetic acid ethyl ester	1.37E-08	5.25E-05	1.15E-07	3.35E-15
145-73-3	Endothall	-	-	-	-
156-59-2	cis-1,2-Dichloroethene	-	-	-	-
156-60-5	1,2-trans-Dichloroethene	9.55E-04	3.65E+00	7.97E-03	2.33E-10
1634-04-4	Methyl tert-butyl ether	3.47E-04	1.33E+00	2.90E-03	8.48E-11
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	2.82E-14	1.08E-10	2.36E-13	6.89E-21
189-55-9	Dibenzo[a,i]pyrene	5.66E-04	2.16E+00	4.73E-03	1.38E-10
189-64-0	Dibenzo[a,h]pyrene	5.66E-04	2.16E+00	4.73E-03	1.38E-10
191-24-2	Benzo(g,h,i)perylene	8.21E-04	3.14E+00	6.86E-03	2.00E-10
191-30-0	Dibenzo(a,l)pyrene	5.66E-04	2.16E+00	4.73E-03	1.38E-10
192-65-4	Dibenzo[a,e]pyrene	5.66E-04	2.16E+00	4.73E-03	1.38E-10
192-97-2	Benzo(e)pyrene	-	-	-	-
193-39-5	Indeno(1,2,3-cd)pyrene	7.56E-04	2.89E+00	6.31E-03	1.84E-10
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	1.79E-14	6.84E-11	1.49E-13	4.37E-21

Table A-17 Estimate of Organic Emission from the HLW Feed (HCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
205-82-3	Benzo[j]fluoranthene	-	-	-	-
205-99-2	Benzo(b)fluoranthene	1.09E-04	4.15E-01	9.06E-04	2.65E-11
206-44-0	Fluoranthene	1.34E-03	5.13E+00	1.12E-02	3.28E-10
207-08-9	Benzo(k)fluoranthene	3.99E-04	1.52E+00	3.33E-03	9.73E-11
208-96-8	Acenaphthylene	2.50E-04	9.56E-01	2.09E-03	6.11E-11
218-01-9	Chrysene	6.82E-07	2.61E-03	5.69E-06	1.67E-13
224-42-0	Dibenz[a,j]acridine	6.42E-04	2.45E+00	5.36E-03	1.57E-10
2245-38-7	2,3,5-Trimethylnaphthalene	-	-	-	-
226-36-8	Dibenz[a,h]acridine	6.03E-04	2.30E+00	5.03E-03	1.47E-10
23950-58-5	Pronamide	-	-	-	-
27154-33-2	Trichlorofluoroethane	1.49E-03	5.70E+00	1.24E-02	3.64E-10
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	1.31E-14	5.01E-11	1.09E-13	3.20E-21
319-84-6	alpha-BHC	1.64E-08	6.27E-05	1.37E-07	4.01E-15
319-85-7	beta-BHC	1.92E-05	7.34E-02	1.60E-04	4.69E-12
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	1.13E-10	4.30E-07	9.40E-10	2.75E-17
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	8.22E-17	3.14E-13	6.86E-16	2.01E-23
3268-87-9	Octachlorodibenzo(p)dioxin	7.19E-12	2.75E-08	6.00E-11	1.76E-18
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	1.25E-13	4.76E-10	1.04E-12	3.04E-20
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	7.88E-13	3.01E-09	6.57E-12	1.92E-19
3697-24-3	5-Methylchrysene	3.34E-04	1.28E+00	2.79E-03	8.15E-11
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	2.07E-14	7.92E-11	1.73E-13	5.06E-21

Table A-17 Estimate of Organic Emission from the HLW Feed (HCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
39001-02-0	Octachlorodibenzofuran	2.30E-12	8.81E-09	1.92E-11	5.63E-19
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	1.81E-13	6.92E-10	1.51E-12	4.42E-20
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	1.08E-13	4.14E-10	9.04E-13	2.64E-20
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	1.00E-12	3.84E-09	8.38E-12	2.45E-19
4170-30-3	Crotonaldehyde (Propylene aldehyde)	1.76E-07	6.71E-04	1.47E-06	4.28E-14
41851-50-7	Chlorocyclopentadiene	-	-	-	-
460-19-5	Cyanogen (oxalonitrile)	-	-	-	-
4786-20-3	2-Butenenitrile	-	-	-	-
50-00-0	Formaldehyde	1.25E-03	4.77E+00	1.04E-02	3.05E-10
50-32-8	Benzo(a)pyrene	1.71E-04	6.52E-01	1.43E-03	4.17E-11
506-68-3	Cyanogen bromide (bromocyanide)	-	-	-	-
506-77-4	Cyanogen chloride	-	-	-	-
510-15-6	Chlorobenzilate	-	-	-	-
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	5.40E-13	2.06E-09	4.51E-12	1.32E-19
51-28-5	2,4-Dinitrophenol	2.48E-03	9.48E+00	2.07E-02	6.06E-10
51-79-6	Ethyl carbamate (urethane)	-	-	-	-
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	4.66E-12	1.78E-08	3.89E-11	1.14E-18
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	-	-	-	-
532-27-4	2-Chloroacetophenone	-	-	-	-
534-52-1	4,6-Dinitro-o-cresol	1.43E-03	5.44E+00	1.19E-02	3.48E-10
53-70-3	Dibenz[a,h]anthracene	2.94E-05	1.12E-01	2.45E-04	7.18E-12

Table A-17 Estimate of Organic Emission from the HLW Feed (HCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
5385-75-1	Dibenzo(a,e)fluoranthene	-	-	-	-
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	6.66E-13	2.54E-09	5.56E-12	1.62E-19
540-73-8	1,2-Dimethylhydrazine	-	-	-	-
540-84-1	2,2,4-Trimethylpentane	-	-	-	-
541-73-1	1,3-Dichlorobenzene	1.69E-07	6.45E-04	1.41E-06	4.12E-14
542-75-6	1,3-Dichloropropene	-	-	-	-
542-88-1	bis(Chloromethyl)ether	-	-	-	-
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	1.05E-13	4.03E-10	8.80E-13	2.57E-20
56-23-5	Carbon tetrachloride	6.65E-09	2.54E-05	5.55E-08	1.62E-15
56-49-5	3-Methylcholanthrene	3.39E-04	1.29E+00	2.83E-03	8.27E-11
56-55-3	Benzo(a)anthracene	1.61E-04	6.16E-01	1.35E-03	3.93E-11
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	7.54E-13	2.88E-09	6.30E-12	1.84E-19
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	5.57E-13	2.13E-09	4.65E-12	1.36E-19
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	2.87E-13	1.10E-09	2.40E-12	7.00E-20
57-24-9	Strychnine	-	-	-	-
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	4.05E-12	1.55E-08	3.38E-11	9.88E-19
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	1.63E-13	6.21E-10	1.36E-12	3.97E-20
57-74-9	Chlordane	-	-	-	-
581-42-0	2,6-Dimethylnaphthalene	-	-	-	-
584-84-9	2,4-Toluene diisocyanate	-	-	-	-
58-89-9	gamma-BHC (Lindane)	2.99E-08	1.14E-04	2.50E-07	7.30E-15

Table A-17 Estimate of Organic Emission from the HLW Feed (HCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
58-90-2	2,3,4,6-Tetrachlorophenol	1.07E-03	4.09E+00	8.93E-03	2.61E-10
589-38-8	3-Hexanone	3.29E-04	1.26E+00	2.75E-03	8.03E-11
591-50-4	Benzene, iodo-	-	-	-	-
591-78-6	2-Hexanone	5.56E-07	2.12E-03	4.64E-06	1.36E-13
593-60-2	Bromoethene (Vinyl bromide)	-	-	-	-
593-74-8	Dimethyl Mercury	1.80E-10	6.86E-07	1.50E-09	4.38E-17
59-50-7	4-Chloro-3-methylphenol	1.83E-03	6.98E+00	1.53E-02	4.46E-10
59-89-2	N-Nitrosomorpholine	5.88E-03	2.25E+01	4.91E-02	1.43E-09
60-11-7	Dimethyl aminoazobenzene	-	-	-	-
602-87-9	5-Nitroacenaphthene	6.11E-04	2.34E+00	5.10E-03	1.49E-10
60-29-7	Ethyl ether	4.83E-07	1.85E-03	4.03E-06	1.18E-13
60-35-5	Acetamide	1.25E-03	4.77E+00	1.04E-02	3.05E-10
606-20-2	2,6-Dinitrotoluene	2.55E-04	9.75E-01	2.13E-03	6.23E-11
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	1.00E-13	3.83E-10	8.37E-13	2.45E-20
608-93-5	Pentachlorobenzene	-	-	-	-
61626-71-9	Dichloropentadiene	-	-	-	-
621-64-7	N-Nitroso-di-n-propylamine	1.80E-03	6.89E+00	1.50E-02	4.40E-10
624-83-9	Methyl isocyanate	-	-	-	-
62-50-0	Ethyl methanesulfonate	-	-	-	-
62-53-3	Aniline	-	-	-	-
62-75-9	N-Nitroso-N,N-dimethylamine	9.95E-06	3.80E-02	8.31E-05	2.43E-12

Table A-17 Estimate of Organic Emission from the HLW Feed (HCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
628-73-9	Hexanenitrile	3.19E-04	1.22E+00	2.66E-03	7.79E-11
630-20-6	1,1,1,2-Tetrachloroethane	1.65E-03	6.32E+00	1.38E-02	4.04E-10
64-18-6	Formic acid (methanoic acid)	-	-	-	-
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	3.59E-10	1.37E-06	3.00E-09	8.77E-17
65-85-0	Benzoic acid	-	-	-	-
67-56-1	Methyl alcohol	7.88E-04	3.01E+00	6.58E-03	1.92E-10
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	3.29E-13	1.26E-09	2.75E-12	8.03E-20
67-63-0	2-Propyl alcohol	4.34E-07	1.66E-03	3.62E-06	1.06E-13
67-64-1	2-Propanone (Acetone)	4.30E-05	1.64E-01	3.59E-04	1.05E-11
67-66-3	Chloroform	4.35E-09	1.66E-05	3.63E-08	1.06E-15
67-72-1	Hexachloroethane	5.14E-05	1.96E-01	4.29E-04	1.25E-11
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	3.26E-13	1.25E-09	2.72E-12	7.96E-20
70-30-4	Hexachlorophene	-	-	-	-
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	7.43E-13	2.84E-09	6.20E-12	1.81E-19
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	2.42E-13	9.24E-10	2.02E-12	5.90E-20
71-36-3	n-Butyl alcohol	1.24E-05	4.74E-02	1.04E-04	3.03E-12
71-43-2	Benzene	1.10E-08	4.20E-05	9.18E-08	2.68E-15
71-55-6	1,1,1-Trichloroethane	4.30E-09	1.64E-05	3.59E-08	1.05E-15
72-43-5	Methoxychlor	-	-	-	-
72-55-9	4,4-DDE	4.68E-04	1.79E+00	3.91E-03	1.14E-10
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	6.02E-14	2.30E-10	5.03E-13	1.47E-20

Table A-17 Estimate of Organic Emission from the HLW Feed (HCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
7439-97-6	Mercury	-	-	-	-
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	2.97E-14	1.14E-10	2.48E-13	7.26E-21
74-83-9	Bromomethane	8.69E-09	3.32E-05	7.25E-08	2.12E-15
74-87-3	Chloromethane	1.73E-08	6.61E-05	1.45E-07	4.23E-15
74-88-4	Iodomethane	1.78E-13	6.79E-10	1.48E-12	4.34E-20
74-95-3	Methylene bromide	-	-	-	-
74-97-5	Bromochloromethane	-	-	-	-
75-00-3	Chloroethane	8.69E-09	3.32E-05	7.25E-08	2.12E-15
75-01-4	1-Chloroethene	8.82E-09	3.37E-05	7.36E-08	2.15E-15
75-02-5	Fluoroethene (vinyl fluoride)	4.54E-04	1.73E+00	3.79E-03	1.11E-10
75-05-8	Acetonitrile	4.73E-04	1.81E+00	3.95E-03	1.15E-10
75-07-0	Acetaldehyde	4.35E-04	1.66E+00	3.63E-03	1.06E-10
75-09-2	Dichloromethane (Methylene Chloride)	2.58E-06	9.84E-03	2.15E-05	6.29E-13
75-15-0	Carbon disulfide	6.45E-18	2.46E-14	5.38E-17	1.57E-24
75-21-8	Ethylene oxide (Oxirane)	7.49E-07	2.86E-03	6.25E-06	1.83E-13
75-25-2	Bromoform	-	-	-	-
75-27-4	Bromodichloromethane	3.23E-03	1.23E+01	2.70E-02	7.88E-10
75-29-6	2-Chloropropane	-	-	-	-
75-34-3	1,1-Dichloroethane	3.48E-09	1.33E-05	2.91E-08	8.50E-16
75-35-4	1,1-Dichloroethene	5.48E-09	2.09E-05	4.57E-08	1.34E-15
75-44-5	Phosgene (hydrogen phosphide)	-	-	-	-

Table A-17 Estimate of Organic Emission from the HLW Feed (HCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
75-45-6	Chlorodifluoromethane	1.29E-08	4.91E-05	1.07E-07	3.14E-15
75-50-3	Trimethylamine	3.88E-04	1.48E+00	3.24E-03	9.48E-11
75-69-4	Trichlorofluoromethane	1.06E-08	4.04E-05	8.83E-08	2.58E-15
75-71-8	Dichlorodifluoromethane	1.08E-08	4.12E-05	8.99E-08	2.63E-15
76-01-7	Pentachloroethane	-	-	-	-
76-13-1	1,2,2-Trichlorotrifluoroethane	1.06E-08	4.07E-05	8.89E-08	2.60E-15
764-41-0	1,4-Dichloro-2-butene	-	-	-	-
76-44-8	Heptachlor	1.00E-08	3.82E-05	8.35E-08	2.44E-15
765-34-4	Glycidylaldehyde	-	-	-	-
7664-41-7	Ammonia/Ammonium	1.27E-02	4.86E+01	1.06E-01	3.11E-09
77-47-4	Hexachlorocyclopentadiene	8.61E-17	3.29E-13	7.19E-16	2.10E-23
77-78-1	Dimethyl sulfate	-	-	-	-
78-83-1	2-Methylpropyl alcohol	7.06E-03	2.70E+01	5.89E-02	1.72E-09
78-87-5	1,2-Dichloropropane	3.48E-09	1.33E-05	2.91E-08	8.50E-16
78-93-3	2-Butanone	9.13E-06	3.49E-02	7.62E-05	2.23E-12
79-00-5	1,1,2-Trichloroethane	4.08E-09	1.56E-05	3.41E-08	9.96E-16
79-01-6	1,1,2-Trichloroethylene	4.64E-09	1.77E-05	3.87E-08	1.13E-15
79-10-7	2-Propenoic acid	1.94E-03	7.41E+00	1.62E-02	4.73E-10
79-34-5	1,1,2,2-Tetrachloroethane	4.08E-09	1.56E-05	3.41E-08	9.97E-16
79-46-9	2-Nitropropane	8.60E-07	3.29E-03	7.18E-06	2.10E-13
80-62-6	Methyl methacrylate	-	-	-	-

Table A-17 Estimate of Organic Emission from the HLW Feed (HCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
822-06-0	Hexamethylene-1,5-diisocyanate	-	-	-	-
823-40-5	Toluene-2,6-diamine	-	-	-	-
82-68-8	Pentachloronitrobenzene (PCNB)	8.12E-07	3.10E-03	6.78E-06	1.98E-13
832-69-9	1-Methylphenanthrene	-	-	-	-
83-32-9	Acenaphthene	1.23E-03	4.71E+00	1.03E-02	3.01E-10
84-66-2	Diethyl phthalate	1.03E-03	3.94E+00	8.61E-03	2.52E-10
84-74-2	Di-n-butylphthalate	1.40E-02	5.35E+01	1.17E-01	3.42E-09
85-01-8	Phenanthrene	2.74E-04	1.05E+00	2.29E-03	6.70E-11
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	-	-	-	-
85-68-7	Butylbenzylphthalate	4.64E-03	1.77E+01	3.87E-02	1.13E-09
86-73-7	Fluorene	2.54E-04	9.71E-01	2.12E-03	6.21E-11
87-61-6	1,2,3-Trichlorobenzene	-	-	-	-
87-68-3	Hexachlorobutadiene	2.21E-06	8.43E-03	1.84E-05	5.39E-13
87-86-5	Pentachlorophenol	5.30E-06	2.02E-02	4.42E-05	1.29E-12
88-06-2	2,4,6-Trichlorophenol	1.33E-03	5.09E+00	1.11E-02	3.25E-10
88-74-4	o-Nitroaniline (2-nitroaniline)	1.20E-04	4.58E-01	1.00E-03	2.93E-11
88-75-5	2-Nitrophenol	1.45E-03	5.55E+00	1.21E-02	3.55E-10
90-04-0	o-Anisidine	-	-	-	-
90-12-0	1-Methylnaphthalene	-	-	-	-
91-20-3	Naphthalene	1.15E-03	4.40E+00	9.62E-03	2.81E-10
91-22-5	Quinoline	-	-	-	-

Table A-17 Estimate of Organic Emission from the HLW Feed (HCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
91-57-6	2-Methylnaphthalene	2.66E-07	1.02E-03	2.22E-06	6.50E-14
91-58-7	2-Chloronaphthalene	3.21E-04	1.22E+00	2.68E-03	7.82E-11
91-94-1	3,3'-Dichlorobenzidine	4.89E-04	1.87E+00	4.08E-03	1.19E-10
924-16-3	N-Nitroso-di-n-Buetylamine	-	-	-	-
92-52-4	1,1`-Biphenyl	8.12E-07	3.10E-03	6.78E-06	1.98E-13
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	-	-	-	-
94-75-7	2,4-D	-	-	-	-
95-48-7	o-Cresol	2.41E-03	9.21E+00	2.01E-02	5.88E-10
95-49-8	o-Chlorotoluene	-	-	-	-
95-50-1	1,2-Dichlorobenzene	3.36E-06	1.28E-02	2.81E-05	8.21E-13
95-53-4	o-Toluidine	-	-	-	-
95-57-8	2-Chlorophenol	1.17E-03	4.46E+00	9.75E-03	2.85E-10
95-63-6	1,2,4-Trimethyl benzene	-	-	-	-
95-94-3	1,2,4,5-Tetrachlorobenzene	-	-	-	-
95-95-4	2,4,5-Trichlorophenol	1.50E-03	5.73E+00	1.25E-02	3.66E-10
96-12-8	1,2-Dibromo-3-chloropropane	-	-	-	-
96-18-4	1,2,3-Trichloropropane	-	-	-	-
96-45-7	Ethylene thiourea	-	-	-	-
97-63-2	Ethyl methacrylate	-	-	-	-
98-01-1	Furfural	-	-	-	-
98-06-6	tert-Butyl benzene	-	-	-	-

Table A-17 Estimate of Organic Emission from the HLW Feed (HCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction WF (mg/kg)	Weight Ratio WR (unitless)	Individual Organic Release R_{IO} (g/s)
98-07-7	Benzotrichloride	-	-	-	-
98-82-8	Cumene	2.62E-04	1.00E+00	2.19E-03	6.40E-11
98-83-9	Methyl styrene (mixed isomers)	-	-	-	-
98-86-2	Acetophenone	1.21E-06	4.61E-03	1.01E-05	2.94E-13
98-95-3	Nitrobenzene	1.81E-05	6.93E-02	1.51E-04	4.42E-12
99-35-4	1,3,5-Trinitrobenzene	-	-	-	-
99-65-0	1,3-Dinitrobenzene	-	-	-	-
99-87-6	p-Cymene	-	-	-	-
			Weight Fraction Sum = WF_s =	4.56E+02	
				Weight Ratio Sum = WR_s =	1.00E+00
					Feed Stream Sum = 2.92E-08

The following indicates the stream properties for feed into the HLW Facility from the HFP feed used to calculate the weight fraction:

$$WF = \frac{(Q_m * 1000)}{\left(Q_v * \frac{\rho}{60 * 60}\right)}$$

Where:

Q_m = compound mass flow rate (g/s)
Q_v = volumetric flow rate (m^3/hr) = 9.47E-01
ρ = density (kg/m^3) = 1252.035

A "-" symbol indicates no data are available for approximating the emissions rate (no data were available, or the corresponding values were below the emissions model tolerance).

Table A-18 Estimate of Organic Emission from the HLW Feed (HFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
100-02-7	p-Nitrophenol	2.88E-03	8.75E+00	2.45E-02	5.40E-07
100-21-0	Phthalic acid	1.20E-03	3.63E+00	1.02E-02	2.24E-07
100-25-4	1,4-Dinitrobenzene	5.19E-06	1.58E-02	4.42E-05	9.72E-10
10028-17-8	Tritium	8.48E-08	2.57E-04	7.22E-07	1.59E-11
100-40-3	4-Ethenylcyclohexene	2.66E-04	8.09E-01	2.26E-03	4.99E-08
100-41-4	Ethyl benzene	7.27E-09	2.21E-05	6.17E-08	1.36E-12
100-42-5	Styrene	3.48E-09	1.06E-05	2.96E-08	6.52E-13
100-44-7	Benzyl chloride	-	-	-	-
100-47-0	Benzonitrile	-	-	-	-
100-51-6	Benzyl alcohol	-	-	-	-
100-52-7	Benzaldehyde	-	-	-	-
10061-01-5	cis-1,3-Dichloropropene	1.29E-08	3.90E-05	1.09E-07	2.41E-12

Table A-18 Estimate of Organic Emission from the HLW Feed (HFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
10061-02-6	trans-1,3-Dichloropropene	1.34E-08	4.07E-05	1.14E-07	2.51E-12
101-55-3	4-Bromophenylphenyl ether	4.09E-04	1.24E+00	3.47E-03	7.66E-08
101-77-9	4,4-Methylenedianiline	-	-	-	-
103-33-3	Azobenzene	-	-	-	-
103-65-1	n-Propyl benzene (Isocumene)	-	-	-	-
104-51-8	n-Butylbenzene	-	-	-	-
104-76-7	2-Ethyl-1-hexanol	3.25E-04	9.87E-01	2.76E-03	6.09E-08
105-67-9	2,4-Dimethylphenol	9.79E-04	2.97E+00	8.31E-03	1.83E-07
10595-95-6	n-Nitrosomethylethylamine	1.02E-03	3.09E+00	8.64E-03	1.91E-07
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	-	-	-	-
106-44-5	p-Cresol (4-methyl phenol)	-	-	-	-
106-46-7	1,4-Dichlorobenzene	2.21E-06	6.70E-03	1.87E-05	4.13E-10
106-47-8	p-Chloroaniline	1.14E-03	3.45E+00	9.66E-03	2.13E-07
106-49-0	p-Toluidine	-	-	-	-
106-51-4	Quinone	-	-	-	-
106-88-7	1,2-Epoxybutane	3.55E-04	1.08E+00	3.02E-03	6.65E-08
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	-	-	-	-
106-93-4	Ethylene dibromide	3.48E-09	1.06E-05	2.96E-08	6.52E-13
106-99-0	1,3-Butadiene	1.17E-07	3.55E-04	9.92E-07	2.19E-11
107-02-8	Acrolein	1.89E-07	5.73E-04	1.60E-06	3.54E-11
107-05-1	3-Chloropropene	1.29E-08	3.90E-05	1.09E-07	2.41E-12
107-06-2	1,2-Dichloroethane	4.07E-09	1.24E-05	3.46E-08	7.63E-13

Table A-18 Estimate of Organic Emission from the HLW Feed (HFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
107-12-0	Propionitrile	1.18E-06	3.60E-03	1.01E-05	2.22E-10
107-13-1	Acrylonitrile	4.14E-07	1.26E-03	3.51E-06	7.75E-11
107-19-7	Propargyl alcohol	-	-	-	-
107-21-1	Ethylene glycol (1,2-ethanediol)	-	-	-	-
107-98-2	Propylene glycol monomethyl ether	-	-	-	-
108-05-4	Acetic acid vinyl ester	4.24E-04	1.29E+00	3.60E-03	7.94E-08
108-10-1	4-Methyl-2-pentanone	4.53E-08	1.37E-04	3.84E-07	8.48E-12
108-39-4	m-Cresol	1.81E-03	5.49E+00	1.53E-02	3.38E-07
108-60-1	bis (2-Chloroisopropyl)ether	-	-	-	-
108-67-8	1,3,5-Trimethylbenzene	-	-	-	-
108-86-1	Bromobenzene (Phenyl bromide)	-	-	-	-
108-87-2	Methylcyclohexane	1.48E-08	4.49E-05	1.26E-07	2.77E-12
108-88-3	Toluene	1.82E-08	5.51E-05	1.54E-07	3.40E-12
108-90-7	Chlorobenzene	4.19E-09	1.27E-05	3.56E-08	7.85E-13
108-94-1	Cyclohexanone	1.44E-05	4.37E-02	1.22E-04	2.70E-09
108-95-2	Phenol	3.22E-04	9.78E-01	2.74E-03	6.04E-08
109-74-0	n-Butanenitrile	3.41E-04	1.03E+00	2.89E-03	6.38E-08
109-75-1	3-Butenenitrile	-	-	-	-
109-77-3	Malononitrile	-	-	-	-
109-86-4	2-Methoxyethanol	-	-	-	-
109-99-9	Tetrahydrofuran	1.40E-07	4.25E-04	1.19E-06	2.62E-11
110-00-9	Furan	-	-	-	-

Table A-18 Estimate of Organic Emission from the HLW Feed (HFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
110-54-3	n-Hexane	6.78E-07	2.06E-03	5.76E-06	1.27E-10
110-59-8	Pentanenitrile	3.28E-04	9.94E-01	2.78E-03	6.13E-08
110-80-5	2-Ethoxyethanol	5.11E-03	1.55E+01	4.34E-02	9.57E-07
110-82-7	Cyclohexane	1.29E-08	3.90E-05	1.09E-07	2.41E-12
110-83-8	Cyclohexene	1.29E-08	3.90E-05	1.09E-07	2.41E-12
110-86-1	Pyridine	3.49E-06	1.06E-02	2.96E-05	6.53E-10
111-15-9	Ethylene glycol monoethyl ether acetate	-	-	-	-
111-44-4	bis(2-Chloroethyl)ether	1.62E-05	4.93E-02	1.38E-04	3.04E-09
111-65-9	n-Octane	1.55E-07	4.71E-04	1.32E-06	2.90E-11
111-76-2	2-Butoxyethanol	6.69E-04	2.03E+00	5.68E-03	1.25E-07
111-84-2	n-Nonane	1.04E-07	3.15E-04	8.82E-07	1.95E-11
111-91-1	bis(2-Chloroethoxy)methane	1.25E-04	3.81E-01	1.06E-03	2.35E-08
1120-21-4	Undecane	-	-	-	-
1120-71-4	1,3-Propane sultone	-	-	-	-
112-30-1	1-Decanol	-	-	-	-
112-31-2	Decanal	-	-	-	-
112-40-3	Dodecane	-	-	-	-
117-81-7	Bis(2-ethylhexyl) phthalate	1.65E-03	5.00E+00	1.40E-02	3.08E-07
117-84-0	Di-n-octylphthalate	1.40E-03	4.26E+00	1.19E-02	2.63E-07
118-74-1	Hexachlorobenzene	7.29E-09	2.21E-05	6.19E-08	1.37E-12
119-90-4	3,3'-Dimethoxybenzidine	-	-	-	-
120-12-7	Anthracene	2.51E-04	7.63E-01	2.13E-03	4.71E-08

Table A-18 Estimate of Organic Emission from the HLW Feed (HFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
120-82-1	1,2,4-Trichlorobenzene	2.58E-07	7.82E-04	2.19E-06	4.83E-11
120-83-2	2,4-Dichlorophenol	5.35E-04	1.62E+00	4.54E-03	1.00E-07
121-14-2	2,4-Dinitrotoluene	3.25E-03	9.86E+00	2.76E-02	6.08E-07
122-39-4	N,N-Diphenylamine	6.02E-07	1.83E-03	5.11E-06	1.13E-10
122-66-7	1,2-Diphenylhydrazine	-	-	-	-
123-33-1	Maleic hydrazide	-	-	-	-
123-38-6	Propionaldehyde	4.28E-07	1.30E-03	3.64E-06	8.02E-11
123-72-8	Butanal	3.55E-04	1.08E+00	3.02E-03	6.65E-08
123-91-1	1,4-Dioxan	1.71E-07	5.19E-04	1.45E-06	3.20E-11
124-18-5	Decane	-	-	-	-
124-38-9	Carbon dioxide	-	-	-	-
124-48-1	Chlorodibromomethane	7.39E-12	2.24E-08	6.28E-11	1.38E-15
126-73-8	Tributyl phosphate	6.59E-04	2.00E+00	5.59E-03	1.23E-07
126-98-7	2-Methyl-2-propenenitrile	1.29E-07	3.90E-04	1.09E-06	2.41E-11
127-18-4	1,1,2,2-Tetrachloroethene	4.23E-09	1.29E-05	3.60E-08	7.93E-13
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	8.68E-06	2.63E-02	7.37E-05	1.63E-09
129-00-0	Pyrene	1.40E-03	4.24E+00	1.18E-02	2.61E-07
131-11-3	Dimethyl Phthalate	8.60E-05	2.61E-01	7.30E-04	1.61E-08
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	-	-	-	-
132-64-9	Dibenzofuran	2.75E-09	8.36E-06	2.34E-08	5.16E-13
1330-20-7	Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations)	1.24E-06	3.77E-03	1.05E-05	2.33E-10
133-06-2	Captan	-	-	-	-

Table A-18 Estimate of Organic Emission from the HLW Feed (HFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
1336-36-3	Polychlorinated biphenyls (1254 Aroclor)	5.65E-04	1.72E+00	4.80E-03	1.06E-07
134-32-7	alpha-Naphthylamine	6.26E-04	1.90E+00	5.31E-03	1.17E-07
135-98-8	sec-Butylbenzene	-	-	-	-
141-78-6	Acetic acid ethyl ester	1.37E-08	4.17E-05	1.17E-07	2.57E-12
145-73-3	Endothall	-	-	-	-
156-59-2	cis-1,2-Dichloroethene	-	-	-	-
156-60-5	1,2-trans-Dichloroethene	9.55E-04	2.90E+00	8.10E-03	1.79E-07
1634-04-4	Methyl tert-butyl ether	3.47E-04	1.05E+00	2.95E-03	6.51E-08
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1.27E-14	3.85E-11	1.08E-13	2.37E-18
189-55-9	Dibenzo[a,i]pyrene	5.66E-04	1.72E+00	4.81E-03	1.06E-07
189-64-0	Dibenzo[a,h]pyrene	5.66E-04	1.72E+00	4.81E-03	1.06E-07
191-24-2	Benzo(g,h,i)perylene	8.16E-04	2.48E+00	6.92E-03	1.53E-07
191-30-0	Dibenzo(a,l)pyrene	5.66E-04	1.72E+00	4.81E-03	1.06E-07
192-65-4	Dibenzo[a,e]pyrene	5.66E-04	1.72E+00	4.81E-03	1.06E-07
192-97-2	Benzo(e)pyrene	-	-	-	-
193-39-5	Indeno(1,2,3-cd)pyrene	7.32E-04	2.22E+00	6.21E-03	1.37E-07
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	1.32E-14	4.00E-11	1.12E-13	2.47E-18
205-82-3	Benzo[j]fluoranthene	-	-	-	-
205-99-2	Benzo(b)fluoranthene	7.98E-05	2.42E-01	6.77E-04	1.49E-08
206-44-0	Fluoranthene	1.30E-03	3.94E+00	1.10E-02	2.43E-07
207-08-9	Benzo(k)fluoranthene	3.89E-04	1.18E+00	3.30E-03	7.28E-08
208-96-8	Acenaphthylene	2.50E-04	7.59E-01	2.12E-03	4.68E-08

Table A-18 Estimate of Organic Emission from the HLW Feed (HFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
218-01-9	Chrysene	1.17E-07	3.54E-04	9.91E-07	2.19E-11
224-42-0	Dibenz[a,j]acridine	6.42E-04	1.95E+00	5.45E-03	1.20E-07
2245-38-7	2,3,5-Trimethylnaphthalene	-	-	-	-
226-36-8	Dibenz[a,h]acridine	6.03E-04	1.83E+00	5.12E-03	1.13E-07
23950-58-5	Pronamide	-	-	-	-
27154-33-2	Trichlorofluoroethane	1.49E-03	4.53E+00	1.27E-02	2.79E-07
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	4.69E-16	1.42E-12	3.98E-15	8.78E-20
319-84-6	alpha-BHC	1.59E-08	4.82E-05	1.35E-07	2.97E-12
319-85-7	beta-BHC	1.92E-05	5.82E-02	1.63E-04	3.59E-09
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	8.64E-11	2.62E-07	7.34E-10	1.62E-14
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	9.63E-19	2.92E-15	8.17E-18	1.80E-22
3268-87-9	Octachlorodibenzo(p)dioxin	5.93E-12	1.80E-08	5.03E-11	1.11E-15
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	3.04E-14	9.24E-11	2.58E-13	5.70E-18
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	5.66E-13	1.72E-09	4.80E-12	1.06E-16
3697-24-3	5-Methylchrysene	3.22E-04	9.76E-01	2.73E-03	6.02E-08
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	2.11E-15	6.42E-12	1.79E-14	3.96E-19
39001-02-0	Octachlorodibenzofuran	2.18E-12	6.62E-09	1.85E-11	4.08E-16
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	1.35E-13	4.09E-10	1.14E-12	2.52E-17
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	3.50E-14	1.06E-10	2.97E-13	6.56E-18
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	9.30E-13	2.82E-09	7.89E-12	1.74E-16
4170-30-3	Crotonaldehyde (Propylene aldehyde)	1.76E-07	5.33E-04	1.49E-06	3.29E-11
41851-50-7	Chlorocyclopentadiene	-	-	-	-

Table A-18 Estimate of Organic Emission from the HLW Feed (HFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
460-19-5	Cyanogen (oxalonitrile)	-	-	-	-
4786-20-3	2-Butenenitrile	-	-	-	-
50-00-0	Formaldehyde	1.24E-03	3.77E+00	1.05E-02	2.33E-07
50-32-8	Benzo(a)pyrene	1.55E-04	4.69E-01	1.31E-03	2.90E-08
506-68-3	Cyanogen bromide (bromocyanide)	-	-	-	-
506-77-4	Cyanogen chloride	-	-	-	-
510-15-6	Chlorobenzilate	-	-	-	-
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	3.65E-13	1.11E-09	3.10E-12	6.84E-17
51-28-5	2,4-Dinitrophenol	2.45E-03	7.43E+00	2.08E-02	4.59E-07
51-79-6	Ethyl carbamate (urethane)	-	-	-	-
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	1.14E-12	3.45E-09	9.66E-12	2.13E-16
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	-	-	-	-
532-27-4	2-Chloroacetophenone	-	-	-	-
534-52-1	4,6-Dinitro-o-cresol	1.37E-03	4.15E+00	1.16E-02	2.56E-07
53-70-3	Dibenz[a,h]anthracene	2.94E-05	8.92E-02	2.50E-04	5.50E-09
5385-75-1	Dibenzo(a,e)fluoranthene	-	-	-	-
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	1.74E-16	5.30E-13	1.48E-15	3.27E-20
540-73-8	1,2-Dimethylhydrazine	-	-	-	-
540-84-1	2,2,4-Trimethylpentane	-	-	-	-
541-73-1	1,3-Dichlorobenzene	1.69E-07	5.13E-04	1.43E-06	3.16E-11
542-75-6	1,3-Dichloropropene	-	-	-	-
542-88-1	bis(Chloromethyl)ether	-	-	-	-

Table A-18 Estimate of Organic Emission from the HLW Feed (HFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	7.19E-14	2.18E-10	6.11E-13	1.35E-17
56-23-5	Carbon tetrachloride	6.65E-09	2.02E-05	5.64E-08	1.25E-12
56-49-5	3-Methylcholanthrene	3.27E-04	9.92E-01	2.77E-03	6.12E-08
56-55-3	Benzo(a)anthracene	1.46E-04	4.43E-01	1.24E-03	2.73E-08
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	6.53E-13	1.98E-09	5.54E-12	1.22E-16
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	4.80E-13	1.46E-09	4.08E-12	8.99E-17
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	2.33E-13	7.07E-10	1.98E-12	4.36E-17
57-24-9	Strychnine	-	-	-	-
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	3.10E-12	9.41E-09	2.63E-11	5.81E-16
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	1.11E-13	3.37E-10	9.42E-13	2.08E-17
57-74-9	Chlordane	-	-	-	-
581-42-0	2,6-Dimethylnaphthalene	-	-	-	-
584-84-9	2,4-Toluene diisocyanate	-	-	-	-
58-89-9	gamma-BHC (Lindane)	2.86E-08	8.68E-05	2.43E-07	5.35E-12
58-90-2	2,3,4,6-Tetrachlorophenol	1.03E-03	3.14E+00	8.77E-03	1.93E-07
589-38-8	3-Hexanone	3.29E-04	9.98E-01	2.79E-03	6.16E-08
591-50-4	Benzene, iodo-	-	-	-	-
591-78-6	2-Hexanone	5.56E-07	1.69E-03	4.72E-06	1.04E-10
593-60-2	Bromoethene (Vinyl bromide)	-	-	-	-
593-74-8	Dimethyl Mercury	1.05E-10	3.19E-07	8.96E-10	1.97E-14
59-50-7	4-Chloro-3-methylphenol	1.78E-03	5.40E+00	1.51E-02	3.33E-07
59-89-2	N-Nitrosomorpholine	5.88E-03	1.78E+01	4.99E-02	1.10E-06

Table A-18 Estimate of Organic Emission from the HLW Feed (HFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
60-11-7	Dimethyl aminoazobenzene	-	-	-	-
602-87-9	5-Nitroacenaphthene	6.02E-04	1.83E+00	5.11E-03	1.13E-07
60-29-7	Ethyl ether	4.83E-07	1.47E-03	4.10E-06	9.04E-11
60-35-5	Acetamide	1.25E-03	3.79E+00	1.06E-02	2.34E-07
606-20-2	2,6-Dinitrotoluene	2.49E-04	7.57E-01	2.12E-03	4.67E-08
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	7.39E-14	2.24E-10	6.27E-13	1.38E-17
608-93-5	Pentachlorobenzene	-	-	-	-
61626-71-9	Dichloropentadiene	-	-	-	-
621-64-7	N-Nitroso-di-n-propylamine	1.76E-03	5.33E+00	1.49E-02	3.29E-07
624-83-9	Methyl isocyanate	-	-	-	-
62-50-0	Ethyl methanesulfonate	-	-	-	-
62-53-3	Aniline	-	-	-	-
62-75-9	N-Nitroso-N,N-dimethylamine	9.73E-06	2.95E-02	8.26E-05	1.82E-09
628-73-9	Hexanenitrile	3.19E-04	9.68E-01	2.71E-03	5.97E-08
630-20-6	1,1,1,2-Tetrachloroethane	1.65E-03	5.02E+00	1.40E-02	3.10E-07
64-18-6	Formic acid (methanoic acid)	-	-	-	-
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	1.96E-10	5.95E-07	1.67E-09	3.67E-14
65-85-0	Benzoic acid	-	-	-	-
67-56-1	Methyl alcohol	7.69E-04	2.33E+00	6.53E-03	1.44E-07
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	2.11E-13	6.39E-10	1.79E-12	3.94E-17
67-63-0	2-Propyl alcohol	4.18E-07	1.27E-03	3.55E-06	7.83E-11
67-64-1	2-Propanone (Acetone)	2.08E-05	6.31E-02	1.76E-04	3.89E-09

Table A-18 Estimate of Organic Emission from the HLW Feed (HFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
67-66-3	Chloroform	4.35E-09	1.32E-05	3.70E-08	8.15E-13
67-72-1	Hexachloroethane	5.14E-05	1.56E-01	4.36E-04	9.62E-09
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	1.05E-13	3.19E-10	8.93E-13	1.97E-17
70-30-4	Hexachlorophene	-	-	-	-
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	4.15E-13	1.26E-09	3.53E-12	7.78E-17
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	1.64E-13	4.98E-10	1.39E-12	3.07E-17
71-36-3	n-Butyl alcohol	1.20E-05	3.63E-02	1.02E-04	2.24E-09
71-43-2	Benzene	1.10E-08	3.34E-05	9.33E-08	2.06E-12
71-55-6	1,1,1-Trichloroethane	4.30E-09	1.31E-05	3.65E-08	8.06E-13
72-43-5	Methoxychlor	-	-	-	-
72-55-9	4,4-DDE	4.59E-04	1.39E+00	3.90E-03	8.60E-08
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	4.44E-14	1.35E-10	3.77E-13	8.31E-18
7439-97-6	Mercury	-	-	-	-
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	5.24E-15	1.59E-11	4.45E-14	9.82E-19
74-83-9	Bromomethane	8.69E-09	2.64E-05	7.38E-08	1.63E-12
74-87-3	Chloromethane	1.73E-08	5.25E-05	1.47E-07	3.24E-12
74-88-4	Iodomethane	2.84E-17	8.62E-14	2.41E-16	5.32E-21
74-95-3	Methylene bromide	-	-	-	-
74-97-5	Bromochloromethane	-	-	-	-
75-00-3	Chloroethane	8.69E-09	2.64E-05	7.38E-08	1.63E-12
75-01-4	1-Chloroethene	8.82E-09	2.68E-05	7.49E-08	1.65E-12
75-02-5	Fluoroethene (vinyl fluoride)	4.54E-04	1.38E+00	3.85E-03	8.50E-08

Table A-18 Estimate of Organic Emission from the HLW Feed (HFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
75-05-8	Acetonitrile	2.07E-04	6.29E-01	1.76E-03	3.88E-08
75-07-0	Acetaldehyde	4.34E-04	1.32E+00	3.69E-03	8.13E-08
75-09-2	Dichloromethane (Methylene Chloride)	2.58E-06	7.82E-03	2.19E-05	4.82E-10
75-15-0	Carbon disulfide	3.22E-23	9.76E-20	2.73E-22	6.03E-27
75-21-8	Ethylene oxide (Oxirane)	7.49E-07	2.27E-03	6.36E-06	1.40E-10
75-25-2	Bromoform	-	-	-	-
75-27-4	Bromodichloromethane	3.23E-03	9.80E+00	2.74E-02	6.05E-07
75-29-6	2-Chloropropane	-	-	-	-
75-34-3	1,1-Dichloroethane	3.48E-09	1.06E-05	2.96E-08	6.52E-13
75-35-4	1,1-Dichloroethene	5.48E-09	1.66E-05	4.65E-08	1.03E-12
75-44-5	Phosgene (hydrogen phosphide)	-	-	-	-
75-45-6	Chlorodifluoromethane	1.29E-08	3.90E-05	1.09E-07	2.41E-12
75-50-3	Trimethylamine	3.88E-04	1.18E+00	3.30E-03	7.27E-08
75-69-4	Trichlorofluoromethane	1.06E-08	3.21E-05	8.98E-08	1.98E-12
75-71-8	Dichlorodifluoromethane	1.08E-08	3.27E-05	9.15E-08	2.02E-12
76-01-7	Pentachloroethane	-	-	-	-
76-13-1	1,2,2-Trichlorotrifluoroethane	1.06E-08	3.23E-05	9.04E-08	1.99E-12
764-41-0	1,4-Dichloro-2-butene	-	-	-	-
76-44-8	Heptachlor	1.00E-08	3.04E-05	8.50E-08	1.87E-12
765-34-4	Glycidylaldehyde	-	-	-	-
7664-41-7	Ammonia/Ammonium	1.27E-02	3.86E+01	1.08E-01	2.38E-06
77-47-4	Hexachlorocyclopentadiene	5.23E-22	1.59E-18	4.44E-21	9.80E-26

Table A-18 Estimate of Organic Emission from the HLW Feed (HFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
77-78-1	Dimethyl sulfate	-	-	-	-
78-83-1	2-Methylpropyl alcohol	6.82E-03	2.07E+01	5.79E-02	1.28E-06
78-87-5	1,2-Dichloropropane	3.48E-09	1.06E-05	2.96E-08	6.52E-13
78-93-3	2-Butanone	3.69E-06	1.12E-02	3.13E-05	6.90E-10
79-00-5	1,1,2-Trichloroethane	4.08E-09	1.24E-05	3.46E-08	7.64E-13
79-01-6	1,1,2-Trichloroethylene	4.64E-09	1.41E-05	3.94E-08	8.68E-13
79-10-7	2-Propenoic acid	1.93E-03	5.85E+00	1.64E-02	3.61E-07
79-34-5	1,1,2,2-Tetrachloroethane	4.08E-09	1.24E-05	3.47E-08	7.65E-13
79-46-9	2-Nitropropane	8.60E-07	2.61E-03	7.30E-06	1.61E-10
80-62-6	Methyl methacrylate	-	-	-	-
822-06-0	Hexamethylene-1,5-diisocyanate	-	-	-	-
823-40-5	Toluene-2,6-diamine	-	-	-	-
82-68-8	Pentachloronitrobenzene (PCNB)	8.12E-07	2.46E-03	6.89E-06	1.52E-10
832-69-9	1-Methylphenanthrene	-	-	-	-
83-32-9	Acenaphthene	1.23E-03	3.74E+00	1.05E-02	2.31E-07
84-66-2	Diethyl phthalate	1.02E-03	3.10E+00	8.68E-03	1.92E-07
84-74-2	Di-n-butylphthalate	1.37E-02	4.15E+01	1.16E-01	2.56E-06
85-01-8	Phenanthrene	2.64E-04	8.01E-01	2.24E-03	4.94E-08
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	-	-	-	-
85-68-7	Butylbenzylphthalate	4.55E-03	1.38E+01	3.87E-02	8.53E-07
86-73-7	Fluorene	2.53E-04	7.66E-01	2.14E-03	4.73E-08
87-61-6	1,2,3-Trichlorobenzene	-	-	-	-

Table A-18 Estimate of Organic Emission from the HLW Feed (HFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
87-68-3	Hexachlorobutadiene	2.21E-06	6.70E-03	1.87E-05	4.13E-10
87-86-5	Pentachlorophenol	5.29E-06	1.61E-02	4.49E-05	9.92E-10
88-06-2	2,4,6-Trichlorophenol	1.28E-03	3.89E+00	1.09E-02	2.40E-07
88-74-4	o-Nitroaniline (2-nitroaniline)	1.19E-04	3.63E-01	1.01E-03	2.24E-08
88-75-5	2-Nitrophenol	1.37E-03	4.16E+00	1.16E-02	2.57E-07
90-04-0	o-Anisidine	-	-	-	-
90-12-0	1-Methylnaphthalene	-	-	-	-
91-20-3	Naphthalene	1.15E-03	3.50E+00	9.78E-03	2.16E-07
91-22-5	Quinoline	-	-	-	-
91-57-6	2-Methylnaphthalene	8.44E-08	2.56E-04	7.17E-07	1.58E-11
91-58-7	2-Chloronaphthalene	3.20E-04	9.73E-01	2.72E-03	6.00E-08
91-94-1	3,3'-Dichlorobenzidine	4.88E-04	1.48E+00	4.15E-03	9.15E-08
924-16-3	N-Nitroso-di-n-Buetylamine	-	-	-	-
92-52-4	1,1`-Biphenyl	8.12E-07	2.46E-03	6.89E-06	1.52E-10
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	-	-	-	-
94-75-7	2,4-D	-	-	-	-
95-48-7	o-Cresol	2.37E-03	7.20E+00	2.01E-02	4.44E-07
95-49-8	o-Chlorotoluene	-	-	-	-
95-50-1	1,2-Dichlorobenzene	3.36E-06	1.02E-02	2.85E-05	6.30E-10
95-53-4	o-Toluidine	-	-	-	-
95-57-8	2-Chlorophenol	1.17E-03	3.54E+00	9.91E-03	2.19E-07
95-63-6	1,2,4-Trimethyl benzene	-	-	-	-

Table A-18 Estimate of Organic Emission from the HLW Feed (HFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
95-94-3	1,2,4,5-Tetrachlorobenzene	-	-	-	-
95-95-4	2,4,5-Trichlorophenol	1.45E-03	4.39E+00	1.23E-02	2.71E-07
96-12-8	1,2-Dibromo-3-chloropropane	-	-	-	-
96-18-4	1,2,3-Trichloropropane	-	-	-	-
96-45-7	Ethylene thiourea	-	-	-	-
97-63-2	Ethyl methacrylate	-	-	-	-
98-01-1	Furfural	-	-	-	-
98-06-6	tert-Butyl benzene	-	-	-	-
98-07-7	Benzotrichloride	-	-	-	-
98-82-8	Cumene	2.62E-04	7.96E-01	2.23E-03	4.91E-08
98-83-9	Methyl styrene (mixed isomers)	-	-	-	-
98-86-2	Acetophenone	1.10E-06	3.35E-03	9.38E-06	2.07E-10
98-95-3	Nitrobenzene	1.11E-05	3.37E-02	9.43E-05	2.08E-09
99-35-4	1,3,5-Trinitrobenzene	-	-	-	-
99-65-0	1,3-Dinitrobenzene	-	-	-	-
99-87-6	p-Cymene	-	-	-	-
			Weight Fraction Sum = WFs =	3.56E+02	
				Weight Ratio Sum = WRs =	1.00E+00
					Feed Stream Sum = 2.20E-05

The following indicates the stream properties for feed into the HLW Facility from the RLD feed used to calculate the weight fraction:

$$WF = \frac{(Q_m * 1000)}{\left(Q_v * \frac{\rho}{60 * 60}\right)}$$

Where:

Q_m= compound mass flow rate (g/s)
Q_v = volumetric flow rate (m^3/hr) = 1.20
ρ = density (kg/m^3) = 1011.095

A "-" symbol indicates no data are available for approximating the emissions rate (no data were available, or the corresponding values were below the emissions model tolerance).

Table A-19 Estimate of Organic Emission from the HLW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
100-02-7	p-Nitrophenol	2.84E-03	8.44E+00	3.85E-02	3.30E-07
100-21-0	Phthalic acid	1.19E-03	3.55E+00	1.62E-02	1.39E-07
100-25-4	1,4-Dinitrobenzene	4.86E-06	1.45E-02	6.60E-05	5.66E-10
10028-17-8	Tritium	6.22E-08	1.85E-04	8.43E-07	7.23E-12
100-40-3	4-Ethenylcyclohexene	1.69E-08	5.01E-05	2.29E-07	1.96E-12
100-41-4	Ethyl benzene	5.17E-13	1.54E-09	7.02E-12	6.01E-17
100-42-5	Styrene	6.00E-13	1.78E-09	8.14E-12	6.98E-17
100-44-7	Benzyl chloride	-	-	-	-
100-47-0	Benzonitrile	-	-	-	-
100-51-6	Benzyl alcohol	-	-	-	-
100-52-7	Benzaldehyde	-	-	-	-
10061-01-5	cis-1,3-Dichloropropene	2.21E-12	6.55E-09	2.99E-11	2.57E-16
10061-02-6	trans-1,3-Dichloropropene	1.71E-11	5.07E-08	2.32E-10	1.98E-15

Table A-19 Estimate of Organic Emission from the HLW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
101-55-3	4-Bromophenylphenyl ether	1.28E-05	3.82E-02	1.74E-04	1.49E-09
101-77-9	4,4-Methylenedianiline	-	-	-	-
103-33-3	Azobenzene	-	-	-	-
103-65-1	n-Propyl benzene (Isocumene)	-	-	-	-
104-51-8	n-Butylbenzene	-	-	-	-
104-76-7	2-Ethyl-1-hexanol	5.27E-05	1.57E-01	7.15E-04	6.13E-09
105-67-9	2,4-Dimethylphenol	2.36E-04	7.01E-01	3.20E-03	2.74E-08
10595-95-6	n-Nitrosomethylethylamine	8.10E-04	2.41E+00	1.10E-02	9.42E-08
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	-	-	-	-
106-44-5	p-Cresol (4-methyl phenol)	-	-	-	-
106-46-7	1,4-Dichlorobenzene	1.16E-08	3.45E-05	1.58E-07	1.35E-12
106-47-8	p-Chloroaniline	2.70E-04	8.03E-01	3.67E-03	3.14E-08
106-49-0	p-Toluidine	-	-	-	-
106-51-4	Quinone	-	-	-	-
106-88-7	1,2-Epoxybutane	6.20E-06	1.84E-02	8.41E-05	7.21E-10
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	-	-	-	-
106-93-4	Ethylene dibromide	5.97E-12	1.77E-08	8.11E-11	6.95E-16
106-99-0	1,3-Butadiene	7.40E-12	2.20E-08	1.00E-10	8.61E-16
107-02-8	Acrolein	5.74E-09	1.71E-05	7.79E-08	6.68E-13
107-05-1	3-Chloropropene	8.52E-13	2.53E-09	1.16E-11	9.91E-17
107-06-2	1,2-Dichloroethane	4.16E-12	1.24E-08	5.64E-11	4.83E-16
107-12-0	Propionitrile	1.39E-07	4.14E-04	1.89E-06	1.62E-11

Table A-19 Estimate of Organic Emission from the HLW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
107-13-1	Acrylonitrile	7.81E-08	2.32E-04	1.06E-06	9.09E-12
107-19-7	Propargyl alcohol	-	-	-	-
107-21-1	Ethylene glycol (1,2-ethanediol)	-	-	-	-
107-98-2	Propylene glycol monomethyl ether	-	-	-	-
108-05-4	Acetic acid vinyl ester	1.41E-06	4.20E-03	1.92E-05	1.64E-10
108-10-1	4-Methyl-2-pentanone	1.12E-09	3.32E-06	1.52E-08	1.30E-13
108-39-4	m-Cresol	1.57E-03	4.65E+00	2.12E-02	1.82E-07
108-60-1	bis (2-Chloroisopropyl)ether	-	-	-	-
108-67-8	1,3,5-Trimethylbenzene	-	-	-	-
108-86-1	Bromobenzene (Phenyl bromide)	-	-	-	-
108-87-2	Methylcyclohexane	9.36E-13	2.78E-09	1.27E-11	1.09E-16
108-88-3	Toluene	1.88E-11	5.58E-08	2.55E-10	2.18E-15
108-90-7	Chlorobenzene	7.33E-11	2.18E-07	9.95E-10	8.53E-15
108-94-1	Cyclohexanone	5.46E-06	1.62E-02	7.41E-05	6.35E-10
108-95-2	Phenol	9.09E-05	2.70E-01	1.23E-03	1.06E-08
109-74-0	n-Butanenitrile	2.79E-05	8.29E-02	3.79E-04	3.25E-09
109-75-1	3-Butenenitrile	-	-	-	-
109-77-3	Malononitrile	-	-	-	-
109-86-4	2-Methoxyethanol	-	-	-	-
109-99-9	Tetrahydrofuran	8.20E-09	2.44E-05	1.11E-07	9.54E-13
110-00-9	Furan	-	-	-	-
110-54-3	n-Hexane	4.29E-11	1.28E-07	5.83E-10	5.00E-15

Table A-19 Estimate of Organic Emission from the HLW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
110-59-8	Pentanenitrile	1.89E-05	5.61E-02	2.56E-04	2.20E-09
110-80-5	2-Ethoxyethanol	4.71E-03	1.40E+01	6.40E-02	5.48E-07
110-82-7	Cyclohexane	8.13E-13	2.42E-09	1.10E-11	9.46E-17
110-83-8	Cyclohexene	8.14E-13	2.42E-09	1.10E-11	9.47E-17
110-86-1	Pyridine	1.34E-06	3.97E-03	1.81E-05	1.55E-10
111-15-9	Ethylene glycol monoethyl ether acetate	-	-	-	-
111-44-4	bis(2-Chloroethyl)ether	1.48E-05	4.41E-02	2.01E-04	1.73E-09
111-65-9	n-Octane	9.81E-12	2.91E-08	1.33E-10	1.14E-15
111-76-2	2-Butoxyethanol	5.21E-04	1.55E+00	7.07E-03	6.06E-08
111-84-2	n-Nonane	6.57E-12	1.95E-08	8.92E-11	7.65E-16
111-91-1	bis(2-Chloroethoxy)methane	3.48E-05	1.03E-01	4.72E-04	4.05E-09
1120-21-4	Undecane	-	-	-	-
1120-71-4	1,3-Propane sultone	-	-	-	-
112-30-1	1-Decanol	-	-	-	-
112-31-2	Decanal	-	-	-	-
112-40-3	Dodecane	-	-	-	-
117-81-7	Bis(2-ethylhexyl) phthalate	1.33E-03	3.96E+00	1.81E-02	1.55E-07
117-84-0	Di-n-octylphthalate	8.74E-05	2.60E-01	1.19E-03	1.02E-08
118-74-1	Hexachlorobenzene	3.70E-08	1.10E-04	5.02E-07	4.30E-12
119-90-4	3,3'-Dimethoxybenzidine	-	-	-	-
120-12-7	Anthracene	1.95E-05	5.79E-02	2.64E-04	2.27E-09
120-82-1	1,2,4-Trichlorobenzene	1.35E-10	4.02E-07	1.84E-09	1.57E-14

Table A-19 Estimate of Organic Emission from the HLW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
120-83-2	2,4-Dichlorophenol	1.10E-07	3.27E-04	1.50E-06	1.28E-11
121-14-2	2,4-Dinitrotoluene	3.13E-03	9.30E+00	4.25E-02	3.64E-07
122-39-4	N,N-Diphenylamine	4.07E-07	1.21E-03	5.52E-06	4.73E-11
122-66-7	1,2-Diphenylhydrazine	-	-	-	-
123-33-1	Maleic hydrazide	-	-	-	-
123-38-6	Propionaldehyde	2.39E-08	7.12E-05	3.25E-07	2.79E-12
123-72-8	Butanal	1.14E-05	3.39E-02	1.55E-04	1.33E-09
123-91-1	1,4-Dioxan	9.19E-08	2.73E-04	1.25E-06	1.07E-11
124-18-5	Decane	-	-	-	-
124-38-9	Carbon dioxide	-	-	-	-
124-48-1	Chlorodibromomethane	1.53E-17	4.56E-14	2.08E-16	1.78E-21
126-73-8	Tributyl phosphate	5.27E-04	1.56E+00	7.15E-03	6.13E-08
126-98-7	2-Methyl-2-propenenitrile	1.41E-09	4.18E-06	1.91E-08	1.63E-13
127-18-4	1,1,2,2-Tetrachloroethene	2.72E-13	8.07E-10	3.69E-12	3.16E-17
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	4.99E-06	1.48E-02	6.78E-05	5.81E-10
129-00-0	Pyrene	4.70E-04	1.40E+00	6.38E-03	5.46E-08
131-11-3	Dimethyl Phthalate	5.11E-05	1.52E-01	6.94E-04	5.95E-09
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	-	-	-	-
132-64-9	Dibenzofuran	9.31E-07	2.77E-03	1.26E-05	1.08E-10
1330-20-7	Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations)	1.39E-10	4.13E-07	1.89E-09	1.62E-14
133-06-2	Captan	-	-	-	-
1336-36-3	Polychlorinated biphenyls (1254 Aroclor)	9.11E-06	2.71E-02	1.24E-04	1.06E-09

Table A-19 Estimate of Organic Emission from the HLW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
134-32-7	alpha-Naphthylamine	6.13E-04	1.82E+00	8.32E-03	7.13E-08
135-98-8	sec-Butylbenzene	-	-	-	-
141-78-6	Acetic acid ethyl ester	3.60E-10	1.07E-06	4.89E-09	4.19E-14
145-73-3	Endothall	-	-	-	-
156-59-2	cis-1,2-Dichloroethene	-	-	-	-
156-60-5	1,2-trans-Dichloroethene	6.51E-08	1.94E-04	8.84E-07	7.58E-12
1634-04-4	Methyl tert-butyl ether	9.04E-07	2.69E-03	1.23E-05	1.05E-10
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	3.64E-14	1.08E-10	4.94E-13	4.24E-18
189-55-9	Dibenzo[a,i]pyrene	5.63E-04	1.67E+00	7.65E-03	6.55E-08
189-64-0	Dibenzo[a,h]pyrene	5.63E-04	1.67E+00	7.65E-03	6.55E-08
191-24-2	Benzo(g,h,i)perylene	6.90E-04	2.05E+00	9.37E-03	8.03E-08
191-30-0	Dibenzo(a,l)pyrene	5.63E-04	1.67E+00	7.65E-03	6.55E-08
192-65-4	Dibenzo[a,e]pyrene	5.63E-04	1.67E+00	7.65E-03	6.55E-08
192-97-2	Benzo(e)pyrene	-	-	-	-
193-39-5	Indeno(1,2,3-cd)pyrene	4.19E-04	1.25E+00	5.69E-03	4.88E-08
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	7.11E-13	2.11E-09	9.65E-12	8.27E-17
205-82-3	Benzo[j]fluoranthene	-	-	-	-
205-99-2	Benzo(b)fluoranthene	4.40E-05	1.31E-01	5.97E-04	5.12E-09
206-44-0	Fluoranthene	3.35E-04	9.95E-01	4.55E-03	3.90E-08
207-08-9	Benzo(k)fluoranthene	1.36E-04	4.05E-01	1.85E-03	1.59E-08
208-96-8	Acenaphthylene	9.80E-06	2.91E-02	1.33E-04	1.14E-09
218-01-9	Chrysene	2.68E-06	7.95E-03	3.63E-05	3.11E-10

Table A-19 Estimate of Organic Emission from the HLW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
224-42-0	Dibenz[a,j]acridine	6.40E-04	1.90E+00	8.69E-03	7.45E-08
2245-38-7	2,3,5-Trimethylnaphthalene	-	-	-	-
226-36-8	Dibenz[a,h]acridine	6.01E-04	1.79E+00	8.16E-03	7.00E-08
23950-58-5	Pronamide	-	-	-	-
27154-33-2	Trichlorofluoroethane	1.00E-07	2.97E-04	1.36E-06	1.16E-11
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	2.50E-13	7.42E-10	3.39E-12	2.91E-17
319-84-6	alpha-BHC	5.26E-09	1.56E-05	7.14E-08	6.12E-13
319-85-7	beta-BHC	1.89E-05	5.61E-02	2.56E-04	2.20E-09
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	4.75E-12	1.41E-08	6.45E-11	5.53E-16
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	1.73E-14	5.14E-11	2.35E-13	2.01E-18
3268-87-9	Octachlorodibenzo(p)dioxin	4.69E-12	1.39E-08	6.37E-11	5.46E-16
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	4.13E-14	1.23E-10	5.61E-13	4.81E-18
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	1.88E-12	5.59E-09	2.55E-11	2.19E-16
3697-24-3	5-Methylchrysene	1.61E-04	4.79E-01	2.19E-03	1.88E-08
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	7.35E-14	2.19E-10	9.98E-13	8.56E-18
39001-02-0	Octachlorodibenzofuran	1.05E-12	3.12E-09	1.42E-11	1.22E-16
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	8.36E-13	2.48E-09	1.13E-11	9.72E-17
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	4.95E-14	1.47E-10	6.72E-13	5.76E-18
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	1.48E-12	4.41E-09	2.01E-11	1.73E-16
4170-30-3	Crotonaldehyde (Propylene aldehyde)	6.34E-08	1.88E-04	8.61E-07	7.38E-12
41851-50-7	Chlorocyclopentadiene	-	-	-	-
460-19-5	Cyanogen (oxalonitrile)	-	-	-	-

Table A-19 Estimate of Organic Emission from the HLW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
4786-20-3	2-Butenenitrile	-	-	-	-
50-00-0	Formaldehyde	1.17E-03	3.48E+00	1.59E-02	1.36E-07
50-32-8	Benzo(a)pyrene	4.55E-05	1.35E-01	6.18E-04	5.29E-09
506-68-3	Cyanogen bromide (bromocyanide)	-	-	-	-
506-77-4	Cyanogen chloride	-	-	-	-
510-15-6	Chlorobenzilate	-	-	-	-
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	1.24E-12	3.70E-09	1.69E-11	1.45E-16
51-28-5	2,4-Dinitrophenol	8.76E-04	2.60E+00	1.19E-02	1.02E-07
51-79-6	Ethyl carbamate (urethane)	-	-	-	-
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	6.27E-14	1.86E-10	8.51E-13	7.29E-18
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	-	-	-	-
532-27-4	2-Chloroacetophenone	-	-	-	-
534-52-1	4,6-Dinitro-o-cresol	3.65E-04	1.09E+00	4.96E-03	4.25E-08
53-70-3	Dibenz[a,h]anthracene	1.24E-04	3.68E-01	1.68E-03	1.44E-08
5385-75-1	Dibenzo(a,e)fluoranthene	-	-	-	-
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	1.83E-22	5.44E-19	2.49E-21	2.13E-26
540-73-8	1,2-Dimethylhydrazine	-	-	-	-
540-84-1	2,2,4-Trimethylpentane	-	-	-	-
541-73-1	1,3-Dichlorobenzene	2.41E-11	7.15E-08	3.27E-10	2.80E-15
542-75-6	1,3-Dichloropropene	-	-	-	-
542-88-1	bis(Chloromethyl)ether	-	-	-	-
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	1.06E-13	3.16E-10	1.44E-12	1.24E-17

Table A-19 Estimate of Organic Emission from the HLW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
56-23-5	Carbon tetrachloride	7.04E-13	2.09E-09	9.55E-12	8.19E-17
56-49-5	3-Methylcholanthrene	1.68E-04	5.00E-01	2.29E-03	1.96E-08
56-55-3	Benzo(a)anthracene	4.26E-05	1.27E-01	5.79E-04	4.96E-09
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	2.55E-13	7.59E-10	3.46E-12	2.97E-17
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	4.92E-13	1.46E-09	6.68E-12	5.72E-17
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	1.65E-13	4.90E-10	2.24E-12	1.92E-17
57-24-9	Strychnine	-	-	-	-
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	3.43E-13	1.02E-09	4.65E-12	3.98E-17
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	4.71E-13	1.40E-09	6.39E-12	5.47E-17
57-74-9	Chlordane	-	-	-	-
581-42-0	2,6-Dimethylnaphthalene	-	-	-	-
584-84-9	2,4-Toluene diisocyanate	-	-	-	-
58-89-9	gamma-BHC (Lindane)	1.49E-08	4.42E-05	2.02E-07	1.73E-12
58-90-2	2,3,4,6-Tetrachlorophenol	5.78E-04	1.72E+00	7.85E-03	6.72E-08
589-38-8	3-Hexanone	9.47E-06	2.81E-02	1.29E-04	1.10E-09
591-50-4	Benzene, iodo-	-	-	-	-
591-78-6	2-Hexanone	2.33E-08	6.92E-05	3.16E-07	2.71E-12
593-60-2	Bromoethene (Vinyl bromide)	-	-	-	-
593-74-8	Dimethyl Mercury	1.41E-09	4.18E-06	1.91E-08	1.64E-13
59-50-7	4-Chloro-3-methylphenol	1.24E-03	3.68E+00	1.68E-02	1.44E-07
59-89-2	N-Nitrosomorpholine	5.84E-03	1.73E+01	7.92E-02	6.79E-07
60-11-7	Dimethyl aminoazobenzene	-	-	-	-

Table A-19 Estimate of Organic Emission from the HLW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
602-87-9	5-Nitroacenaphthene	5.03E-04	1.49E+00	6.82E-03	5.85E-08
60-29-7	Ethyl ether	3.22E-10	9.58E-07	4.38E-09	3.75E-14
60-35-5	Acetamide	1.25E-03	3.70E+00	1.69E-02	1.45E-07
606-20-2	2,6-Dinitrotoluene	7.48E-05	2.22E-01	1.02E-03	8.70E-09
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	6.00E-14	1.78E-10	8.14E-13	6.98E-18
608-93-5	Pentachlorobenzene	-	-	-	-
61626-71-9	Dichloropentadiene	-	-	-	-
621-64-7	N-Nitroso-di-n-propylamine	1.25E-03	3.73E+00	1.70E-02	1.46E-07
624-83-9	Methyl isocyanate	-	-	-	-
62-50-0	Ethyl methanesulfonate	-	-	-	-
62-53-3	Aniline	-	-	-	-
62-75-9	N-Nitroso-N,N-dimethylamine	7.35E-06	2.18E-02	9.98E-05	8.55E-10
628-73-9	Hexanenitrile	1.31E-05	3.89E-02	1.78E-04	1.52E-09
630-20-6	1,1,1,2-Tetrachloroethane	3.36E-07	9.99E-04	4.56E-06	3.91E-11
64-18-6	Formic acid (methanoic acid)	-	-	-	-
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	1.50E-13	4.46E-10	2.04E-12	1.75E-17
65-85-0	Benzoic acid	-	-	-	-
67-56-1	Methyl alcohol	4.24E-04	1.26E+00	5.75E-03	4.93E-08
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	3.19E-13	9.49E-10	4.33E-12	3.71E-17
67-63-0	2-Propyl alcohol	1.69E-07	5.03E-04	2.30E-06	1.97E-11
67-64-1	2-Propanone (Acetone)	1.19E-06	3.55E-03	1.62E-05	1.39E-10
67-66-3	Chloroform	7.34E-11	2.18E-07	9.96E-10	8.53E-15

Table A-19 Estimate of Organic Emission from the HLW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
67-72-1	Hexachloroethane	5.62E-09	1.67E-05	7.64E-08	6.54E-13
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	2.58E-13	7.66E-10	3.50E-12	3.00E-17
70-30-4	Hexachlorophene	-	-	-	-
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	3.36E-13	9.99E-10	4.56E-12	3.91E-17
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	7.58E-13	2.25E-09	1.03E-11	8.82E-17
71-36-3	n-Butyl alcohol	4.60E-06	1.37E-02	6.24E-05	5.35E-10
71-43-2	Benzene	4.81E-11	1.43E-07	6.53E-10	5.60E-15
71-55-6	1,1,1-Trichloroethane	2.77E-13	8.23E-10	3.76E-12	3.22E-17
72-43-5	Methoxychlor	-	-	-	-
72-55-9	4,4-DDE	9.17E-05	2.73E-01	1.24E-03	1.07E-08
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	2.56E-14	7.62E-11	3.48E-13	2.98E-18
7439-97-6	Mercury	-	-	-	-
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	7.69E-14	2.29E-10	1.04E-12	8.95E-18
74-83-9	Bromomethane	2.07E-11	6.15E-08	2.81E-10	2.41E-15
74-87-3	Chloromethane	9.42E-12	2.80E-08	1.28E-10	1.10E-15
74-88-4	Iodomethane	3.08E-11	9.16E-08	4.19E-10	3.59E-15
74-95-3	Methylene bromide	-	-	-	-
74-97-5	Bromochloromethane	-	-	-	-
75-00-3	Chloroethane	6.01E-13	1.79E-09	8.16E-12	6.99E-17
75-01-4	1-Chloroethene	5.60E-13	1.67E-09	7.61E-12	6.52E-17
75-02-5	Fluoroethene (vinyl fluoride)	2.87E-08	8.53E-05	3.90E-07	3.34E-12
75-05-8	Acetonitrile	3.18E-06	9.44E-03	4.31E-05	3.70E-10

Table A-19 Estimate of Organic Emission from the HLW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
75-07-0	Acetaldehyde	2.23E-05	6.62E-02	3.02E-04	2.59E-09
75-09-2	Dichloromethane (Methylene Chloride)	8.53E-10	2.54E-06	1.16E-08	9.92E-14
75-15-0	Carbon disulfide	2.81E-13	8.34E-10	3.81E-12	3.26E-17
75-21-8	Ethylene oxide (Oxirane)	1.72E-08	5.11E-05	2.33E-07	2.00E-12
75-25-2	Bromoform	-	-	-	-
75-27-4	Bromodichloromethane	1.33E-06	3.95E-03	1.80E-05	1.54E-10
75-29-6	2-Chloropropane	-	-	-	-
75-34-3	1,1-Dichloroethane	2.86E-13	8.50E-10	3.88E-12	3.33E-17
75-35-4	1,1-Dichloroethene	3.48E-13	1.03E-09	4.73E-12	4.05E-17
75-44-5	Phosgene (hydrogen phosphide)	-	-	-	-
75-45-6	Chlorodifluoromethane	8.14E-13	2.42E-09	1.11E-11	9.47E-17
75-50-3	Trimethylamine	1.42E-05	4.21E-02	1.92E-04	1.65E-09
75-69-4	Trichlorofluoromethane	6.70E-13	1.99E-09	9.10E-12	7.80E-17
75-71-8	Dichlorodifluoromethane	6.82E-13	2.03E-09	9.25E-12	7.93E-17
76-01-7	Pentachloroethane	-	-	-	-
76-13-1	1,2,2-Trichlorotrifluoroethane	6.74E-13	2.00E-09	9.14E-12	7.84E-17
764-41-0	1,4-Dichloro-2-butene	-	-	-	-
76-44-8	Heptachlor	6.33E-13	1.88E-09	8.59E-12	7.37E-17
765-34-4	Glycidylaldehyde	-	-	-	-
7664-41-7	Ammonia/Ammonium	1.27E-02	3.77E+01	1.72E-01	1.48E-06
77-47-4	Hexachlorocyclopentadiene	2.05E-10	6.08E-07	2.78E-09	2.38E-14
77-78-1	Dimethyl sulfate	-	-	-	-

Table A-19 Estimate of Organic Emission from the HLW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
78-83-1	2-Methylpropyl alcohol	2.45E-03	7.27E+00	3.32E-02	2.84E-07
78-87-5	1,2-Dichloropropane	5.70E-13	1.69E-09	7.74E-12	6.63E-17
78-93-3	2-Butanone	2.12E-07	6.31E-04	2.88E-06	2.47E-11
79-00-5	1,1,2-Trichloroethane	4.78E-12	1.42E-08	6.49E-11	5.56E-16
79-01-6	1,1,2-Trichloroethylene	6.61E-12	1.96E-08	8.97E-11	7.69E-16
79-10-7	2-Propenoic acid	1.81E-03	5.37E+00	2.45E-02	2.10E-07
79-34-5	1,1,2,2-Tetrachloroethane	2.70E-11	8.02E-08	3.66E-10	3.14E-15
79-46-9	2-Nitropropane	2.64E-08	7.84E-05	3.58E-07	3.07E-12
80-62-6	Methyl methacrylate	-	-	-	-
822-06-0	Hexamethylene-1,5-diisocyanate	-	-	-	-
823-40-5	Toluene-2,6-diamine	-	-	-	-
82-68-8	Pentachloronitrobenzene (PCNB)	4.47E-09	1.33E-05	6.07E-08	5.20E-13
832-69-9	1-Methylphenanthrene	-	-	-	-
83-32-9	Acenaphthene	2.65E-05	7.87E-02	3.60E-04	3.08E-09
84-66-2	Diethyl phthalate	8.11E-04	2.41E+00	1.10E-02	9.43E-08
84-74-2	Di-n-butylphthalate	9.79E-03	2.91E+01	1.33E-01	1.14E-06
85-01-8	Phenanthrene	5.75E-05	1.71E-01	7.80E-04	6.68E-09
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	-	-	-	-
85-68-7	Butylbenzylphthalate	3.56E-03	1.06E+01	4.83E-02	4.14E-07
86-73-7	Fluorene	2.07E-05	6.17E-02	2.82E-04	2.41E-09
87-61-6	1,2,3-Trichlorobenzene	-	-	-	-
87-68-3	Hexachlorobutadiene	1.56E-10	4.63E-07	2.11E-09	1.81E-14

Table A-19 Estimate of Organic Emission from the HLW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
87-86-5	Pentachlorophenol	5.26E-06	1.56E-02	7.14E-05	6.12E-10
88-06-2	2,4,6-Trichlorophenol	5.31E-04	1.58E+00	7.21E-03	6.18E-08
88-74-4	o-Nitroaniline (2-nitroaniline)	7.02E-05	2.09E-01	9.53E-04	8.17E-09
88-75-5	2-Nitrophenol	5.13E-04	1.53E+00	6.97E-03	5.97E-08
90-04-0	o-Anisidine	-	-	-	-
90-12-0	1-Methylnaphthalene	-	-	-	-
91-20-3	Naphthalene	1.83E-05	5.44E-02	2.48E-04	2.13E-09
91-22-5	Quinoline	-	-	-	-
91-57-6	2-Methylnaphthalene	5.12E-06	1.52E-02	6.95E-05	5.96E-10
91-58-7	2-Chloronaphthalene	2.41E-06	7.15E-03	3.27E-05	2.80E-10
91-94-1	3,3'-Dichlorobenzidine	4.23E-04	1.26E+00	5.74E-03	4.92E-08
924-16-3	N-Nitroso-di-n-Buetylamine	-	-	-	-
92-52-4	1,1`-Biphenyl	6.28E-09	1.87E-05	8.53E-08	7.31E-13
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	-	-	-	-
94-75-7	2,4-D	-	-	-	-
95-48-7	o-Cresol	1.95E-03	5.81E+00	2.65E-02	2.27E-07
95-49-8	o-Chlorotoluene	-	-	-	-
95-50-1	1,2-Dichlorobenzene	1.02E-09	3.03E-06	1.39E-08	1.19E-13
95-53-4	o-Toluidine	-	-	-	-
95-57-8	2-Chlorophenol	6.12E-06	1.82E-02	8.31E-05	7.12E-10
95-63-6	1,2,4-Trimethyl benzene	-	-	-	-
95-94-3	1,2,4,5-Tetrachlorobenzene	-	-	-	-

Table A-19 Estimate of Organic Emission from the HLW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction WF (mg/kg)	Weight Ratio WR (unitless)	Individual Organic Release R_{IO} (g/s)
95-95-4	2,4,5-Trichlorophenol	8.15E-04	2.42E+00	1.11E-02	9.48E-08
96-12-8	1,2-Dibromo-3-chloropropane	-	-	-	-
96-18-4	1,2,3-Trichloropropane	-	-	-	-
96-45-7	Ethylene thiourea	-	-	-	-
97-63-2	Ethyl methacrylate	-	-	-	-
98-01-1	Furfural	-	-	-	-
98-06-6	tert-Butyl benzene	-	-	-	-
98-07-7	Benzotrichloride	-	-	-	-
98-82-8	Cumene	1.66E-08	4.94E-05	2.26E-07	1.93E-12
98-83-9	Methyl styrene (mixed isomers)	-	-	-	-
98-86-2	Acetophenone	3.73E-07	1.11E-03	5.06E-06	4.34E-11
98-95-3	Nitrobenzene	1.15E-05	3.42E-02	1.56E-04	1.34E-09
99-35-4	1,3,5-Trinitrobenzene	-	-	-	-
99-65-0	1,3-Dinitrobenzene	-	-	-	-
99-87-6	p-Cymene	-	-	-	-
			Weight Fraction Sum = WF_s =	2.19E+02	
				Weight Ratio Sum = WR_s =	1.00E+00
					Feed Stream Sum = 8.58E-06

Appendix B

DFLAW Emissions Report

The *Protocol for Equipment Lead Emission Estimates* (EPA 1995) provides the following formula to calculate the estimated release of organic material from ancillary equipment.

$E_{HO} = N \times R_{avg} \times WF_S \times H$

where:

- E_{HO} = estimated annual release by equipment type, kg/year
- N = ancillary equipment count by equipment type; equipment count obtained from Component Information System (2017)
- R_{avg} = average release factor by equipment type, (kg/hour); from *Protocol for Equipment Leak Emission Estimates* (EPA 1995)
- WF_S = weight fraction of organic material = WFs from tables 2 through 19, multiplied by 1/(1000×1000) to convert from mg/kg to kg/kg
- H = Hours per year (8760 hr/yr)

$E_{RO} = E_{HO}$ kg/yr × 1000 g/kg / (365 d/yr × 24 hr/d × 60 min/hr × 60 s/min)

where:

- E_{RO} = waste stream organic release (gm/s) by equipment type, thus;
- $ER_{O\text{-}PTF}$ = sum of PT Facility feed stream estimated release = Sum ER_O by equipment type
- $ER_{O\text{-}LAW}$ = sum of LAW Concentrate Stream estimated release = Sum ER_O by equipment type
- $ER_{O\text{-}HLW}$ = sum of HLW feed stream = Sum ER_O by equipment type

Table B-1 Estimate of the Release of Organic Compounds from Ancillary Equipment

System Descriptions	Valve Count *N*	Connector Count *N*	Valve Count *N*/85%	Connector Count *N*/85%	Valve R_{avg} (kg/hour)	Connector R_{av} (kg/hour)	Waste Stream Organic Weight Fraction WF_S	Operating Hours *H* (hr/yr)	Estimated Valve Annual Release E_{HO} (kg/yr)	Estimated Connector Annual Release E_{HO} (kg/yr)	Estimated Valve Release ER_O (g/s)	Estimated Connector Release ER_O (g/s)	Sum of Stream Feed estimation releases (g/s)
LAW Facility													
LCP	1	73	1	86	2.30E-04	1.83E-03	4.943E-04	8760	0.00	0.68	3.16E-08	2.16E-05	**2.16E-05**
LFP	12	114	14	169	2.30E-04	1.83E-03	2.820E-04	8760	0.01	0.76	2.52E-07	2.42E-05	**2.45E-05**
RLD	0	6	0	7	2.30E-04	1.83E-03	1.046E-03	8760	0.00	0.12	0.00E+00	3.72E-06	**3.72E-06**
										$ER_{O\text{-}LAW}$ =	**4.98E-05**		

The following indicates the stream properties for feed into the LCP feed used to calculate the weight fraction:

$$WF = \frac{(Q_m * 1000)}{\left(Q_v * \frac{\rho}{60 * 60}\right)}$$

Where:

Q_m = compound mass flow rate (g/s)
Q_v = volumetric flow rate (m^3/hr) = 1.45
ρ = density (kg/m^3) = 1268.516

A "-" symbol indicates no data are available for approximating the emissions rate (no data were available, or the corresponding values were below the emissions model tolerance).

Table B-2 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
100-02-7	p-Nitrophenol	2.21E-02	4.33E+01	8.75E-02	1.89E-06
100-21-0	Phthalic acid	5.65E-03	1.11E+01	2.24E-02	4.84E-07
100-25-4	1,4-Dinitrobenzene	2.58E-06	5.04E-03	1.02E-05	2.21E-10
10028-17-8	Tritium	7.24E-07	1.42E-03	2.87E-06	6.21E-11
100-40-3	4-Ethenylcyclohexene	2.39E-04	4.68E-01	9.47E-04	2.05E-08
100-41-4	Ethyl benzene	1.35E-08	2.64E-05	5.35E-08	1.16E-12
100-42-5	Styrene	7.64E-09	1.49E-05	3.02E-08	6.54E-13
100-44-7	Benzyl chloride	-	-	-	-
100-47-0	Benzonitrile	-	-	-	-
100-51-6	Benzyl alcohol	-	-	-	-
100-52-7	Benzaldehyde	-	-	-	-
10061-01-5	cis-1,3-Dichloropropene	2.81E-08	5.51E-05	1.11E-07	2.41E-12
10061-02-6	trans-1,3-Dichloropropene	3.13E-08	6.13E-05	1.24E-07	2.69E-12

Table B-2 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
101-55-3	4-Bromophenylphenyl ether	9.82E-04	1.92E+00	3.89E-03	8.42E-08
101-77-9	4,4-Methylenedianiline	-	-	-	-
103-33-3	Azobenzene	-	-	-	-
103-65-1	n-Propyl benzene (Isocumene)	-	-	-	-
104-51-8	n-Butylbenzene	-	-	-	-
104-76-7	2-Ethyl-1-hexanol	7.74E-04	1.51E+00	3.06E-03	6.63E-08
105-67-9	2,4-Dimethylphenol	3.94E-04	7.70E-01	1.56E-03	3.37E-08
10595-95-6	n-Nitrosomethylethylamine	1.47E-03	2.88E+00	5.83E-03	1.26E-07
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	-	-	-	-
106-44-5	p-Cresol (4-methyl phenol)	-	-	-	-
106-46-7	1,4-Dichlorobenzene	4.88E-06	9.55E-03	1.93E-05	4.18E-10
106-47-8	p-Chloroaniline	6.90E-04	1.35E+00	2.73E-03	5.92E-08
106-49-0	p-Toluidine	-	-	-	-
106-51-4	Quinone	-	-	-	-
106-88-7	1,2-Epoxybutane	8.51E-04	1.67E+00	3.37E-03	7.29E-08
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	-	-	-	-
106-93-4	Ethylene dibromide	8.17E-09	1.60E-05	3.24E-08	7.00E-13
106-99-0	1,3-Butadiene	7.46E-08	1.46E-04	2.95E-07	6.39E-12
107-02-8	Acrolein	4.54E-07	8.88E-04	1.80E-06	3.89E-11
107-05-1	3-Chloropropene	2.19E-08	4.29E-05	8.68E-08	1.88E-12
107-06-2	1,2-Dichloroethane	9.71E-09	1.90E-05	3.84E-08	8.32E-13
107-12-0	Propionitrile	2.84E-06	5.56E-03	1.12E-05	2.43E-10
107-13-1	Acrylonitrile	5.47E-07	1.07E-03	2.17E-06	4.69E-11

Table B-2 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
107-19-7	Propargyl alcohol	-	-	-	-
107-21-1	Ethylene glycol (1,2-ethanediol)	-	-	-	-
107-98-2	Propylene glycol monomethyl ether	-	-	-	-
108-05-4	Acetic acid vinyl ester	1.00E-03	1.97E+00	3.98E-03	8.60E-08
108-10-1	4-Methyl-2-pentanone	1.09E-07	2.13E-04	4.30E-07	9.32E-12
108-39-4	m-Cresol	2.47E-03	4.83E+00	9.77E-03	2.11E-07
108-60-1	bis (2-Chloroisopropyl)ether	-	-	-	-
108-67-8	1,3,5-Trimethylbenzene	-	-	-	-
108-86-1	Bromobenzene (Phenyl bromide)	-	-	-	-
108-87-2	Methylcyclohexane	2.08E-09	4.07E-06	8.24E-09	1.78E-13
108-88-3	Toluene	3.51E-08	6.86E-05	1.39E-07	3.00E-12
108-90-7	Chlorobenzene	8.87E-09	1.74E-05	3.51E-08	7.61E-13
108-94-1	Cyclohexanone	3.04E-05	5.96E-02	1.20E-04	2.61E-09
108-95-2	Phenol	5.08E-04	9.94E-01	2.01E-03	4.35E-08
109-74-0	n-Butanenitrile	8.20E-04	1.60E+00	3.25E-03	7.03E-08
109-75-1	3-Butenenitrile	-	-	-	-
109-77-3	Malononitrile	-	-	-	-
109-86-4	2-Methoxyethanol	-	-	-	-
109-99-9	Tetrahydrofuran	3.37E-07	6.59E-04	1.33E-06	2.88E-11
110-00-9	Furan	-	-	-	-
110-54-3	n-Hexane	2.38E-08	4.67E-05	9.44E-08	2.04E-12
110-59-8	Pentanenitrile	7.88E-04	1.54E+00	3.12E-03	6.75E-08
110-80-5	2-Ethoxyethanol	6.98E-03	1.37E+01	2.77E-02	5.98E-07

Table B-2 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
110-82-7	Cyclohexane	4.66E-09	9.12E-06	1.84E-08	3.99E-13
110-83-8	Cyclohexene	1.14E-08	2.24E-05	4.53E-08	9.80E-13
110-86-1	Pyridine	7.34E-06	1.44E-02	2.91E-05	6.29E-10
111-15-9	Ethylene glycol monoethyl ether acetate	-	-	-	-
111-44-4	bis(2-Chloroethyl)ether	3.17E-06	6.21E-03	1.26E-05	2.72E-10
111-65-9	n-Octane	3.11E-09	6.10E-06	1.23E-08	2.67E-13
111-76-2	2-Butoxyethanol	9.81E-04	1.92E+00	3.88E-03	8.41E-08
111-84-2	n-Nonane	1.97E-09	3.85E-06	7.78E-09	1.68E-13
111-91-1	bis(2-Chloroethoxy)methane	3.12E-05	6.10E-02	1.23E-04	2.67E-09
1120-21-4	Undecane	-	-	-	-
1120-71-4	1,3-Propane sultone	-	-	-	-
112-30-1	1-Decanol	-	-	-	-
112-31-2	Decanal	-	-	-	-
112-40-3	Dodecane	-	-	-	-
117-81-7	Bis(2-ethylhexyl) phthalate	9.57E-03	1.87E+01	3.79E-02	8.20E-07
117-84-0	Di-n-octylphthalate	3.38E-03	6.61E+00	1.34E-02	2.89E-07
118-74-1	Hexachlorobenzene	1.68E-08	3.29E-05	6.66E-08	1.44E-12
119-90-4	3,3'-Dimethoxybenzidine	-	-	-	-
120-12-7	Anthracene	6.04E-04	1.18E+00	2.39E-03	5.18E-08
120-82-1	1,2,4-Trichlorobenzene	5.91E-07	1.16E-03	2.34E-06	5.06E-11
120-83-2	2,4-Dichlorophenol	1.18E-03	2.32E+00	4.69E-03	1.01E-07
121-14-2	2,4-Dinitrotoluene	7.97E-03	1.56E+01	3.16E-02	6.83E-07
122-39-4	N,N-Diphenylamine	9.75E-07	1.91E-03	3.86E-06	8.36E-11

Table B-2 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
122-66-7	1,2-Diphenylhydrazine	-	-	-	-
123-33-1	Maleic hydrazide	-	-	-	-
123-38-6	Propionaldehyde	1.03E-06	2.02E-03	4.08E-06	8.83E-11
123-72-8	Butanal	8.53E-04	1.67E+00	3.38E-03	7.31E-08
123-91-1	1,4-Dioxan	3.14E-07	6.14E-04	1.24E-06	2.69E-11
124-18-5	Decane	-	-	-	-
124-38-9	Carbon dioxide	-	-	-	-
124-48-1	Chlorodibromomethane	5.70E-10	1.12E-06	2.26E-09	4.88E-14
126-73-8	Tributyl phosphate	9.56E-04	1.87E+00	3.79E-03	8.20E-08
126-98-7	2-Methyl-2-propenenitrile	3.07E-07	6.01E-04	1.22E-06	2.63E-11
127-18-4	1,1,2,2-Tetrachloroethene	6.09E-09	1.19E-05	2.41E-08	5.22E-13
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	1.52E-05	2.97E-02	6.00E-05	1.30E-09
129-00-0	Pyrene	2.96E-03	5.80E+00	1.17E-02	2.54E-07
131-11-3	Dimethyl Phthalate	8.97E-04	1.76E+00	3.55E-03	7.69E-08
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	-	-	-	-
132-64-9	Dibenzofuran	1.27E-08	2.48E-05	5.02E-08	1.09E-12
1330-20-7	Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations)	2.51E-06	4.91E-03	9.93E-06	2.15E-10
133-06-2	Captan	-	-	-	-
1336-36-3	Polychlorinated biphenyls (1254 Aroclor)	1.35E-03	2.65E+00	5.36E-03	1.16E-07
134-32-7	alpha-Naphthylamine	1.34E-03	2.62E+00	5.29E-03	1.15E-07
135-98-8	sec-Butylbenzene	-	-	-	-
141-78-6	Acetic acid ethyl ester	3.30E-08	6.45E-05	1.30E-07	2.82E-12

Table B-2 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
145-73-3	Endothall	-	-	-	-
156-59-2	cis-1,2-Dichloroethene	-	-	-	-
156-60-5	1,2-trans-Dichloroethene	1.70E-03	3.33E+00	6.74E-03	1.46E-07
1634-04-4	Methyl tert-butyl ether	8.19E-04	1.60E+00	3.24E-03	7.02E-08
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	4.13E-15	8.08E-12	1.63E-14	3.54E-19
189-55-9	Dibenzo[a,i]pyrene	2.48E-03	4.85E+00	9.80E-03	2.12E-07
189-64-0	Dibenzo[a,h]pyrene	2.48E-03	4.85E+00	9.80E-03	2.12E-07
191-24-2	Benzo(g,h,i)perylene	2.35E-03	4.61E+00	9.32E-03	2.02E-07
191-30-0	Dibenzo(a,l)pyrene	2.48E-03	4.85E+00	9.80E-03	2.12E-07
192-65-4	Dibenzo[a,e]pyrene	2.48E-03	4.85E+00	9.80E-03	2.12E-07
192-97-2	Benzo(e)pyrene	-	-	-	-
193-39-5	Indeno(1,2,3-cd)pyrene	9.64E-04	1.89E+00	3.82E-03	8.26E-08
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	3.30E-14	6.46E-11	1.31E-13	2.83E-18
205-82-3	Benzo[j]fluoranthene	-	-	-	-
205-99-2	Benzo(b)fluoranthene	1.87E-07	3.65E-04	7.39E-07	1.60E-11
206-44-0	Fluoranthene	2.96E-03	5.79E+00	1.17E-02	2.54E-07
207-08-9	Benzo(k)fluoranthene	7.93E-04	1.55E+00	3.14E-03	6.80E-08
208-96-8	Acenaphthylene	6.00E-04	1.18E+00	2.38E-03	5.15E-08
218-01-9	Chrysene	1.37E-07	2.68E-04	5.42E-07	1.17E-11
224-42-0	Dibenz[a,j]acridine	3.40E-03	6.65E+00	1.35E-02	2.91E-07
2245-38-7	2,3,5-Trimethylnaphthalene	-	-	-	-
226-36-8	Dibenz[a,h]acridine	3.41E-03	6.67E+00	1.35E-02	2.92E-07
23950-58-5	Pronamide	-	-	-	-

Table B-2 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
27154-33-2	Trichlorofluoroethane	2.59E-03	5.07E+00	1.03E-02	2.22E-07
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	3.84E-15	7.53E-12	1.52E-14	3.29E-19
319-84-6	alpha-BHC	3.48E-08	6.82E-05	1.38E-07	2.99E-12
319-85-7	beta-BHC	5.48E-08	1.07E-04	2.17E-07	4.70E-12
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	2.23E-12	4.36E-09	8.82E-12	1.91E-16
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	4.84E-17	9.48E-14	1.92E-16	4.15E-21
3268-87-9	Octachlorodibenzo(p)dioxin	1.58E-12	3.08E-09	6.24E-12	1.35E-16
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	2.20E-14	4.31E-11	8.72E-14	1.89E-18
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	1.20E-13	2.35E-10	4.76E-13	1.03E-17
3697-24-3	5-Methylchrysene	6.15E-04	1.20E+00	2.43E-03	5.27E-08
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	3.84E-15	7.52E-12	1.52E-14	3.29E-19
39001-02-0	Octachlorodibenzofuran	1.58E-12	3.10E-09	6.26E-12	1.36E-16
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	2.06E-14	4.03E-11	8.15E-14	1.76E-18
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	1.70E-14	3.33E-11	6.74E-14	1.46E-18
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	2.30E-13	4.51E-10	9.12E-13	1.97E-17
4170-30-3	Crotonaldehyde (Propylene aldehyde)	4.25E-07	8.32E-04	1.68E-06	3.64E-11
41851-50-7	Chlorocyclopentadiene	-	-	-	-
460-19-5	Cyanogen (oxalonitrile)	-	-	-	-
4786-20-3	2-Butenenitrile	-	-	-	-
50-00-0	Formaldehyde	1.76E-03	3.44E+00	6.96E-03	1.51E-07
50-32-8	Benzo(a)pyrene	8.29E-05	1.62E-01	3.28E-04	7.11E-09
506-68-3	Cyanogen bromide (bromocyanide)	-	-	-	-
506-77-4	Cyanogen chloride	-	-	-	-

Table B-2 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
510-15-6	Chlorobenzilate	-	-	-	-
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	7.91E-14	1.55E-10	3.13E-13	6.78E-18
51-28-5	2,4-Dinitrophenol	6.96E-03	1.36E+01	2.76E-02	5.96E-07
51-79-6	Ethyl carbamate (urethane)	-	-	-	-
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	2.22E-14	4.34E-11	8.78E-14	1.90E-18
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	-	-	-	-
532-27-4	2-Chloroacetophenone	-	-	-	-
534-52-1	4,6-Dinitro-o-cresol	1.13E-03	2.20E+00	4.46E-03	9.65E-08
53-70-3	Dibenz[a,h]anthracene	3.80E-03	7.43E+00	1.50E-02	3.25E-07
5385-75-1	Dibenzo(a,e)fluoranthene	-	-	-	-
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	1.49E-12	2.91E-09	5.89E-12	1.27E-16
540-73-8	1,2-Dimethylhydrazine	-	-	-	-
540-84-1	2,2,4-Trimethylpentane	-	-	-	-
541-73-1	1,3-Dichlorobenzene	3.65E-07	7.14E-04	1.44E-06	3.13E-11
542-75-6	1,3-Dichloropropene	-	-	-	-
542-88-1	bis(Chloromethyl)ether	-	-	-	-
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	1.68E-14	3.29E-11	6.65E-14	1.44E-18
56-23-5	Carbon tetrachloride	7.52E-09	1.47E-05	2.98E-08	6.44E-13
56-49-5	3-Methylcholanthrene	6.17E-04	1.21E+00	2.44E-03	5.28E-08
56-55-3	Benzo(a)anthracene	7.42E-05	1.45E-01	2.94E-04	6.36E-09
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	2.84E-13	5.56E-10	1.13E-12	2.43E-17
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	1.89E-13	3.69E-10	7.47E-13	1.62E-17
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	6.47E-14	1.27E-10	2.56E-13	5.55E-18

Table B-2 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
57-24-9	Strychnine	-	-	-	-
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	8.47E-13	1.66E-09	3.35E-12	7.26E-17
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	3.49E-14	6.83E-11	1.38E-13	2.99E-18
57-74-9	Chlordane	-	-	-	-
581-42-0	2,6-Dimethylnaphthalene	-	-	-	-
584-84-9	2,4-Toluene diisocyanate	-	-	-	-
58-89-9	gamma-BHC (Lindane)	4.77E-08	9.33E-05	1.89E-07	4.08E-12
58-90-2	2,3,4,6-Tetrachlorophenol	1.87E-03	3.66E+00	7.41E-03	1.60E-07
589-38-8	3-Hexanone	7.89E-04	1.55E+00	3.13E-03	6.77E-08
591-50-4	Benzene, iodo-	-	-	-	-
591-78-6	2-Hexanone	1.34E-06	2.61E-03	5.29E-06	1.14E-10
593-60-2	Bromoethene (Vinyl bromide)	-	-	-	-
593-74-8	Dimethyl Mercury	2.85E-07	5.57E-04	1.13E-06	2.44E-11
59-50-7	4-Chloro-3-methylphenol	2.90E-03	5.69E+00	1.15E-02	2.49E-07
59-89-2	N-Nitrosomorpholine	1.24E-02	2.43E+01	4.92E-02	1.06E-06
60-11-7	Dimethyl aminoazobenzene	2.40E-25	4.70E-22	9.51E-25	2.06E-29
602-87-9	5-Nitroacenaphthene	8.75E-04	1.71E+00	3.46E-03	7.50E-08
60-29-7	Ethyl ether	1.11E-06	2.18E-03	4.41E-06	9.54E-11
60-35-5	Acetamide	3.32E-03	6.50E+00	1.32E-02	2.85E-07
606-20-2	2,6-Dinitrotoluene	4.14E-04	8.11E-01	1.64E-03	3.55E-08
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	1.88E-14	3.67E-11	7.43E-14	1.61E-18
608-93-5	Pentachlorobenzene	-	-	-	-
61626-71-9	Dichloropentadiene	-	-	-	-

Table B-2 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
621-64-7	N-Nitroso-di-n-propylamine	2.73E-03	5.34E+00	1.08E-02	2.34E-07
624-83-9	Methyl isocyanate	-	-	-	-
62-50-0	Ethyl methanesulfonate	-	-	-	-
62-53-3	Aniline	-	-	-	-
62-75-9	N-Nitroso-N,N-dimethylamine	1.46E-05	2.86E-02	5.78E-05	1.25E-09
628-73-9	Hexanenitrile	7.67E-04	1.50E+00	3.04E-03	6.57E-08
630-20-6	1,1,1,2-Tetrachloroethane	3.66E-03	7.16E+00	1.45E-02	3.13E-07
64-18-6	Formic acid (methanoic acid)	-	-	-	-
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	1.89E-13	3.71E-10	7.50E-13	1.62E-17
65-85-0	Benzoic acid	-	-	-	-
67-56-1	Methyl alcohol	1.54E-03	3.02E+00	6.11E-03	1.32E-07
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	5.55E-14	1.09E-10	2.20E-13	4.75E-18
67-63-0	2-Propyl alcohol	8.69E-07	1.70E-03	3.44E-06	7.45E-11
67-64-1	2-Propanone (Acetone)	1.88E-05	3.68E-02	7.43E-05	1.61E-09
67-66-3	Chloroform	9.22E-09	1.80E-05	3.65E-08	7.90E-13
67-72-1	Hexachloroethane	1.08E-04	2.12E-01	4.28E-04	9.27E-09
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	5.90E-14	1.16E-10	2.34E-13	5.06E-18
70-30-4	Hexachlorophene	-	-	-	-
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	1.31E-13	2.56E-10	5.17E-13	1.12E-17
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	2.35E-14	4.61E-11	9.32E-14	2.02E-18
71-36-3	n-Butyl alcohol	2.52E-05	4.92E-02	9.96E-05	2.16E-09
71-43-2	Benzene	2.19E-08	4.29E-05	8.67E-08	1.88E-12
71-55-6	1,1,1-Trichloroethane	6.33E-09	1.24E-05	2.50E-08	5.42E-13

Table B-2 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
72-43-5	Methoxychlor	-	-	-	-
72-55-9	4,4-DDE	1.08E-03	2.11E+00	4.28E-03	9.25E-08
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	1.18E-14	2.32E-11	4.69E-14	1.02E-18
7439-97-6	Mercury	-	-	-	-
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	6.34E-15	1.24E-11	2.51E-14	5.43E-19
74-83-9	Bromomethane	1.70E-08	3.32E-05	6.72E-08	1.45E-12
74-87-3	Chloromethane	3.13E-08	6.13E-05	1.24E-07	2.69E-12
74-88-4	Iodomethane	5.94E-13	1.16E-09	2.35E-12	5.09E-17
74-95-3	Methylene bromide	-	-	-	-
74-97-5	Bromochloromethane	-	-	-	-
75-00-3	Chloroethane	1.57E-08	3.08E-05	6.23E-08	1.35E-12
75-01-4	1-Chloroethene	1.05E-08	2.06E-05	4.17E-08	9.03E-13
75-02-5	Fluoroethene (vinyl fluoride)	2.01E-04	3.93E-01	7.96E-04	1.72E-08
75-05-8	Acetonitrile	5.95E-05	1.17E-01	2.36E-04	5.10E-09
75-07-0	Acetaldehyde	1.04E-03	2.04E+00	4.13E-03	8.94E-08
75-09-2	Dichloromethane (Methylene Chloride)	5.74E-06	1.12E-02	2.27E-05	4.92E-10
75-15-0	Carbon disulfide	5.39E-16	1.05E-12	2.13E-15	4.62E-20
75-21-8	Ethylene oxide (Oxirane)	1.80E-06	3.52E-03	7.11E-06	1.54E-10
75-25-2	Bromoform	2.25E-25	4.40E-22	8.91E-25	1.93E-29
75-27-4	Bromodichloromethane	7.35E-03	1.44E+01	2.91E-02	6.29E-07
75-29-6	2-Chloropropane	-	-	-	-
75-34-3	1,1-Dichloroethane	6.94E-09	1.36E-05	2.75E-08	5.94E-13
75-35-4	1,1-Dichloroethene	6.67E-09	1.31E-05	2.64E-08	5.72E-13

Table B-2 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
75-44-5	Phosgene (hydrogen phosphide)	-	-	-	-
75-45-6	Chlorodifluoromethane	1.23E-08	2.40E-05	4.86E-08	1.05E-12
75-50-3	Trimethylamine	9.33E-04	1.83E+00	3.69E-03	7.99E-08
75-69-4	Trichlorofluoromethane	5.48E-09	1.07E-05	2.17E-08	4.69E-13
75-71-8	Dichlorodifluoromethane	1.87E-09	3.66E-06	7.41E-09	1.60E-13
76-01-7	Pentachloroethane	-	-	-	-
76-13-1	1,2,2-Trichlorotrifluoroethane	1.24E-09	2.42E-06	4.90E-09	1.06E-13
764-41-0	1,4-Dichloro-2-butene	-	-	-	-
76-44-8	Heptachlor	4.22E-10	8.25E-07	1.67E-09	3.61E-14
765-34-4	Glycidylaldehyde	-	-	-	-
7664-41-7	Ammonia/Ammonium	8.04E-03	1.57E+01	3.18E-02	6.89E-07
77-47-4	Hexachlorocyclopentadiene	2.59E-15	5.06E-12	1.02E-14	2.22E-19
77-78-1	Dimethyl sulfate	-	-	-	-
78-83-1	2-Methylpropyl alcohol	1.46E-02	2.86E+01	5.79E-02	1.25E-06
78-87-5	1,2-Dichloropropane	7.60E-09	1.49E-05	3.01E-08	6.51E-13
78-93-3	2-Butanone	4.23E-06	8.29E-03	1.68E-05	3.63E-10
79-00-5	1,1,2-Trichloroethane	9.52E-09	1.86E-05	3.77E-08	8.16E-13
79-01-6	1,1,2-Trichloroethylene	8.12E-09	1.59E-05	3.22E-08	6.96E-13
79-10-7	2-Propenoic acid	2.67E-03	5.22E+00	1.06E-02	2.29E-07
79-34-5	1,1,2,2-Tetrachloroethane	9.72E-09	1.90E-05	3.85E-08	8.33E-13
79-46-9	2-Nitropropane	2.06E-06	4.04E-03	8.17E-06	1.77E-10
80-62-6	Methyl methacrylate	-	-	-	-
822-06-0	Hexamethylene-1,5-diisocyanate	-	-	-	-

Table B-2 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
823-40-5	Toluene-2,6-diamine	-	-	-	-
82-68-8	Pentachloronitrobenzene (PCNB)	1.93E-06	3.78E-03	7.64E-06	1.65E-10
832-69-9	1-Methylphenanthrene	-	-	-	-
83-32-9	Acenaphthene	2.95E-03	5.78E+00	1.17E-02	2.53E-07
84-66-2	Diethyl phthalate	1.78E-03	3.49E+00	7.06E-03	1.53E-07
84-74-2	Di-n-butylphthalate	1.98E-02	3.87E+01	7.83E-02	1.69E-06
85-01-8	Phenanthrene	6.07E-04	1.19E+00	2.40E-03	5.20E-08
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	-	-	-	-
85-68-7	Butylbenzylphthalate	6.49E-03	1.27E+01	2.57E-02	5.57E-07
86-73-7	Fluorene	6.07E-04	1.19E+00	2.40E-03	5.20E-08
87-61-6	1,2,3-Trichlorobenzene	-	-	-	-
87-68-3	Hexachlorobutadiene	4.08E-06	7.98E-03	1.61E-05	3.49E-10
87-86-5	Pentachlorophenol	1.81E-05	3.53E-02	7.15E-05	1.55E-09
88-06-2	2,4,6-Trichlorophenol	2.63E-03	5.15E+00	1.04E-02	2.26E-07
88-74-4	o-Nitroaniline (2-nitroaniline)	1.22E-03	2.38E+00	4.81E-03	1.04E-07
88-75-5	2-Nitrophenol	2.68E-03	5.25E+00	1.06E-02	2.30E-07
90-04-0	o-Anisidine	-	-	-	-
90-12-0	1-Methylnaphthalene	-	-	-	-
91-20-3	Naphthalene	2.73E-03	5.34E+00	1.08E-02	2.34E-07
91-22-5	Quinoline	-	-	-	-
91-57-6	2-Methylnaphthalene	5.68E-10	1.11E-06	2.25E-09	4.86E-14
91-58-7	2-Chloronaphthalene	7.64E-04	1.50E+00	3.03E-03	6.55E-08
91-94-1	3,3'-Dichlorobenzidine	1.17E-02	2.29E+01	4.63E-02	1.00E-06

Table B-2 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
924-16-3	N-Nitroso-di-n-Buetylamine	-	-	-	-
92-52-4	1,1`-Biphenyl	1.94E-06	3.79E-03	7.67E-06	1.66E-10
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	-	-	-	-
94-75-7	2,4-D	-	-	-	-
95-48-7	o-Cresol	3.33E-03	6.52E+00	1.32E-02	2.85E-07
95-49-8	o-Chlorotoluene	-	-	-	-
95-50-1	1,2-Dichlorobenzene	7.56E-06	1.48E-02	2.99E-05	6.48E-10
95-53-4	o-Toluidine	-	-	-	-
95-57-8	2-Chlorophenol	2.77E-03	5.43E+00	1.10E-02	2.38E-07
95-63-6	1,2,4-Trimethyl benzene	-	-	-	-
95-94-3	1,2,4,5-Tetrachlorobenzene	-	-	-	-
95-95-4	2,4,5-Trichlorophenol	2.59E-03	5.07E+00	1.03E-02	2.22E-07
96-12-8	1,2-Dibromo-3-chloropropane	-	-	-	-
96-18-4	1,2,3-Trichloropropane	-	-	-	-
96-45-7	Ethylene thiourea	-	-	-	-
97-63-2	Ethyl methacrylate	-	-	-	-
98-01-1	Furfural	-	-	-	-
98-06-6	tert-Butyl benzene	-	-	-	-
98-07-7	Benzotrichloride	-	-	-	-
98-82-8	Cumene	1.39E-05	2.72E-02	5.49E-05	1.19E-09
98-83-9	Methyl styrene (mixed isomers)	-	-	-	-
98-86-2	Acetophenone	1.96E-06	3.84E-03	7.78E-06	1.68E-10
98-95-3	Nitrobenzene	8.51E-06	1.67E-02	3.37E-05	7.29E-10

Table B-2 Estimate of Organic Emission from the LAW Feed (LCP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction WF (mg/kg)	Weight Ratio WR (unitless)	Individual Organic Release R_{IO} (g/s)
99-35-4	1,3,5-Trinitrobenzene	-	-	-	-
99-65-0	1,3-Dinitrobenzene	-	-	-	-
99-87-6	p-Cymene	-	-	-	-
			Weight Fraction Sum = WF_s =	4.94E+02	
				Weight Ratio Sum = WR_s =	1.00E+00
					Feed Stream Sum = 2.16E-05

The following indicates the stream properties for feed into the LFP feed used to calculate the weight fraction:

$$WF = \frac{(Q_m * 1000)}{\left(Q_v * \frac{\rho}{60 * 60}\right)}$$

Where:

Q_m= compound mass flow rate (g/s)
Q_v = volumetric flow rate (m^3/hr) = 2.01
ρ = density (kg/m^3) = 1556.055

A "-" symbol indicates no data are available for approximating the emissions rate (no data were available, or the corresponding values were below the emissions model tolerance).

Table B-3 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
100-02-7	p-Nitrophenol	2.21E-02	2.54E+01	9.02E-02	2.21E-06
100-21-0	Phthalic acid	5.65E-03	6.50E+00	2.30E-02	5.64E-07
100-25-4	1,4-Dinitrobenzene	2.58E-06	2.96E-03	1.05E-05	2.57E-10
10028-17-8	Tritium	7.24E-07	8.33E-04	2.95E-06	7.23E-11
100-40-3	4-Ethenylcyclohexene	1.17E-05	1.34E-02	4.77E-05	1.17E-09
100-41-4	Ethyl benzene	5.13E-09	5.90E-06	2.09E-08	5.12E-13
100-42-5	Styrene	5.18E-09	5.96E-06	2.11E-08	5.17E-13
100-44-7	Benzyl chloride	-	-	-	-
100-47-0	Benzonitrile	-	-	-	-
100-51-6	Benzyl alcohol	-	-	-	-
100-52-7	Benzaldehyde	-	-	-	-
10061-01-5	cis-1,3-Dichloropropene	1.91E-08	2.20E-05	7.79E-08	1.91E-12
10061-02-6	trans-1,3-Dichloropropene	2.74E-08	3.16E-05	1.12E-07	2.74E-12

Table B-3 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
101-55-3	4-Bromophenylphenyl ether	9.64E-04	1.11E+00	3.93E-03	9.63E-08
101-77-9	4,4-Methylenedianiline	-	-	-	-
103-33-3	Azobenzene	-	-	-	-
103-65-1	n-Propyl benzene (Isocumene)	-	-	-	-
104-51-8	n-Butylbenzene	-	-	-	-
104-76-7	2-Ethyl-1-hexanol	7.70E-04	8.86E-01	3.14E-03	7.69E-08
105-67-9	2,4-Dimethylphenol	3.93E-04	4.53E-01	1.60E-03	3.93E-08
10595-95-6	n-Nitrosomethylethylamine	1.47E-03	1.69E+00	6.00E-03	1.47E-07
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	-	-	-	-
106-44-5	p-Cresol (4-methyl phenol)	-	-	-	-
106-46-7	1,4-Dichlorobenzene	3.45E-06	3.96E-03	1.41E-05	3.44E-10
106-47-8	p-Chloroaniline	6.90E-04	7.94E-01	2.81E-03	6.89E-08
106-49-0	p-Toluidine	-	-	-	-
106-51-4	Quinone	-	-	-	-
106-88-7	1,2-Epoxybutane	8.27E-04	9.51E-01	3.37E-03	8.26E-08
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	-	-	-	-
106-93-4	Ethylene dibromide	7.30E-09	8.39E-06	2.98E-08	7.29E-13
106-99-0	1,3-Butadiene	1.62E-09	1.86E-06	6.61E-09	1.62E-13
107-02-8	Acrolein	4.45E-07	5.12E-04	1.82E-06	4.44E-11
107-05-1	3-Chloropropene	6.25E-09	7.19E-06	2.55E-08	6.24E-13
107-06-2	1,2-Dichloroethane	8.36E-09	9.62E-06	3.41E-08	8.35E-13
107-12-0	Propionitrile	2.82E-06	3.25E-03	1.15E-05	2.82E-10

Table B-3 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
107-13-1	Acrylonitrile	5.38E-07	6.19E-04	2.19E-06	5.37E-11
107-19-7	Propargyl alcohol	-	-	-	-
107-21-1	Ethylene glycol (1,2-ethanediol)	-	-	-	-
107-98-2	Propylene glycol monomethyl ether	-	-	-	-
108-05-4	Acetic acid vinyl ester	9.27E-04	1.07E+00	3.78E-03	9.26E-08
108-10-1	4-Methyl-2-pentanone	1.06E-07	1.22E-04	4.34E-07	1.06E-11
108-39-4	m-Cresol	2.47E-03	2.84E+00	1.01E-02	2.46E-07
108-60-1	bis (2-Chloroisopropyl)ether	-	-	-	-
108-67-8	1,3,5-Trimethylbenzene	-	-	-	-
108-86-1	Bromobenzene (Phenyl bromide)	-	-	-	-
108-87-2	Methylcyclohexane	4.92E-12	5.66E-09	2.01E-11	4.92E-16
108-88-3	Toluene	1.51E-08	1.74E-05	6.17E-08	1.51E-12
108-90-7	Chlorobenzene	5.31E-09	6.10E-06	2.16E-08	5.30E-13
108-94-1	Cyclohexanone	3.04E-05	3.49E-02	1.24E-04	3.03E-09
108-95-2	Phenol	5.08E-04	5.84E-01	2.07E-03	5.07E-08
109-74-0	n-Butanenitrile	8.13E-04	9.35E-01	3.32E-03	8.12E-08
109-75-1	3-Butenenitrile	-	-	-	-
109-77-3	Malononitrile	-	-	-	-
109-86-4	2-Methoxyethanol	-	-	-	-
109-99-9	Tetrahydrofuran	3.33E-07	3.83E-04	1.36E-06	3.32E-11
110-00-9	Furan	-	-	-	-
110-54-3	n-Hexane	1.49E-10	1.71E-07	6.07E-10	1.49E-14

Table B-3 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
110-59-8	Pentanenitrile	7.79E-04	8.96E-01	3.18E-03	7.78E-08
110-80-5	2-Ethoxyethanol	6.98E-03	8.03E+00	2.85E-02	6.97E-07
110-82-7	Cyclohexane	3.08E-11	3.55E-08	1.26E-10	3.08E-15
110-83-8	Cyclohexene	5.45E-10	6.27E-07	2.22E-09	5.44E-14
110-86-1	Pyridine	7.33E-06	8.43E-03	2.99E-05	7.32E-10
111-15-9	Ethylene glycol monoethyl ether acetate	-	-	-	-
111-44-4	bis(2-Chloroethyl)ether	3.16E-06	3.64E-03	1.29E-05	3.16E-10
111-65-9	n-Octane	3.45E-11	3.97E-08	1.41E-10	3.45E-15
111-76-2	2-Butoxyethanol	9.81E-04	1.13E+00	4.00E-03	9.79E-08
111-84-2	n-Nonane	2.26E-11	2.60E-08	9.24E-11	2.26E-15
111-91-1	bis(2-Chloroethoxy)methane	3.12E-05	3.58E-02	1.27E-04	3.11E-09
1120-21-4	Undecane	-	-	-	-
1120-71-4	1,3-Propane sultone	-	-	-	-
112-30-1	1-Decanol	-	-	-	-
112-31-2	Decanal	-	-	-	-
112-40-3	Dodecane	-	-	-	-
117-81-7	Bis(2-ethylhexyl) phthalate	9.57E-03	1.10E+01	3.90E-02	9.55E-07
117-84-0	Di-n-octylphthalate	3.34E-03	3.84E+00	1.36E-02	3.34E-07
118-74-1	Hexachlorobenzene	1.38E-08	1.59E-05	5.64E-08	1.38E-12
119-90-4	3,3'-Dimethoxybenzidine	-	-	-	-
120-12-7	Anthracene	5.98E-04	6.88E-01	2.44E-03	5.97E-08
120-82-1	1,2,4-Trichlorobenzene	4.79E-07	5.51E-04	1.95E-06	4.78E-11

Table B-3 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
120-83-2	2,4-Dichlorophenol	8.36E-04	9.62E-01	3.41E-03	8.35E-08
121-14-2	2,4-Dinitrotoluene	7.97E-03	9.17E+00	3.25E-02	7.96E-07
122-39-4	N,N-Diphenylamine	9.75E-07	1.12E-03	3.98E-06	9.73E-11
122-66-7	1,2-Diphenylhydrazine	-	-	-	-
123-33-1	Maleic hydrazide	-	-	-	-
123-38-6	Propionaldehyde	1.02E-06	1.17E-03	4.15E-06	1.02E-10
123-72-8	Butanal	8.38E-04	9.63E-01	3.42E-03	8.36E-08
123-91-1	1,4-Dioxan	3.14E-07	3.61E-04	1.28E-06	3.13E-11
124-18-5	Decane	-	-	-	-
124-38-9	Carbon dioxide	-	-	-	-
124-48-1	Chlorodibromomethane	5.05E-10	5.81E-07	2.06E-09	5.05E-14
126-73-8	Tributyl phosphate	9.56E-04	1.10E+00	3.90E-03	9.55E-08
126-98-7	2-Methyl-2-propenenitrile	2.96E-07	3.40E-04	1.21E-06	2.95E-11
127-18-4	1,1,2,2-Tetrachloroethene	1.03E-09	1.19E-06	4.22E-09	1.03E-13
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	1.51E-05	1.74E-02	6.18E-05	1.51E-09
129-00-0	Pyrene	2.96E-03	3.40E+00	1.21E-02	2.95E-07
131-11-3	Dimethyl Phthalate	8.97E-04	1.03E+00	3.66E-03	8.96E-08
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	-	-	-	-
132-64-9	Dibenzofuran	1.23E-08	1.41E-05	5.00E-08	1.22E-12
1330-20-7	Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations)	1.26E-06	1.45E-03	5.15E-06	1.26E-10
133-06-2	Captan	-	-	-	-
1336-36-3	Polychlorinated biphenyls (1254 Aroclor)	1.31E-03	1.51E+00	5.36E-03	1.31E-07

Table B-3 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
134-32-7	alpha-Naphthylamine	1.34E-03	1.54E+00	5.45E-03	1.33E-07
135-98-8	sec-Butylbenzene	-	-	-	-
141-78-6	Acetic acid ethyl ester	3.23E-08	3.71E-05	1.32E-07	3.22E-12
145-73-3	Endothall	-	-	-	-
156-59-2	cis-1,2-Dichloroethene	-	-	-	-
156-60-5	1,2-trans-Dichloroethene	5.63E-04	6.47E-01	2.30E-03	5.62E-08
1634-04-4	Methyl tert-butyl ether	7.49E-04	8.61E-01	3.05E-03	7.47E-08
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	4.11E-15	4.72E-12	1.68E-14	4.10E-19
189-55-9	Dibenzo[a,i]pyrene	2.48E-03	2.85E+00	1.01E-02	2.47E-07
189-64-0	Dibenzo[a,h]pyrene	2.48E-03	2.85E+00	1.01E-02	2.47E-07
191-24-2	Benzo(g,h,i)perylene	2.35E-03	2.71E+00	9.60E-03	2.35E-07
191-30-0	Dibenzo(a,l)pyrene	2.48E-03	2.85E+00	1.01E-02	2.47E-07
192-65-4	Dibenzo[a,e]pyrene	2.48E-03	2.85E+00	1.01E-02	2.47E-07
192-97-2	Benzo(e)pyrene	-	-	-	-
193-39-5	Indeno(1,2,3-cd)pyrene	9.64E-04	1.11E+00	3.93E-03	9.63E-08
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	3.29E-14	3.79E-11	1.34E-13	3.29E-18
205-82-3	Benzo[j]fluoranthene	-	-	-	-
205-99-2	Benzo(b)fluoranthene	1.83E-07	2.11E-04	7.48E-07	1.83E-11
206-44-0	Fluoranthene	2.95E-03	3.40E+00	1.20E-02	2.95E-07
207-08-9	Benzo(k)fluoranthene	7.93E-04	9.12E-01	3.23E-03	7.92E-08
208-96-8	Acenaphthylene	5.90E-04	6.78E-01	2.40E-03	5.89E-08
218-01-9	Chrysene	1.35E-07	1.55E-04	5.50E-07	1.35E-11

Table B-3 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
224-42-0	Dibenz[a,j]acridine	3.40E-03	3.91E+00	1.39E-02	3.39E-07
2245-38-7	2,3,5-Trimethylnaphthalene	-	-	-	-
226-36-8	Dibenz[a,h]acridine	3.41E-03	3.92E+00	1.39E-02	3.40E-07
23950-58-5	Pronamide	-	-	-	-
27154-33-2	Trichlorofluoroethane	7.86E-04	9.04E-01	3.21E-03	7.85E-08
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	3.68E-15	4.23E-12	1.50E-14	3.67E-19
319-84-6	alpha-BHC	3.48E-08	4.00E-05	1.42E-07	3.47E-12
319-85-7	beta-BHC	5.48E-08	6.31E-05	2.24E-07	5.47E-12
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	2.22E-12	2.56E-09	9.07E-12	2.22E-16
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	4.27E-17	4.91E-14	1.74E-16	4.26E-21
3268-87-9	Octachlorodibenzo(p)dioxin	1.57E-12	1.81E-09	6.42E-12	1.57E-16
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	2.18E-14	2.51E-11	8.88E-14	2.17E-18
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	1.20E-13	1.38E-10	4.90E-13	1.20E-17
3697-24-3	5-Methylchrysene	6.14E-04	7.06E-01	2.50E-03	6.13E-08
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	3.76E-15	4.32E-12	1.53E-14	3.75E-19
39001-02-0	Octachlorodibenzofuran	1.58E-12	1.82E-09	6.45E-12	1.58E-16
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	2.05E-14	2.36E-11	8.38E-14	2.05E-18
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	1.69E-14	1.94E-11	6.88E-14	1.69E-18
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	2.30E-13	2.65E-10	9.39E-13	2.30E-17
4170-30-3	Crotonaldehyde (Propylene aldehyde)	4.24E-07	4.88E-04	1.73E-06	4.24E-11
41851-50-7	Chlorocyclopentadiene	-	-	-	-
460-19-5	Cyanogen (oxalonitrile)	-	-	-	-

Table B-3 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
4786-20-3	2-Butenenitrile	-	-	-	-
50-00-0	Formaldehyde	1.76E-03	2.02E+00	7.17E-03	1.75E-07
50-32-8	Benzo(a)pyrene	8.29E-05	9.53E-02	3.38E-04	8.27E-09
506-68-3	Cyanogen bromide (bromocyanide)	-	-	-	-
506-77-4	Cyanogen chloride	-	-	-	-
510-15-6	Chlorobenzilate	-	-	-	-
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	7.89E-14	9.08E-11	3.22E-13	7.88E-18
51-28-5	2,4-Dinitrophenol	6.96E-03	8.00E+00	2.84E-02	6.95E-07
51-79-6	Ethyl carbamate (urethane)	-	-	-	-
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	2.19E-14	2.52E-11	8.94E-14	2.19E-18
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	-	-	-	-
532-27-4	2-Chloroacetophenone	-	-	-	-
534-52-1	4,6-Dinitro-o-cresol	1.13E-03	1.30E+00	4.59E-03	1.12E-07
53-70-3	Dibenz[a,h]anthracene	3.80E-03	4.37E+00	1.55E-02	3.79E-07
5385-75-1	Dibenzo(a,e)fluoranthene	-	-	-	-
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	8.49E-13	9.76E-10	3.46E-12	8.47E-17
540-73-8	1,2-Dimethylhydrazine	-	-	-	-
540-84-1	2,2,4-Trimethylpentane	-	-	-	-
541-73-1	1,3-Dichlorobenzene	2.35E-07	2.71E-04	9.60E-07	2.35E-11
542-75-6	1,3-Dichloropropene	-	-	-	-
542-88-1	bis(Chloromethyl)ether	-	-	-	-
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	1.68E-14	1.93E-11	6.84E-14	1.67E-18

Table B-3 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
56-23-5	Carbon tetrachloride	6.61E-10	7.60E-07	2.69E-09	6.60E-14
56-49-5	3-Methylcholanthrene	6.16E-04	7.09E-01	2.51E-03	6.15E-08
56-55-3	Benzo(a)anthracene	7.42E-05	8.53E-02	3.03E-04	7.41E-09
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	2.84E-13	3.27E-10	1.16E-12	2.83E-17
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	1.88E-13	2.17E-10	7.69E-13	1.88E-17
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	6.47E-14	7.44E-11	2.64E-13	6.46E-18
57-24-9	Strychnine	-	-	-	-
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	8.46E-13	9.73E-10	3.45E-12	8.45E-17
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	3.49E-14	4.01E-11	1.42E-13	3.48E-18
57-74-9	Chlordane	-	-	-	-
581-42-0	2,6-Dimethylnaphthalene	-	-	-	-
584-84-9	2,4-Toluene diisocyanate	-	-	-	-
58-89-9	gamma-BHC (Lindane)	4.76E-08	5.48E-05	1.94E-07	4.75E-12
58-90-2	2,3,4,6-Tetrachlorophenol	1.87E-03	2.15E+00	7.63E-03	1.87E-07
589-38-8	3-Hexanone	7.74E-04	8.90E-01	3.16E-03	7.73E-08
591-50-4	Benzene, iodo-	-	-	-	-
591-78-6	2-Hexanone	1.32E-06	1.51E-03	5.37E-06	1.31E-10
593-60-2	Bromoethene (Vinyl bromide)	-	-	-	-
593-74-8	Dimethyl Mercury	4.51E-07	5.18E-04	1.84E-06	4.50E-11
59-50-7	4-Chloro-3-methylphenol	2.90E-03	3.34E+00	1.18E-02	2.90E-07
59-89-2	N-Nitrosomorpholine	1.24E-02	1.43E+01	5.07E-02	1.24E-06
60-11-7	Dimethyl aminoazobenzene	2.40E-25	2.76E-22	9.80E-25	2.40E-29

Table B-3 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
602-87-9	5-Nitroacenaphthene	8.75E-04	1.01E+00	3.57E-03	8.73E-08
60-29-7	Ethyl ether	9.25E-07	1.06E-03	3.77E-06	9.24E-11
60-35-5	Acetamide	3.32E-03	3.82E+00	1.35E-02	3.32E-07
606-20-2	2,6-Dinitrotoluene	4.14E-04	4.77E-01	1.69E-03	4.14E-08
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	1.87E-14	2.16E-11	7.64E-14	1.87E-18
608-93-5	Pentachlorobenzene	-	-	-	-
61626-71-9	Dichloropentadiene	-	-	-	-
621-64-7	N-Nitroso-di-n-propylamine	2.73E-03	3.13E+00	1.11E-02	2.72E-07
624-83-9	Methyl isocyanate	-	-	-	-
62-50-0	Ethyl methanesulfonate	-	-	-	-
62-53-3	Aniline	-	-	-	-
62-75-9	N-Nitroso-N,N-dimethylamine	1.46E-05	1.68E-02	5.95E-05	1.46E-09
628-73-9	Hexanenitrile	7.55E-04	8.69E-01	3.08E-03	7.54E-08
630-20-6	1,1,1,2-Tetrachloroethane	2.57E-03	2.96E+00	1.05E-02	2.57E-07
64-18-6	Formic acid (methanoic acid)	-	-	-	-
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	1.89E-13	2.17E-10	7.70E-13	1.88E-17
65-85-0	Benzoic acid	-	-	-	-
67-56-1	Methyl alcohol	1.54E-03	1.77E+00	6.29E-03	1.54E-07
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	5.54E-14	6.37E-11	2.26E-13	5.53E-18
67-63-0	2-Propyl alcohol	8.68E-07	9.99E-04	3.54E-06	8.67E-11
67-64-1	2-Propanone (Acetone)	1.87E-05	2.15E-02	7.61E-05	1.86E-09
67-66-3	Chloroform	5.51E-09	6.34E-06	2.25E-08	5.50E-13

Table B-3 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
67-72-1	Hexachloroethane	6.32E-05	7.27E-02	2.58E-04	6.31E-09
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	5.85E-14	6.73E-11	2.39E-13	5.84E-18
70-30-4	Hexachlorophene	-	-	-	-
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	1.30E-13	1.50E-10	5.31E-13	1.30E-17
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	2.35E-14	2.70E-11	9.58E-14	2.35E-18
71-36-3	n-Butyl alcohol	2.51E-05	2.89E-02	1.02E-04	2.51E-09
71-43-2	Benzene	1.05E-08	1.21E-05	4.29E-08	1.05E-12
71-55-6	1,1,1-Trichloroethane	1.15E-09	1.32E-06	4.68E-09	1.15E-13
72-43-5	Methoxychlor	-	-	-	-
72-55-9	4,4-DDE	1.08E-03	1.24E+00	4.39E-03	1.07E-07
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	1.18E-14	1.36E-11	4.82E-14	1.18E-18
7439-97-6	Mercury	-	-	-	-
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	6.25E-15	7.19E-12	2.55E-14	6.24E-19
74-83-9	Bromomethane	7.60E-09	8.74E-06	3.10E-08	7.59E-13
74-87-3	Chloromethane	1.09E-08	1.25E-05	4.43E-08	1.08E-12
74-88-4	Iodomethane	2.96E-13	3.41E-10	1.21E-12	2.96E-17
74-95-3	Methylene bromide	-	-	-	-
74-97-5	Bromochloromethane	-	-	-	-
75-00-3	Chloroethane	5.48E-09	6.31E-06	2.24E-08	5.48E-13
75-01-4	1-Chloroethene	1.07E-09	1.23E-06	4.37E-09	1.07E-13
75-02-5	Fluoroethene (vinyl fluoride)	1.99E-06	2.29E-03	8.11E-06	1.98E-10
75-05-8	Acetonitrile	5.92E-05	6.81E-02	2.41E-04	5.91E-09

Table B-3 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
75-07-0	Acetaldehyde	1.03E-03	1.19E+00	4.20E-03	1.03E-07
75-09-2	Dichloromethane (Methylene Chloride)	4.16E-06	4.79E-03	1.70E-05	4.16E-10
75-15-0	Carbon disulfide	4.81E-17	5.54E-14	1.96E-16	4.80E-21
75-21-8	Ethylene oxide (Oxirane)	1.75E-06	2.02E-03	7.16E-06	1.75E-10
75-25-2	Bromoform	-	-	-	-
75-27-4	Bromodichloromethane	5.79E-03	6.65E+00	2.36E-02	5.78E-07
75-29-6	2-Chloropropane	-	-	-	-
75-34-3	1,1-Dichloroethane	3.34E-09	3.85E-06	1.36E-08	3.34E-13
75-35-4	1,1-Dichloroethene	7.14E-10	8.21E-07	2.91E-09	7.12E-14
75-44-5	Phosgene (hydrogen phosphide)	-	-	-	-
75-45-6	Chlorodifluoromethane	6.98E-10	8.02E-07	2.84E-09	6.96E-14
75-50-3	Trimethylamine	9.17E-04	1.06E+00	3.74E-03	9.16E-08
75-69-4	Trichlorofluoromethane	7.49E-11	8.61E-08	3.05E-10	7.47E-15
75-71-8	Dichlorodifluoromethane	4.72E-12	5.43E-09	1.93E-11	4.71E-16
76-01-7	Pentachloroethane	-	-	-	-
76-13-1	1,2,2-Trichlorotrifluoroethane	3.00E-12	3.45E-09	1.22E-11	3.00E-16
764-41-0	1,4-Dichloro-2-butene	-	-	-	-
76-44-8	Heptachlor	2.21E-12	2.54E-09	9.00E-12	2.20E-16
765-34-4	Glycidylaldehyde	-	-	-	-
7664-41-7	Ammonia/Ammonium	8.04E-03	9.25E+00	3.28E-02	8.03E-07
77-47-4	Hexachlorocyclopentadiene	2.65E-16	3.05E-13	1.08E-15	2.65E-20
77-78-1	Dimethyl sulfate	-	-	-	-

Table B-3 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
78-83-1	2-Methylpropyl alcohol	1.46E-02	1.68E+01	5.95E-02	1.46E-06
78-87-5	1,2-Dichloropropane	5.10E-09	5.87E-06	2.08E-08	5.09E-13
78-93-3	2-Butanone	4.20E-06	4.83E-03	1.71E-05	4.19E-10
79-00-5	1,1,2-Trichloroethane	8.29E-09	9.53E-06	3.38E-08	8.27E-13
79-01-6	1,1,2-Trichloroethylene	2.53E-09	2.91E-06	1.03E-08	2.53E-13
79-10-7	2-Propenoic acid	2.67E-03	3.07E+00	1.09E-02	2.66E-07
79-34-5	1,1,2,2-Tetrachloroethane	9.22E-09	1.06E-05	3.76E-08	9.21E-13
79-46-9	2-Nitropropane	2.03E-06	2.33E-03	8.26E-06	2.02E-10
80-62-6	Methyl methacrylate	-	-	-	-
822-06-0	Hexamethylene-1,5-diisocyanate	-	-	-	-
823-40-5	Toluene-2,6-diamine	-	-	-	-
82-68-8	Pentachloronitrobenzene (PCNB)	1.82E-06	2.09E-03	7.42E-06	1.82E-10
832-69-9	1-Methylphenanthrene	-	-	-	-
83-32-9	Acenaphthene	2.88E-03	3.31E+00	1.17E-02	2.88E-07
84-66-2	Diethyl phthalate	1.78E-03	2.05E+00	7.28E-03	1.78E-07
84-74-2	Di-n-butylphthalate	1.98E-02	2.27E+01	8.06E-02	1.97E-06
85-01-8	Phenanthrene	6.05E-04	6.96E-01	2.47E-03	6.04E-08
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	-	-	-	-
85-68-7	Butylbenzylphthalate	6.49E-03	7.47E+00	2.65E-02	6.48E-07
86-73-7	Fluorene	6.01E-04	6.91E-01	2.45E-03	6.00E-08
87-61-6	1,2,3-Trichlorobenzene	-	-	-	-
87-68-3	Hexachlorobutadiene	1.51E-06	1.74E-03	6.17E-06	1.51E-10

Table B-3 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
87-86-5	Pentachlorophenol	1.81E-05	2.08E-02	7.36E-05	1.80E-09
88-06-2	2,4,6-Trichlorophenol	2.63E-03	3.02E+00	1.07E-02	2.62E-07
88-74-4	o-Nitroaniline (2-nitroaniline)	1.22E-03	1.40E+00	4.96E-03	1.21E-07
88-75-5	2-Nitrophenol	2.68E-03	3.08E+00	1.09E-02	2.67E-07
90-04-0	o-Anisidine	-	-	-	-
90-12-0	1-Methylnaphthalene	-	-	-	-
91-20-3	Naphthalene	2.53E-03	2.91E+00	1.03E-02	2.53E-07
91-22-5	Quinoline	-	-	-	-
91-57-6	2-Methylnaphthalene	5.24E-10	6.03E-07	2.14E-09	5.23E-14
91-58-7	2-Chloronaphthalene	7.28E-04	8.37E-01	2.97E-03	7.26E-08
91-94-1	3,3'-Dichlorobenzidine	1.17E-02	1.34E+01	4.77E-02	1.17E-06
924-16-3	N-Nitroso-di-n-Buetylamine	-	-	-	-
92-52-4	1,1`-Biphenyl	1.85E-06	2.12E-03	7.52E-06	1.84E-10
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	-	-	-	-
94-75-7	2,4-D	-	-	-	-
95-48-7	o-Cresol	3.33E-03	3.83E+00	1.36E-02	3.32E-07
95-49-8	o-Chlorotoluene	-	-	-	-
95-50-1	1,2-Dichlorobenzene	5.72E-06	6.58E-03	2.33E-05	5.71E-10
95-53-4	o-Toluidine	-	-	-	-
95-57-8	2-Chlorophenol	2.61E-03	3.00E+00	1.06E-02	2.61E-07
95-63-6	1,2,4-Trimethyl benzene	-	-	-	-
95-94-3	1,2,4,5-Tetrachlorobenzene	-	-	-	-

Table B-3 Estimate of Organic Emission from the LAW Feed (LFP)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction WF (mg/kg)	Weight Ratio WR (unitless)	Individual Organic Release R_{IO} (g/s)
95-95-4	2,4,5-Trichlorophenol	2.59E-03	2.98E+00	1.06E-02	2.59E-07
96-12-8	1,2-Dibromo-3-chloropropane	-	-	-	-
96-18-4	1,2,3-Trichloropropane	-	-	-	-
96-45-7	Ethylene thiourea	-	-	-	-
97-63-2	Ethyl methacrylate	-	-	-	-
98-01-1	Furfural	-	-	-	-
98-06-6	tert-Butyl benzene	-	-	-	-
98-07-7	Benzotrichloride	-	-	-	-
98-82-8	Cumene	5.87E-08	6.75E-05	2.39E-07	5.86E-12
98-83-9	Methyl styrene (mixed isomers)	-	-	-	-
98-86-2	Acetophenone	1.96E-06	2.26E-03	8.00E-06	1.96E-10
98-95-3	Nitrobenzene	8.48E-06	9.75E-03	3.46E-05	8.46E-10
99-35-4	1,3,5-Trinitrobenzene	-	-	-	-
99-65-0	1,3-Dinitrobenzene	-	-	-	-
99-87-6	p-Cymene	-	-	-	-
			Weight Fraction Sum = WF_s =	2.82E+02	
				Weight Ratio Sum = WR_s =	1.00E+00
					Feed Stream Sum = 2.23E-05

The following indicates the stream properties for feed into the RLD feed used to calculate the weight fraction:

$$WF = \frac{(Q_m * 1000)}{\left(Q_v * \frac{\rho}{60 * 60}\right)}$$

Where:

Q_m = compound mass flow rate (g/s)
Q_v = volumetric flow rate (m^3/hr) = 1.37
ρ = density (kg/m^3) = 1001.782

A "-" symbol indicates no data are available for approximating the emissions rate (no data were available, or the corresponding values were below the emissions model tolerance).

Table B-4 Estimate of Organic Emission from the LAW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
100-02-7	p-Nitrophenol	2.37E-02	6.25E+01	5.97E-02	2.22E-07
100-21-0	Phthalic acid	5.65E-03	1.49E+01	1.42E-02	5.29E-08
100-25-4	1,4-Dinitrobenzene	2.48E-06	6.52E-03	6.23E-06	2.32E-11
10028-17-8	Tritium	6.06E-07	1.59E-03	1.52E-06	5.67E-12
100-40-3	4-Ethenylcyclohexene	2.47E-09	6.50E-06	6.21E-09	2.31E-14
100-41-4	Ethyl benzene	6.15E-12	1.62E-08	1.55E-11	5.75E-17
100-42-5	Styrene	2.61E-05	6.86E-02	6.56E-05	2.44E-10
100-44-7	Benzyl chloride	-	-	-	-
100-47-0	Benzonitrile	-	-	-	-
100-51-6	Benzyl alcohol	-	-	-	-
100-52-7	Benzaldehyde	-	-	-	-
10061-01-5	cis-1,3-Dichloropropene	6.65E-11	1.75E-07	1.67E-10	6.23E-16

Table B-4 Estimate of Organic Emission from the LAW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
10061-02-6	trans-1,3-Dichloropropene	2.96E-10	7.79E-07	7.45E-10	2.77E-15
101-55-3	4-Bromophenylphenyl ether	7.22E-05	1.90E-01	1.82E-04	6.76E-10
101-77-9	4,4-Methylenedianiline	-	-	-	-
103-33-3	Azobenzene	-	-	-	-
103-65-1	n-Propyl benzene (Isocumene)	-	-	-	-
104-51-8	n-Butylbenzene	-	-	-	-
104-76-7	2-Ethyl-1-hexanol	2.02E-04	5.31E-01	5.08E-04	1.89E-09
105-67-9	2,4-Dimethylphenol	9.07E-03	2.39E+01	2.28E-02	8.49E-08
10595-95-6	n-Nitrosomethylethylamine	1.28E-03	3.36E+00	3.21E-03	1.20E-08
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	-	-	-	-
106-44-5	p-Cresol (4-methyl phenol)	-	-	-	-
106-46-7	1,4-Dichlorobenzene	1.05E-05	2.77E-02	2.65E-05	9.85E-11
106-47-8	p-Chloroaniline	9.98E-03	2.63E+01	2.51E-02	9.34E-08
106-49-0	p-Toluidine	-	-	-	-
106-51-4	Quinone	-	-	-	-
106-88-7	1,2-Epoxybutane	4.13E-05	1.09E-01	1.04E-04	3.87E-10
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	-	-	-	-
106-93-4	Ethylene dibromide	9.27E-11	2.44E-07	2.33E-10	8.68E-16
106-99-0	1,3-Butadiene	2.07E-13	5.45E-10	5.21E-13	1.94E-18
107-02-8	Acrolein	3.25E-08	8.57E-05	8.19E-08	3.05E-13
107-05-1	3-Chloropropene	5.34E-12	1.40E-08	1.34E-11	5.00E-17

Table B-4 Estimate of Organic Emission from the LAW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
107-06-2	1,2-Dichloroethane	7.13E-05	1.88E-01	1.79E-04	6.68E-10
107-12-0	Propionitrile	5.76E-07	1.52E-03	1.45E-06	5.39E-12
107-13-1	Acrylonitrile	7.78E-04	2.05E+00	1.96E-03	7.29E-09
107-19-7	Propargyl alcohol	-	-	-	-
107-21-1	Ethylene glycol (1,2-ethanediol)	-	-	-	-
107-98-2	Propylene glycol monomethyl ether	-	-	-	-
108-05-4	Acetic acid vinyl ester	1.68E-05	4.42E-02	4.23E-05	1.57E-10
108-10-1	4-Methyl-2-pentanone	6.82E-09	1.80E-05	1.72E-08	6.39E-14
108-39-4	m-Cresol	2.26E-03	5.95E+00	5.68E-03	2.12E-08
108-60-1	bis (2-Chloroisopropyl)ether	-	-	-	-
108-67-8	1,3,5-Trimethylbenzene	-	-	-	-
108-86-1	Bromobenzene (Phenyl bromide)	-	-	-	-
108-87-2	Methylcyclohexane	1.09E-16	2.86E-13	2.73E-16	1.02E-21
108-88-3	Toluene	1.07E-05	2.81E-02	2.69E-05	1.00E-10
108-90-7	Chlorobenzene	1.90E-05	5.01E-02	4.79E-05	1.78E-10
108-94-1	Cyclohexanone	1.56E-05	4.11E-02	3.93E-05	1.46E-10
108-95-2	Phenol	3.03E-03	7.97E+00	7.62E-03	2.84E-08
109-74-0	n-Butanenitrile	1.24E-04	3.26E-01	3.12E-04	1.16E-09
109-75-1	3-Butenenitrile	-	-	-	-
109-77-3	Malononitrile	-	-	-	-
109-86-4	2-Methoxyethanol	-	-	-	-

Table B-4 Estimate of Organic Emission from the LAW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
109-99-9	Tetrahydrofuran	3.96E-08	1.04E-04	9.96E-08	3.71E-13
110-00-9	Furan	-	-	-	-
110-54-3	n-Hexane	7.76E-16	2.04E-12	1.95E-15	7.27E-21
110-59-8	Pentanenitrile	9.12E-05	2.40E-01	2.29E-04	8.54E-10
110-80-5	2-Ethoxyethanol	6.65E-03	1.75E+01	1.67E-02	6.23E-08
110-82-7	Cyclohexane	1.93E-15	5.09E-12	4.87E-15	1.81E-20
110-83-8	Cyclohexene	1.13E-13	2.99E-10	2.85E-13	1.06E-18
110-86-1	Pyridine	3.78E-06	9.95E-03	9.51E-06	3.54E-11
111-15-9	Ethylene glycol monoethyl ether acetate	-	-	-	-
111-44-4	bis(2-Chloroethyl)ether	7.74E-04	2.04E+00	1.95E-03	7.25E-09
111-65-9	n-Octane	1.02E-16	2.69E-13	2.57E-16	9.57E-22
111-76-2	2-Butoxyethanol	8.39E-04	2.21E+00	2.11E-03	7.86E-09
111-84-2	n-Nonane	6.29E-17	1.66E-13	1.58E-16	5.89E-22
111-91-1	bis(2-Chloroethoxy)methane	1.43E-03	3.77E+00	3.60E-03	1.34E-08
1120-21-4	Undecane	-	-	-	-
1120-71-4	1,3-Propane sultone	-	-	-	-
112-30-1	1-Decanol	-	-	-	-
112-31-2	Decanal	-	-	-	-
112-40-3	Dodecane	-	-	-	-
117-81-7	Bis(2-ethylhexyl) phthalate	1.71E-02	4.50E+01	4.30E-02	1.60E-07
117-84-0	Di-n-octylphthalate	4.34E-04	1.14E+00	1.09E-03	4.06E-09

Table B-4 Estimate of Organic Emission from the LAW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
118-74-1	Hexachlorobenzene	1.70E-05	4.48E-02	4.28E-05	1.59E-10
119-90-4	3,3'-Dimethoxybenzidine	-	-	-	-
120-12-7	Anthracene	3.03E-04	7.96E-01	7.61E-04	2.83E-09
120-82-1	1,2,4-Trichlorobenzene	3.20E-09	8.41E-06	8.04E-09	2.99E-14
120-83-2	2,4-Dichlorophenol	3.27E-06	8.59E-03	8.22E-06	3.06E-11
121-14-2	2,4-Dinitrotoluene	9.56E-03	2.52E+01	2.41E-02	8.95E-08
122-39-4	N,N-Diphenylamine	7.59E-07	2.00E-03	1.91E-06	7.11E-12
122-66-7	1,2-Diphenylhydrazine	-	-	-	-
123-33-1	Maleic hydrazide	-	-	-	-
123-38-6	Propionaldehyde	1.17E-07	3.08E-04	2.94E-07	1.09E-12
123-72-8	Butanal	6.38E-05	1.68E-01	1.60E-04	5.97E-10
123-91-1	1,4-Dioxan	2.09E-07	5.49E-04	5.25E-07	1.95E-12
124-18-5	Decane	-	-	-	-
124-38-9	Carbon dioxide	-	-	-	-
124-48-1	Chlorodibromomethane	8.98E-05	2.36E-01	2.26E-04	8.41E-10
126-73-8	Tributyl phosphate	8.32E-04	2.19E+00	2.09E-03	7.79E-09
126-98-7	2-Methyl-2-propenenitrile	1.09E-08	2.87E-05	2.75E-08	1.02E-13
127-18-4	1,1,2,2-Tetrachloroethene	5.41E-13	1.42E-09	1.36E-12	5.06E-18
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	1.05E-05	2.77E-02	2.65E-05	9.86E-11
129-00-0	Pyrene	2.30E-03	6.05E+00	5.78E-03	2.15E-08
131-11-3	Dimethyl Phthalate	1.77E-03	4.67E+00	4.46E-03	1.66E-08

Table B-4 Estimate of Organic Emission from the LAW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	-	-	-	-
132-64-9	Dibenzofuran	1.00E-04	2.64E-01	2.52E-04	9.39E-10
1330-20-7	Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations)	1.37E-05	3.60E-02	3.44E-05	1.28E-10
133-06-2	Captan	-	-	-	-
1336-36-3	Polychlorinated biphenyls (1254 Aroclor)	6.20E-05	1.63E-01	1.56E-04	5.80E-10
134-32-7	alpha-Naphthylamine	1.32E-03	3.48E+00	3.32E-03	1.24E-08
135-98-8	sec-Butylbenzene	-	-	-	-
141-78-6	Acetic acid ethyl ester	2.13E-09	5.61E-06	5.36E-09	2.00E-14
145-73-3	Endothall	-	-	-	-
156-59-2	cis-1,2-Dichloroethene	-	-	-	-
156-60-5	1,2-trans-Dichloroethene	5.69E-07	1.50E-03	1.43E-06	5.33E-12
1634-04-4	Methyl tert-butyl ether	1.19E-05	3.14E-02	3.00E-05	1.12E-10
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1.66E-12	4.37E-09	4.18E-12	1.56E-17
189-55-9	Dibenzo[a,i]pyrene	2.47E-03	6.49E+00	6.20E-03	2.31E-08
189-64-0	Dibenzo[a,h]pyrene	2.47E-03	6.49E+00	6.20E-03	2.31E-08
191-24-2	Benzo(g,h,i)perylene	5.39E-03	1.42E+01	1.36E-02	5.04E-08
191-30-0	Dibenzo(a,l)pyrene	2.47E-03	6.49E+00	6.20E-03	2.31E-08
192-65-4	Dibenzo[a,e]pyrene	2.47E-03	6.49E+00	6.20E-03	2.31E-08
192-97-2	Benzo(e)pyrene	-	-	-	-
193-39-5	Indeno(1,2,3-cd)pyrene	3.93E-03	1.04E+01	9.90E-03	3.68E-08
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	2.74E-12	7.20E-09	6.88E-12	2.56E-17

Table B-4 Estimate of Organic Emission from the LAW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
205-82-3	Benzo[j]fluoranthene	-	-	-	-
205-99-2	Benzo(b)fluoranthene	3.68E-04	9.68E-01	9.25E-04	3.44E-09
206-44-0	Fluoranthene	1.93E-03	5.08E+00	4.86E-03	1.81E-08
207-08-9	Benzo(k)fluoranthene	4.95E-03	1.30E+01	1.25E-02	4.63E-08
208-96-8	Acenaphthylene	1.81E-04	4.77E-01	4.56E-04	1.70E-09
218-01-9	Chrysene	2.26E-04	5.94E-01	5.67E-04	2.11E-09
224-42-0	Dibenz[a,j]acridine	3.39E-03	8.92E+00	8.53E-03	3.18E-08
2245-38-7	2,3,5-Trimethylnaphthalene	-	-	-	-
226-36-8	Dibenz[a,h]acridine	3.40E-03	8.95E+00	8.55E-03	3.18E-08
23950-58-5	Pronamide	-	-	-	-
27154-33-2	Trichlorofluoroethane	7.20E-07	1.89E-03	1.81E-06	6.74E-12
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	5.07E-11	1.33E-07	1.28E-10	4.75E-16
319-84-6	alpha-BHC	1.61E-08	4.25E-05	4.06E-08	1.51E-13
319-85-7	beta-BHC	5.09E-08	1.34E-04	1.28E-07	4.76E-13
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	1.80E-10	4.73E-07	4.52E-10	1.68E-15
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	6.09E-12	1.60E-08	1.53E-11	5.70E-17
3268-87-9	Octachlorodibenzo(p)dioxin	7.59E-11	2.00E-07	1.91E-10	7.11E-16
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	2.44E-11	6.42E-08	6.14E-11	2.29E-16
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	1.28E-11	3.37E-08	3.23E-11	1.20E-16
3697-24-3	5-Methylchrysene	3.90E-04	1.03E+00	9.80E-04	3.65E-09
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	1.58E-11	4.15E-08	3.97E-11	1.48E-16
39001-02-0	Octachlorodibenzofuran	2.07E-11	5.46E-08	5.22E-11	1.94E-16

Table B-4 Estimate of Organic Emission from the LAW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	1.93E-12	5.07E-09	4.85E-12	1.81E-17
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	1.18E-11	3.11E-08	2.97E-11	1.11E-16
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	6.80E-12	1.79E-08	1.71E-11	6.37E-17
4170-30-3	Crotonaldehyde (Propylene aldehyde)	2.10E-07	5.52E-04	5.28E-07	1.96E-12
41851-50-7	Chlorocyclopentadiene	-	-	-	-
460-19-5	Cyanogen (oxalonitrile)	-	-	-	-
4786-20-3	2-Butenenitrile	-	-	-	-
50-00-0	Formaldehyde	1.70E-03	4.47E+00	4.27E-03	1.59E-08
50-32-8	Benzo(a)pyrene	1.83E-03	4.81E+00	4.60E-03	1.71E-08
506-68-3	Cyanogen bromide (bromocyanide)	-	-	-	-
506-77-4	Cyanogen chloride	-	-	-	-
510-15-6	Chlorobenzilate	-	-	-	-
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	1.10E-11	2.91E-08	2.78E-11	1.03E-16
51-28-5	2,4-Dinitrophenol	3.11E-02	8.18E+01	7.82E-02	2.91E-07
51-79-6	Ethyl carbamate (urethane)	-	-	-	-
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	2.31E-11	6.08E-08	5.82E-11	2.16E-16
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	-	-	-	-
532-27-4	2-Chloroacetophenone	-	-	-	-
534-52-1	4,6-Dinitro-o-cresol	1.37E-02	3.61E+01	3.45E-02	1.28E-07
53-70-3	Dibenz[a,h]anthracene	4.15E-03	1.09E+01	1.04E-02	3.88E-08
5385-75-1	Dibenzo(a,e)fluoranthene	-	-	-	-

Table B-4 Estimate of Organic Emission from the LAW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	1.72E-05	4.54E-02	4.34E-05	1.61E-10
540-73-8	1,2-Dimethylhydrazine	-	-	-	-
540-84-1	2,2,4-Trimethylpentane	-	-	-	-
541-73-1	1,3-Dichlorobenzene	7.17E-10	1.89E-06	1.80E-09	6.71E-15
542-75-6	1,3-Dichloropropene	-	-	-	-
542-88-1	bis(Chloromethyl)ether	-	-	-	-
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	2.28E-12	5.99E-09	5.72E-12	2.13E-17
56-23-5	Carbon tetrachloride	2.35E-06	6.19E-03	5.92E-06	2.20E-11
56-49-5	3-Methylcholanthrene	4.02E-04	1.06E+00	1.01E-03	3.76E-09
56-55-3	Benzo(a)anthracene	1.74E-03	4.59E+00	4.38E-03	1.63E-08
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	9.04E-12	2.38E-08	2.27E-11	8.46E-17
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	6.12E-12	1.61E-08	1.54E-11	5.73E-17
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	3.80E-12	1.00E-08	9.56E-12	3.56E-17
57-24-9	Strychnine	-	-	-	-
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	6.73E-11	1.77E-07	1.69E-10	6.30E-16
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	3.37E-12	8.86E-09	8.47E-12	3.15E-17
57-74-9	Chlordane	-	-	-	-
581-42-0	2,6-Dimethylnaphthalene	-	-	-	-
584-84-9	2,4-Toluene diisocyanate	-	-	-	-
58-89-9	gamma-BHC (Lindane)	3.09E-08	8.13E-05	7.77E-08	2.89E-13
58-90-2	2,3,4,6-Tetrachlorophenol	1.27E-03	3.35E+00	3.20E-03	1.19E-08

Table B-4 Estimate of Organic Emission from the LAW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
589-38-8	3-Hexanone	5.45E-05	1.44E-01	1.37E-04	5.11E-10
591-50-4	Benzene, iodo-	-	-	-	-
591-78-6	2-Hexanone	1.21E-07	3.19E-04	3.05E-07	1.14E-12
593-60-2	Bromoethene (Vinyl bromide)	-	-	-	-
593-74-8	Dimethyl Mercury	3.46E-07	9.11E-04	8.71E-07	3.24E-12
59-50-7	4-Chloro-3-methylphenol	2.58E-03	6.78E+00	6.49E-03	2.41E-08
59-89-2	N-Nitrosomorpholine	1.24E-02	3.26E+01	3.12E-02	1.16E-07
60-11-7	Dimethyl aminoazobenzene	-	-	-	-
602-87-9	5-Nitroacenaphthene	7.83E-04	2.06E+00	1.97E-03	7.34E-09
60-29-7	Ethyl ether	7.10E-09	1.87E-05	1.79E-08	6.65E-14
60-35-5	Acetamide	3.32E-03	8.74E+00	8.35E-03	3.11E-08
606-20-2	2,6-Dinitrotoluene	2.70E-03	7.11E+00	6.80E-03	2.53E-08
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	1.82E-12	4.78E-09	4.57E-12	1.70E-17
608-93-5	Pentachlorobenzene	-	-	-	-
61626-71-9	Dichloropentadiene	-	-	-	-
621-64-7	N-Nitroso-di-n-propylamine	2.20E-03	5.80E+00	5.55E-03	2.06E-08
624-83-9	Methyl isocyanate	-	-	-	-
62-50-0	Ethyl methanesulfonate	-	-	-	-
62-53-3	Aniline	-	-	-	-
62-75-9	N-Nitroso-N,N-dimethylamine	1.23E-05	3.23E-02	3.09E-05	1.15E-10
628-73-9	Hexanenitrile	6.86E-05	1.80E-01	1.73E-04	6.42E-10

Table B-4 Estimate of Organic Emission from the LAW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
630-20-6	1,1,1,2-Tetrachloroethane	9.97E-06	2.62E-02	2.51E-05	9.34E-11
64-18-6	Formic acid (methanoic acid)	-	-	-	-
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	4.38E-11	1.15E-07	1.10E-10	4.10E-16
65-85-0	Benzoic acid	-	-	-	-
67-56-1	Methyl alcohol	1.04E-03	2.75E+00	2.62E-03	9.77E-09
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	6.95E-12	1.83E-08	1.75E-11	6.51E-17
67-63-0	2-Propyl alcohol	4.69E-07	1.23E-03	1.18E-06	4.39E-12
67-64-1	2-Propanone (Acetone)	2.94E-03	7.73E+00	7.39E-03	2.75E-08
67-66-3	Chloroform	1.90E-05	5.01E-02	4.79E-05	1.78E-10
67-72-1	Hexachloroethane	1.53E-07	4.01E-04	3.84E-07	1.43E-12
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	3.91E-11	1.03E-07	9.83E-11	3.66E-16
70-30-4	Hexachlorophene	-	-	-	-
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	2.85E-11	7.50E-08	7.17E-11	2.67E-16
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	4.33E-12	1.14E-08	1.09E-11	4.06E-17
71-36-3	n-Butyl alcohol	1.30E-05	3.43E-02	3.28E-05	1.22E-10
71-43-2	Benzene	1.26E-05	3.31E-02	3.17E-05	1.18E-10
71-55-6	1,1,1-Trichloroethane	6.35E-13	1.67E-09	1.60E-12	5.95E-18
72-43-5	Methoxychlor	-	-	-	-
72-55-9	4,4-DDE	3.36E-04	8.84E-01	8.45E-04	3.14E-09
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	1.09E-12	2.88E-09	2.75E-12	1.03E-17
7439-97-6	Mercury	-	-	-	-
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	9.67E-12	2.54E-08	2.43E-11	9.05E-17

Table B-4 Estimate of Organic Emission from the LAW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
74-83-9	Bromomethane	1.13E-05	2.97E-02	2.84E-05	1.06E-10
74-87-3	Chloromethane	8.00E-06	2.10E-02	2.01E-05	7.49E-11
74-88-4	Iodomethane	1.29E-05	3.38E-02	3.23E-05	1.20E-10
74-95-3	Methylene bromide	-	-	-	-
74-97-5	Bromochloromethane	-	-	-	-
75-00-3	Chloroethane	5.89E-12	1.55E-08	1.48E-11	5.52E-17
75-01-4	1-Chloroethene	3.73E-13	9.82E-10	9.39E-13	3.49E-18
75-02-5	Fluoroethene (vinyl fluoride)	1.60E-10	4.20E-07	4.01E-10	1.49E-15
75-05-8	Acetonitrile	3.16E-02	8.32E+01	7.95E-02	2.96E-07
75-07-0	Acetaldehyde	1.11E-04	2.92E-01	2.79E-04	1.04E-09
75-09-2	Dichloromethane (Methylene Chloride)	8.33E-04	2.19E+00	2.10E-03	7.80E-09
75-15-0	Carbon disulfide	2.40E-06	6.31E-03	6.04E-06	2.25E-11
75-21-8	Ethylene oxide (Oxirane)	1.06E-07	2.78E-04	2.66E-07	9.91E-13
75-25-2	Bromoform	1.09E-08	2.88E-05	2.75E-08	1.02E-13
75-27-4	Bromodichloromethane	3.38E-05	8.91E-02	8.51E-05	3.17E-10
75-29-6	2-Chloropropane	-	-	-	-
75-34-3	1,1-Dichloroethane	5.68E-12	1.49E-08	1.43E-11	5.32E-17
75-35-4	1,1-Dichloroethene	2.58E-13	6.80E-10	6.50E-13	2.42E-18
75-44-5	Phosgene (hydrogen phosphide)	-	-	-	-
75-45-6	Chlorodifluoromethane	1.63E-13	4.28E-10	4.09E-13	1.52E-18
75-50-3	Trimethylamine	7.69E-05	2.02E-01	1.93E-04	7.20E-10
75-69-4	Trichlorofluoromethane	7.26E-15	1.91E-11	1.83E-14	6.80E-20

Table B-4 Estimate of Organic Emission from the LAW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
75-71-8	Dichlorodifluoromethane	1.30E-16	3.43E-13	3.28E-16	1.22E-21
76-01-7	Pentachloroethane	-	-	-	-
76-13-1	1,2,2-Trichlorotrifluoroethane	5.40E-17	1.42E-13	1.36E-16	5.06E-22
764-41-0	1,4-Dichloro-2-butene	-	-	-	-
76-44-8	Heptachlor	1.39E-17	3.67E-14	3.51E-17	1.30E-22
765-34-4	Glycidylaldehyde	-	-	-	-
7664-41-7	Ammonia/Ammonium	6.15E-02	1.62E+02	1.55E-01	5.76E-07
77-47-4	Hexachlorocyclopentadiene	9.09E-06	2.39E-02	2.29E-05	8.51E-11
77-78-1	Dimethyl sulfate	-	-	-	-
78-83-1	2-Methylpropyl alcohol	7.20E-03	1.89E+01	1.81E-02	6.74E-08
78-87-5	1,2-Dichloropropane	1.72E-11	4.53E-08	4.33E-11	1.61E-16
78-93-3	2-Butanone	1.08E-03	2.84E+00	2.72E-03	1.01E-08
79-00-5	1,1,2-Trichloroethane	8.54E-11	2.25E-07	2.15E-10	8.00E-16
79-01-6	1,1,2-Trichloroethylene	7.05E-06	1.86E-02	1.77E-05	6.61E-11
79-10-7	2-Propenoic acid	2.57E-03	6.76E+00	6.46E-03	2.40E-08
79-34-5	1,1,2,2-Tetrachloroethane	2.50E-10	6.58E-07	6.29E-10	2.34E-15
79-46-9	2-Nitropropane	1.49E-07	3.93E-04	3.76E-07	1.40E-12
80-62-6	Methyl methacrylate	-	-	-	-
822-06-0	Hexamethylene-1,5-diisocyanate	-	-	-	-
823-40-5	Toluene-2,6-diamine	-	-	-	-
82-68-8	Pentachloronitrobenzene (PCNB)	4.45E-08	1.17E-04	1.12E-07	4.16E-13

Table B-4 Estimate of Organic Emission from the LAW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
832-69-9	1-Methylphenanthrene	-	-	-	-
83-32-9	Acenaphthene	2.66E-04	7.00E-01	6.69E-04	2.49E-09
84-66-2	Diethyl phthalate	4.06E-03	1.07E+01	1.02E-02	3.81E-08
84-74-2	Di-n-butylphthalate	2.73E-02	7.18E+01	6.87E-02	2.56E-07
85-01-8	Phenanthrene	7.32E-04	1.93E+00	1.84E-03	6.86E-09
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	-	-	-	-
85-68-7	Butylbenzylphthalate	8.07E-03	2.12E+01	2.03E-02	7.56E-08
86-73-7	Fluorene	3.65E-04	9.60E-01	9.18E-04	3.42E-09
87-61-6	1,2,3-Trichlorobenzene	-	-	-	-
87-68-3	Hexachlorobutadiene	1.76E-09	4.62E-06	4.42E-09	1.64E-14
87-86-5	Pentachlorophenol	1.80E-05	4.74E-02	4.53E-05	1.69E-10
88-06-2	2,4,6-Trichlorophenol	1.44E-03	3.78E+00	3.62E-03	1.35E-08
88-74-4	o-Nitroaniline (2-nitroaniline)	2.44E-03	6.42E+00	6.13E-03	2.28E-08
88-75-5	2-Nitrophenol	4.01E-03	1.06E+01	1.01E-02	3.75E-08
90-04-0	o-Anisidine	-	-	-	-
90-12-0	1-Methylnaphthalene	-	-	-	-
91-20-3	Naphthalene	5.15E-03	1.36E+01	1.30E-02	4.82E-08
91-22-5	Quinoline	-	-	-	-
91-57-6	2-Methylnaphthalene	3.81E-05	1.00E-01	9.58E-05	3.57E-10
91-58-7	2-Chloronaphthalene	2.13E-05	5.61E-02	5.36E-05	1.99E-10
91-94-1	3,3'-Dichlorobenzidine	1.45E-02	3.83E+01	3.66E-02	1.36E-07

Table B-4 Estimate of Organic Emission from the LAW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction *WF* (mg/kg)	Weight Ratio *WR* (unitless)	Individual Organic Release R_{IO} (g/s)
924-16-3	N-Nitroso-di-n-Buetylamine	-	-	-	-
92-52-4	1,1`-Biphenyl	5.50E-08	1.45E-04	1.38E-07	5.15E-13
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	-	-	-	-
94-75-7	2,4-D	-	-	-	-
95-48-7	o-Cresol	2.95E-03	7.77E+00	7.43E-03	2.77E-08
95-49-8	o-Chlorotoluene	-	-	-	-
95-50-1	1,2-Dichlorobenzene	2.85E-08	7.49E-05	7.16E-08	2.67E-13
95-53-4	o-Toluidine	-	-	-	-
95-57-8	2-Chlorophenol	6.18E-05	1.63E-01	1.55E-04	5.79E-10
95-63-6	1,2,4-Trimethyl benzene	-	-	-	-
95-94-3	1,2,4,5-Tetrachlorobenzene	-	-	-	-
95-95-4	2,4,5-Trichlorophenol	1.78E-03	4.68E+00	4.47E-03	1.66E-08
96-12-8	1,2-Dibromo-3-chloropropane	-	-	-	-
96-18-4	1,2,3-Trichloropropane	-	-	-	-
96-45-7	Ethylene thiourea	-	-	-	-
97-63-2	Ethyl methacrylate	-	-	-	-
98-01-1	Furfural	-	-	-	-
98-06-6	tert-Butyl benzene	-	-	-	-
98-07-7	Benzotrichloride	-	-	-	-
98-82-8	Cumene	4.69E-13	1.23E-09	1.18E-12	4.39E-18
98-83-9	Methyl styrene (mixed isomers)	-	-	-	-

Table B-4 Estimate of Organic Emission from the LAW Feed (RLD)

CAS#	Organic Compound	Compound Mass Flow Rate Q_m (g/s)	Individual Organic Weight Fraction WF (mg/kg)	Weight Ratio WR (unitless)	Individual Organic Release R_{IO} (g/s)
98-86-2	Acetophenone	9.23E-07	2.43E-03	2.32E-06	8.65E-12
98-95-3	Nitrobenzene	6.21E-04	1.63E+00	1.56E-03	5.82E-09
99-35-4	1,3,5-Trinitrobenzene	-	-	-	-
99-65-0	1,3-Dinitrobenzene	-	-	-	-
99-87-6	p-Cymene	-	-	-	-
			Weight Fraction Sum = WF_s =	1.05E+03	
				Weight Ratio Sum = WR_s =	1.00E+00
					Feed Stream Sum = 3.50E-06

Attachment 4
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0	Supersedes 24590-WTP-RPT-ENS-07-002, Rev. 1.	David Blumenkranz
1	Values updated where appropriate.	David Blumenkranz
2	Added Appendix A. It was left out in Revision 1	Katie Henckel

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Acronyms

BAF	bioaccumulation factor
BaP	benzo[a]pyrene
BCF	bioconcentration factor
BEF	bioaccumulation equivalency factor
BSAF	biota-sediment accumulation factor
BW	body weight
COPC	chemical of potential concern
CSF	cancer slope factor
DW	dry weight
FCM	food chain multiplier
FW	fresh weight
GAF	gastrointestinal absorption factor
IUR	inhalation unit risk
RAWP	*Environmental Risk Assessment Work Plan for the Hanford Tank Waste Treatment and Immobilization Plant* (24590-WTP-RPT-ENV-14-003)
RCF	root concentration factor
RfC	reference concentration
RfD	reference dose
ROPC	radionuclide of potential concern
TCDD	tetrachlorodibenzo-p-dioxin
TEF	toxicity equivalency factor
TRV	toxicity reference value
URF	unit risk factor

Introduction

This document presents the input data used in the environmental risk assessment for the Hanford Tank Waste Treatment and Immobilization Plant (WTP). This document supplements the *Environmental Risk Assessment Work Plan for the Hanford Tank Waste Treatment and Immobilization Plant* (RAWP, 24590-WTP-RPT-ENV-14-002). Section 1 of this document simply identifies whether data are available. Sections 2 through 8 provide available quantities (values) and corresponding references. Only risk assessment modeling input relevant to constituents and their toxicity is included in this supplemental document. The RAWP describes the site-specific inputs and receptor exposure parameters. Data presented in this document are done so with a reference indicator (in brackets) in the right-hand column, adjacent to the data and applicable units. At the end of each data table, the reference indicators and their corresponding references are described. The figure below further illustrates the association of data with references. Where surrogate values are cited as references, the table entry for the surrogate should be inspected to determine the specific source of the reported value. Note that a blank or empty table cell is used to indicate where no data was available.

Table 3-4 Permeability Constant, Octanol/Water Partition

CAS Registry Number	Analyte Name	Permeability Constant (*Kp*)	Units for Permeability Constant	Reference	Octanol-water Partition
100-00-5	p-Nitrochlorobenzene	1.16E-02	cm/hr	[3]	2.88E
100-02-7	4-Nitrophenol	6.13E-03	cm/hr	[3]	8.13E
100-21-0	p-Phthalic acid	4.86E-03	cm/hr	[3]	1.00E+0
100-25-4	1,4-Dinitrobenzene	1.95E-03	cm/hr	[3]	2.88E+0
100-40-3	4-Vinylcyclohexene				8.51E
100-41-4	Ethyl benzene	7.39E-02	cm/hr	[3]	1.26
	Styre	5.48E-02			1.00

Data (value) and units

Reference indicator

A blank cell indicates no data available.

Reference **Reference (source) for Permeability**

[3] ORNL. *The Risk Assessment Information System (RAIS) Database*. Copyright © 2013 Oak Ridge National Laboratory and The University of Tennessee, Oak Ridge, TN (http://rais.ornl.gov, accessed April 2014).

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1 Tabulation of Available Inputs

The hierarchy for physical and toxicological parameters included using EPA references were available (including databases), with references and databases from other government agencies and national laboratories being secondary, followed by scientific or academic publications or databases. Where such data were not available, values were computed using Appendix A methods from the *Human Health Risk Assessment Protocol* (EPA 2005), or EPI Suite. Lastly, surrogate values were used (see CCN 097844). Acute and ecological toxicological values were the exception, and their references followed the hierarchy documented in the *Environmental Risk Assessment Work Plan for the Hanford Tank Waste Treatment and Immobilization Plant* (24590-WTP-RPT-ENV-14-002, Sections 7.2.1.2, 8.3.1, and 8.3.2).

The following table identifies data available in literature and database references, as indicated by an "X." Inputs that are calculated during the risk assessment modeling process are identified with "calc" (refer the Appendix A of the *Human Health Risk Assessment Protocol*, EPA 2005). Inputs that are obtained from surrogate constituents are identified with "surr." Blank table entries indicate where data are unavailable or not applicable (e.g., radiological half-lives are not applicable to nonradionuclides). Table 1-1 identifies available constituent physical parameters.

Table 1-1 Available COPC/ROPC Physical Parameters

CAS Registry Number	Constituent Name	Molar Weight	Solubility	Vapor Fraction	Vapor Pressure	Air Diffusivity	Water Diffusivity	Henry's Law Constant	Permeability Constant	Soil-Water Partitioning Coeff.	Sediment-Water Partitioning Coeff.	Bed Sediment-Pore Water Partitioning Coeff.	Org. Carbon-Water Partitioning Coeff.	Octanol-Water Partitioning Coeff.	Half-life in Soil	Radiological Half-life
100-02-7	p-Nitrophenol	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
100-21-0	Phthalic acid	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
100-25-4	1,4-Dinitrobenzene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
100-40-3	4-Ethenylcyclohexene	X	X	X	X	calc.	calc.	X	X	calc.	calc.	calc.	calc.	X		
100-41-4	Ethyl benzene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
100-42-5	Styrene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
100-44-7	Benzyl chloride	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
100-47-0	Benzonitrile	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
100-51-6	Benzyl alcohol	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
100-52-7	Benzaldehyde	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
10028-15-6	Ozone	X	X	calc.	X	calc.	calc.	calc.	X					X		
10028-17-8	Tritium	X	X	X	X	calc.	X	calc.		X				X		X
10045-97-3	Cesium-137	X		X		calc.	calc.	calc.		X	X	X			X	X
10061-01-5	cis-1,3-Dichloropropene	X	X	X	X	X	X	X	X	surr.	surr.	surr.	X	X		
10061-02-6	trans-1,3-Dichloropropene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
10098-91-6	Yttrium-90	X		X		calc.	calc.	calc.		X	X	X				X
10098-97-2	Strontium-90	X		X		calc.	calc.	calc.		X	X	X			X	X

Table 1-1 Available COPC/ROPC Physical Parameters

CAS Registry Number	Constituent Name	Molar Weight	Solubility	Vapor Fraction	Vapor Pressure	Air Diffusivity	Water Diffusivity	Henry's Law Constant	Permeability Constant	Soil-Water Partitioning Coeff.	Sediment-Water Partitioning Coeff.	Bed Sediment-Pore Water Partitioning Coeff.	Org. Carbon-Water Partitioning Coeff.	Octanol-Water Partitioning Coeff.	Half-life in Soil	Radiological Half-life
101-55-3	4-Bromophenylphenyl ether	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
101-77-9	4,4-Methylenedianiline	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
10102-44-0	Nitrogen dioxide	X	X	X	X	calc.	calc.	X	X					X		
10198-40-0	Cobalt-60	X		X		calc.	calc.	calc.		X	X	X				X
103-33-3	Azobenzene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
103-65-1	n-Propyl benzene (Isocumene)	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
104-51-8	n-Butylbenzene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	calc.	X		
104-76-7	2-Ethyl-1-hexanol	X	X	X	X	calc.	calc.	X	X	calc.	calc.	calc.	calc.	X		
105-67-9	2,4-Dimethylphenol	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
10595-95-6	n-Nitrosomethylethylamine	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
106-44-5	p-Cresol (4-methyl phenol)	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
106-46-7	1,4-Dichlorobenzene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
106-47-8	p-Chloroaniline	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
106-49-0	p-Toluidine	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
106-51-4	Quinone	X	X	X	X	calc.	calc.	X	X	calc.	calc.	calc.	calc.	X	X	
106-88-7	1,2-Epoxybutane	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
106-93-4	Ethylene dibromide	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
106-99-0	1,3-Butadiene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
107-02-8	Acrolein	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
107-05-1	3-Chloropropene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
107-06-2	1,2-Dichloroethane	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
107-12-0	Propionitrile	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
107-13-1	Acrylonitrile	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
107-19-7	Propargyl alcohol	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
107-21-1	Ethylene glycol (1,2-ethanediol)	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
107-98-2	Propylene glycol monomethyl ether	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
108-05-4	Acetic acid vinyl ester	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X		
108-10-1	4-Methyl-2-pentanone	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	

Table 1-1 Available COPC/ROPC Physical Parameters

CAS Registry Number	Constituent Name	Molar Weight	Solubility	Vapor Fraction	Vapor Pressure	Air Diffusivity	Water Diffusivity	Henry's Law Constant	Permeability Constant	Soil-Water Partitioning Coeff.	Sediment-Water Partitioning Coeff.	Bed Sediment-Pore Water Partitioning Coeff.	Org. Carbon-Water Partitioning Coeff.	Octanol-Water Partitioning Coeff.	Half-life in Soil	Radiological Half-life
108-39-4	m-Cresol	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
108-60-1	bis (2-Chloroisopropyl)ether	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
108-67-8	1,3,5-Trimethylbenzene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
108-86-1	Bromobenzene (Phenyl bromide)	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
108-87-2	Methylcyclohexane	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
108-88-3	Toluene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
108-90-7	Chlorobenzene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
108-94-1	Cyclohexanone	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
108-95-2	Phenol	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
109-74-0	n-Butanenitrile	X	X	X	X	calc.	calc.	X	X	calc.	calc.	calc.	calc.	X		
109-75-1	3-Butenenitrile	X	X	calc.	X	calc.	calc.	X	X	calc.	calc.	calc.	calc.	X		
109-77-3	Malononitrile	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
109-86-4	2-Methoxyethanol	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
109-99-9	Tetrahydrofuran	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
110-00-9	Furan	X	X	calc.	X	X	X	X	X	calc.	calc.	calc.	X	X		
110-54-3	n-Hexane	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
110-59-8	Pentanenitrile	X	X	X	X	calc.	calc.	X	X	calc.	calc.	calc.	calc.	X		
110-80-5	2-Ethoxyethanol	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
110-82-7	Cyclohexane	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
110-83-8	Cyclohexene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
110-86-1	Pyridine	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
111-15-9	Ethylene glycol monoethyl ether acetate	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
111-44-4	Bis(2-chloroethyl)ether	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
111-65-9	n-Octane	X	X	X	X	calc.	calc.	X	X	calc.	calc.	calc.	calc.	X		
111-76-2	2-Butoxyethanol	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
111-84-2	n-Nonane	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
111-91-1	Bis(2-chloroethoxy)methane	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
112-30-1	1-Decanol	X	X	calc.	X	X	X	X	X	calc.	calc.	calc.	X	X		
112-31-2	Decanal	X	X	calc.	X	calc.	calc.	X	X	calc.	calc.	calc.	calc.	X		
112-40-3	Dodecane	X	X	calc.	X	calc.	calc.	X	X	calc.	calc.	calc.	calc.	X		
1120-21-4	Undecane	X	X	calc.	X	calc.	calc.	X	X	calc.	calc.	calc.	calc.	X		
1120-71-4	1,3-Propane sultone	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
117-81-7	Bis(2-ethylhexyl) phthalate	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X		
117-84-0	Di-n-octylphthalate	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
118-74-1	Hexachlorobenzene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	

Table 1-1 Available COPC/ROPC Physical Parameters

CAS Registry Number	Constituent Name	Molar Weight	Solubility	Vapor Fraction	Vapor Pressure	Air Diffusivity	Water Diffusivity	Henry's Law Constant	Permeability Constant	Soil-Water Partitioning Coeff.	Sediment-Water Partitioning Coeff.	Bed Sediment-Pore Water Partitioning Coeff.	Org. Carbon-Water Partitioning Coeff.	Octanol-Water Partitioning Coeff.	Half-life in Soil	Radiological Half-life
119-90-4	3,3'-Dimethoxybenzidine	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
120-12-7	Anthracene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
120-82-1	1,2,4-Trichlorobenzene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
120-83-2	2,4-Dichlorophenol	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
121-14-2	2,4-Dinitrotoluene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
122-39-4	N,N-Diphenylamine	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
122-66-7	1,2-Diphenylhydrazine	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
123-33-1	Maleic hydrazide	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
123-38-6	Propionaldehyde	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
123-72-8	Butanal	X	X	X	X	calc.	calc.	X	X	calc.	calc.	calc.	calc.	X	X	
123-91-1	1,4-Dioxan	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
124-18-5	Decane	X	X	calc.	X	X	X	X	X	calc.	calc.	calc.	X	X		
124-38-9	Carbon dioxide	X	X	calc.	X	calc.	calc.	calc.		calc.	calc.	calc.	calc.	X		
124-48-1	Chlorodibromomethane	X	X	X	X	X	X	X	X	calc.	calc.	calc.	calc.	X	X	
126-73-8	Tributyl phosphate	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
126-98-7	2-Methyl-2-propenenitrile	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
127-18-4	1,1,2,2-Tetrachloroethene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	X	X	X	X	X	X	X	X					X		
129-00-0	Pyrene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
131-11-3	Dimethyl Phthalate	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
132-64-9	Dibenzofuran	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
133-06-2	Captan	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
1330-20-7	Xylenes (mixed isomers)	X	X	calc.	X	X	X	X	X	calc.	calc.	calc.	X	X		
1336-36-3	Polychlorinated biphenyls	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
134-32-7	alpha-Naphthylamine	X	X	X	X	X	X	X	X					X	X	
135-98-8	sec-Butylbenzene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	surr.	
13966-29-5	Uranium-234	X		X		calc.	calc.	calc.		X	X	X				X
13967-48-1	Ruthenium-106	X		X		calc.	calc.	calc.		X	X	X				X
13967-70-9	Cesium-134	X		X		calc.	calc.	calc.		X	X	X			X	X
13968-55-3	Uranium-233	X		X		calc.	calc.	calc.		X	X	X				X
13981-15-2	Curium-244	X		X		calc.	calc.	calc.		X	X	X				X
13981-16-3	Plutonium-238	X		X		calc.	calc.	calc.		X	X	X				X

Table 1-1 Available COPC/ROPC Physical Parameters

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13981-37-8	Nickel-63	X		X		calc.	calc.	calc.		X	X	X				X
13982-10-0	Plutonium-242	X		X		calc.	calc.	calc.		X	X	X				X
13982-63-3	Radium-226	X		X		calc.	calc.	calc.		X	X	X				X
13982-70-2	Uranium-236	X		X		calc.	calc.	calc.		X	X	X				X
13994-20-2	Neptunium-237	X		X		calc.	calc.	calc.		X	X	X				X
141-78-6	Acetic acid ethyl ester	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
14119-32-5	Plutonium-241	X		X		calc.	calc.	calc.		X	X	X				X
14119-33-6	Plutonium-240	X		X		calc.	calc.	calc.		X	X	X				X
14133-76-7	Technetium-99	X		X		calc.	calc.	calc.		X	X	X				X
14158-29-3	Uranium-232	X		X		calc.	calc.	calc.		X	X	X				X
14234-35-6	Antimony-125	X		X		calc.	calc.	calc.		X	X	X				X
14265-44-2	Phosphate	X		X		calc.	calc.	calc.								
14331-85-2	Protactinium-231	X		X		calc.	calc.	calc.		X	X	X				X
14336-70-0	Nickel-59	X		X		calc.	calc.	calc.		X	X	X				X
14391-16-3	Europium-155	X		X		calc.	calc.	calc.		X	X	X				X
145-73-3	Endothall	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
14596-10-2	Americium-241	X		X		calc.	calc.	calc.		X	X	X				X
14683-23-9	Europium-152	X		X		calc.	calc.	calc.		X	X	X				X
14762-75-5	Carbon-14	X		X		calc.	calc.	calc.		X	X	X				X
14797-55-8	Nitrate	X	X	X	X	calc.	calc.	X	X					X		
14797-65-0	Nitrite	X		X		calc.	calc.	calc.	X							
14808-79-8	Sulfate	X	X	X	X	calc.	calc.	calc.	X							
14952-40-0	Actinium-227	X		X		calc.	calc.	calc.		X	X	X				X
14993-75-0	Americium-243	X		X		calc.	calc.	calc.		X	X	X				X
15046-84-1	Iodine-129	X		X	X	calc.	calc.	calc.		X	X	X			X	X
15117-48-3	Plutonium-239	X		X		calc.	calc.	calc.		X	X	X				X
15117-96-1	Uranium-235	X		X		calc.	calc.	calc.		X	X	X				X
15262-20-1	Radium-228	X		X		calc.	calc.	calc.		X	X	X				X
15510-73-3	Curium-242	X		X		calc.	calc.	calc.		X	X	X				X
15585-10-1	Europium-154	X		X		calc.	calc.	calc.		X	X	X				X
15594-54-4	Thorium-229	X		X		calc.	calc.	calc.		X	X	X				X
156-59-2	cis-1,2-Dichloroethene	X	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X		
156-60-5	1,2-trans-Dichloroethene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X		
15715-94-3	Samarium-151	X		X		calc.	calc.	calc.		X	X	X				X
15751-77-6	Zirconium-93	X		X		calc.	calc.	calc.		X	X	X				X
15757-87-6	Curium-243	X		X		calc.	calc.	calc.		X	X	X				X
15758-45-9	Selenium-79	X		X		calc.	calc.	calc.		X	X	X				X
15832-50-5	Tin-126	X		X		calc.	calc.	calc.		X	X	X				X
1634-04-4	Methyl tert-butyl ether	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	

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16887-00-6	Chloride	X	X	X	X	calc.	calc.	X	X					X		
16984-48-8	Fluoride	X	X	X		calc.	calc.	calc.	X	X						
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
18540-29-9	Chromium(VI)	X	X	X	X	X	X	X	X	X	X	X		X		
189-55-9	Dibenzo[a,i]pyrene	X	X	X	X	X	X	X	X	surr.	surr.	surr.	X	X	X	
189-64-0	Dibenzo[a,h]pyrene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	surr.	
191-24-2	Benzo(g,h,i)perylene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
191-30-0	Dibenzo(a,l)pyrene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
192-65-4	Dibenzo[a,e]pyrene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
192-97-2	Benzo(e)pyrene	X	X	X	X	calc.	calc.	X	X	calc.	calc.	calc.	calc.	X		
193-39-5	Indeno(1,2,3-cd)pyrene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
205-82-3	Benzo[j]fluoranthene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
205-99-2	Benzo(b)fluoranthene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
206-44-0	Fluoranthene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
207-08-9	Benzo(k)fluoranthene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
208-96-8	Acenaphthylene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
218-01-9	Chrysene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
224-42-0	Dibenz[a,j]acridine	X	X	X	X	X	X	X	X	surr.	surr.	surr.	X	X	surr.	
2245-38-7	2,3,5-Trimethylnaphthalene	X	X	calc.	X	calc.	calc.	X	X	calc.	calc.	calc.	calc.	X		
226-36-8	Dibenz[a,h]acridine	X	X	X	X	X	X	X	X	surr.	surr.	surr.	X	X	surr.	
22967-92-6	Methyl mercury	X	X	X	X	X	X	X	X	X	X	X				
23950-58-5	Pronamide	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
24959-67-9	Bromide	X	X	X	X	calc.	calc.	X	X					X		
27154-33-2	Trichlorofluoroethane	X	surr.	X	X	surr.	surr.	calc.	surr.	surr.	surr.	surr.	surr.	surr.	surr.	
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
319-84-6	alpha-BHC	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
319-85-7	beta-BHC	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	

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32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
3268-87-9	Octachlorodibenzo(p)dioxin	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
3697-24-3	5-Methylchrysene	X	X	X	X	X	X	X	X	surr.	surr.	surr.	X	X	surr.	
378253-40-8	Barium-137m	X		X		calc.	calc.	calc.		X	X	X				X
378253-44-2	Cadmium-113m	X		X		calc.	calc.	calc.		X	X	X				X
378782-82-2	Niobium-93m	X		X		calc.	calc.	calc.		X	X	X				X
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
39001-02-0	Octachlorodibenzofuran	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
4170-30-3	Crotonaldehyde (Propylene aldehyde)	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
41851-50-7	Chlorocyclopentadiene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
460-19-5	Cyanogen (oxalonitrile)	X	X	X	X	X	X	X	X	calc.	calc.	calc.	calc.	X		
4786-20-3	2-Butenenitrile	X	X	calc.	X	calc.	calc.	X	X	calc.	calc.	calc.	calc.	X		
50-00-0	Formaldehyde	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
50-32-8	Benzo(a)pyrene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
506-68-3	Cyanogen bromide (bromocyanide)	X	X	X	X	X	X	calc.	X	calc.	calc.	calc.	calc.	X		
506-77-4	Cyanogen chloride	X	X	X	X	X	X	X	X	calc.	calc.	calc.	calc.	X		
51-28-5	2,4-Dinitrophenol	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	

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51-79-6	Ethyl carbamate (urethane)	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
510-15-6	Chlorobenzilate	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
53-70-3	Dibenz[a,h]anthracene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
532-27-4	2-Chloroacetophenone	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
534-52-1	4,6-Dinitro-o-cresol	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
5385-75-1	Dibenzo(a,e)fluoranthene	X	X	X	X	surr.	surr.	X	surr.	calc.	calc.	calc.	surr.	X	surr.	
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
540-73-8	1,2-Dimethylhydrazine	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
540-84-1	2,2,4-Trimethylpentane	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
541-73-1	1,3-Dichlorobenzene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
542-75-6	1,3-Dichloropropene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
542-88-1	Bis(chloromethyl)ether	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
56-23-5	Carbon tetrachloride	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
56-49-5	3-Methylcholanthrene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	calc.	X	X	
56-55-3	Benzo(a)anthracene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
57-12-5	Cyanide	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X		
57-24-9	Strychnine	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
57-74-9	Chlordane	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	

Table 1-1 Available COPC/ROPC Physical Parameters

CAS Registry Number	Constituent Name	Molar Weight	Solubility	Vapor Fraction	Vapor Pressure	Air Diffusivity	Water Diffusivity	Henry's Law Constant	Permeability Constant	Soil-Water Partitioning Coeff.	Sediment-Water Partitioning Coeff.	Bed Sediment-Pore Water Partitioning Coeff.	Org. Carbon-Water Partitioning Coeff.	Octanol-Water Partitioning Coeff.	Half-life in Soil	Radiological Half-life
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	X	surr.	X	X	X	X	calc.	X	calc.	calc.	calc.	X	surr.	X	
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
58-89-9	gamma-BHC (Lindane)	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
58-90-2	2,3,4,6-Tetrachlorophenol	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
581-42-0	2,6-Dimethylnaphthalene	X	X	calc.	X	calc.	calc.	X	X	calc.	calc.	calc.	calc.	X		
584-84-9	2,4-Toluene diisocyanate	X	X	X	X	surr.	surr.	X	surr.	surr.	surr.	surr.	surr.	X	surr.	
589-38-8	3-Hexanone	X	X	X	X	calc.	calc.	X	X	calc.	calc.	calc.	calc.	X		
59-50-7	4-Chloro-3-methylphenol	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
59-89-2	N-Nitrosomorpholine	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
591-50-4	Benzene, iodo-	X	X	calc.	X	calc.	calc.	X	X	calc.	calc.	calc.	calc.	X		
591-78-6	2-Hexanone	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
593-60-2	Bromoethene (Vinyl bromide)	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
593-74-8	Dimethyl Mercury	X	X	calc.	X	X	X	X	X				X	X		
60-11-7	Dimethyl aminoazobenzene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
60-29-7	Ethyl ether	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
60-35-5	Acetamide	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
602-87-9	5-Nitroacenaphthene	X	X	X	X	X	X	X	X	surr.	surr.	surr.	X	X	surr.	
606-20-2	2,6-Dinitrotoluene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
608-93-5	Pentachlorobenzene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
61626-71-9	Dichloropentadiene	X	surr.	X	surr.	surr.	surr.	calc.	surr.	calc.	calc.	calc.	surr.	surr.		
62-50-0	Ethyl methanesulfonate	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
62-53-3	Aniline	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X		

Table 1-1 Available COPC/ROPC Physical Parameters

CAS Registry Number	Constituent Name	Molar Weight	Solubility	Vapor Fraction	Vapor Pressure	Air Diffusivity	Water Diffusivity	Henry's Law Constant	Permeability Constant	Soil-Water Partitioning Coeff.	Sediment-Water Partitioning Coeff.	Bed Sediment-Pore Water Partitioning Coeff.	Org. Carbon-Water Partitioning Coeff.	Octanol-Water Partitioning Coeff.	Half-life in Soil	Radiological Half-life
62-75-9	N-Nitroso-N,N-dimethylamine	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
621-64-7	N-Nitroso-di-n-propylamine	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
624-83-9	Methyl isocyanate	X	X	calc.	X	X	X	X	X	surr.	surr.	surr.	X	X	X	
628-73-9	Hexanenitrile	X	X	X	X	calc.	calc.	X	X	calc.	calc.	calc.	calc.	X		
630-08-0	Carbon monoxide	X	X	X	X	X	X	X	X				X	X		
630-20-6	1,1,1,2-Tetrachloroethane	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
64-18-6	Formic acid (methanoic acid)	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
65-85-0	Benzoic acid	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	X	X	X	X	X	X	calc.	X	calc.	calc.	calc.	X	surr.	X	
67-56-1	Methyl alcohol	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
67-63-0	2-Propyl alcohol	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
67-64-1	2-Propanone (Acetone)	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
67-66-3	Chloroform	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
67-72-1	Hexachloroethane	X	X	X	X	X	X	X	X	calc.	calc.	calc.	calc.	X		
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	X	surr.	X	X	X	X	calc.	X	calc.	calc.	calc.	X	X		
70-30-4	Hexachlorophene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	X	surr.	X	X	X	X	calc.	X	calc.	calc.	calc.	X	surr.	surr.	
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
71-36-3	n-Butyl alcohol	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
71-43-2	Benzene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
71-55-6	1,1,1-Trichloroethane	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
72-43-5	Methoxychlor	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
72-55-9	4,4-DDE	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	

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72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
74-83-9	Bromomethane	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
74-87-3	Chloromethane	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
74-88-4	Iodomethane	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
74-95-3	Methylene bromide	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
74-97-5	Bromochloromethane	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
7429-90-5	Aluminum	X	X	X	X	calc.	calc.	X	X	X	X	X				
7439-89-6	Iron	X	X	X	X	calc.	calc.	X	X	X	X	X				
7439-92-1	Lead	X	X	X	X	X	X	X	X	X	X	X	calc.	X		
7439-93-2	Lithium	X	X	X	X	calc.	calc.		X	X	X	X				
7439-95-4	Magnesium	X	X	X	X	calc.	calc.		X	X	X	X				
7439-96-5	Manganese	X	X	X	X	calc.	calc.	X	X	X	X	X				
7439-97-6	Mercury	X	X	X	X	X	X	X	X	X	X	X		X		
7439-98-7	Molybdenum	X	X	X	X	calc.	calc.	X	X	X	X	X				
7440-02-0	Nickel	X	X	X	X	X	X	X	X	X	X	X		X		
7440-16-6	Rhodium	X		X		calc.	calc.	calc.		X	X	X				
7440-22-4	Silver	X	X	X	X	X	X	X	X	X	X	X		X		
7440-23-5	Sodium	X	X	X		calc.	calc.		X	X	X	X				
7440-24-6	Strontium (total)	X	X	X	X	calc.	calc.	X	X	X	X	X		X		
7440-25-7	Tantalum	X		X		calc.	calc.	calc.		X	X	X				
7440-28-0	Thallium	X	X	X	X	X	X	X	X	X	X	X		X		
7440-29-1	Thorium-232	X	X	X		calc.	calc.		X	X	X	X				X
7440-31-5	Tin	X	X	X	X	calc.	calc.	X	X	X	X	X				
7440-33-7	Tungsten	X	X	X	X	calc.	calc.		X	X	X	X				
7440-36-0	Antimony	X	X	X	X	X	X	X	X	X	X	X		X		
7440-38-2	Arsenic	X	X	X	X	X	X	X	X	X	X	X		X		
7440-39-3	Barium	X	X	X	X	X	X	X	X	X	X	X		X		
7440-41-7	Beryllium	X	X	X	X	X	X	X	X	X	X	X		X		
7440-43-9	Cadmium	X	X	X	X	X	X	X	X	X	X	X		X		
7440-47-3	Chromium	X	X	X	X	X	X	X	X	X	X	X		X		
7440-48-4	Cobalt	X	X	X	X	calc.	calc.		X	X	X	X				
7440-50-8	Copper	X	X	X	X	calc.	calc.	X	X	X	X	X				
7440-61-1	Uranium	X	X	X	X	calc.	calc.		X	X	X	X				
7440-61-1R	Uranium-238	X		X		calc.	calc.	calc.		X	X	X				X
7440-62-2	Vanadium	X	X	X	X	calc.	calc.	X	X	X	X	X				
7440-65-5	Yttrium	X		X		calc.	calc.	calc.	X	X	X	X				
7440-66-6	Zinc	X	X	X	X	X	X	X	X	X	calc.	calc.		X		
7440-67-7	Zirconium	X	X	X	X	calc.	calc.		X	X	X	X				

Table 1-1 Available COPC/ROPC Physical Parameters

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7446-09-5	Sulfur dioxide	X	X	X	X	calc.	calc.	X	X					X		
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
7487-94-7	Mercuric chloride (HgCl2)	X	X	X	X	X	X	X	X	X	X	X		X		
75-00-3	Chloroethane	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
75-01-4	1-Chloroethene	X	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	
75-02-5	Fluoroethene (vinyl fluoride)	X	X	X	X	calc.	calc.	X	X	calc.	calc.	calc.	calc.	X		
75-05-8	Acetonitrile	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
75-07-0	Acetaldehyde	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
75-09-2	Dichloromethane (Methylene Chloride)	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
75-15-0	Carbon disulfide	X	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X		
75-21-8	Ethylene oxide (Oxirane)	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
75-25-2	Bromoform	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
75-27-4	Bromodichloromethane	X	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X		
75-29-6	2-Chloropropane	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
75-34-3	1,1-Dichloroethane	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
75-35-4	1,1-Dichloroethene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
75-44-5	Phosgene (hydrogen phosphide)	X	X	X	X	X	X	X	X	surr.	surr.	surr.	X	X	X	
75-45-6	Chlorodifluoromethane	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
75-50-3	Trimethylamine	X	X	X	X	calc.	calc.	X	X					X		
75-69-4	Trichlorofluoromethane	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
75-71-8	Dichlorodifluoromethane	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
76-01-7	Pentachloroethane	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
76-13-1	1,2,2-Trichlorotrifluoroethane	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
76-44-8	Heptachlor	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
764-41-0	1,4-Dichloro-2-butene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
7647-01-0	Hydrogen chloride	X	X	X	X	calc.	calc.	calc.	X							
765-34-4	Glycidylaldehyde	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
7664-39-3	Hydrogen Fluoride	X	X	X	X	calc.	calc.	X	X					X		
7664-41-7	Ammonia/Ammonium	X	X	X	X	calc.	calc.	X	X					X		
77-47-4	Hexachlorocyclopentadiene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	

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77-78-1	Dimethyl sulfate	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
7704-34-9	Total Sulfur (thermodynamically stable)	X		X		calc.	calc.	calc.	X					X		
7723-14-0	Phosphorus	X	X	X	X	calc.	calc.	X	X	X	X	X		X		
7782-41-4	Fluorine gas F2	X	X	X	X	calc.	calc.	X	X	X			calc.	X		
7782-49-2	Selenium	X	X	X	X	X	X	X	X	X	X	X		X		
7782-50-5	Chlorine	X	X	X	X	X	X	X	X	X				X		
78-83-1	2-Methylpropyl alcohol	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
78-87-5	1,2-Dichloropropane	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
78-93-3	2-Butanone	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
79-00-5	1,1,2-Trichloroethane	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
79-01-6	1,1,2-Trichloroethylene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
79-10-7	2-Propenoic acid	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
79-34-5	1,1,2,2-Tetrachloroethane	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
79-46-9	2-Nitropropane	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
80-62-6	Methyl methacrylate	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
82-68-8	Pentachloronitrobenzene (PCNB)	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
822-06-0	Hexamethylene-1,5-diisocyanate	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
823-40-5	Toluene-2,6-diamine	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
83-32-9	Acenaphthene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
832-69-9	1-Methylphenanthrene	X	X	calc.	X	calc.	calc.	X	X	calc.	calc.	calc.	calc.	X		
84-66-2	Diethyl phthalate	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
84-74-2	Di-n-butylphthalate	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
85-01-8	Phenanthrene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
85-68-7	Butylbenzylphthalate	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
86-73-7	Fluorene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
87-61-6	1,2,3-Trichlorobenzene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
87-68-3	Hexachlorobutadiene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
87-86-5	Pentachlorophenol	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
88-06-2	2,4,6-Trichlorophenol	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
88-74-4	o-Nitroaniline (2-nitroaniline)	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
88-75-5	2-Nitrophenol	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	

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90-04-0	o-Anisidine	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
90-12-0	1-Methylnaphthalene	X	X	calc.	X	X	X	X	X	calc.	calc.	calc.	X	X		
91-20-3	Naphthalene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
91-22-5	Quinoline	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
91-57-6	2-Methylnaphthalene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
91-58-7	2-Chloronaphthalene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
91-94-1	3,3'-Dichlorobenzidine	X	X	X	X	X	X	X	X	calc.	calc.	calc.	calc.	X	X	
92-52-4	1,1`-Biphenyl	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
924-16-3	N-Nitroso-di-n-Buetylamine	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
94-75-7	2,4-D	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
95-48-7	o-Cresol	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
95-49-8	o-Chlorotoluene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
95-50-1	1,2-Dichlorobenzene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
95-53-4	o-Toluidine	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
95-57-8	2-Chlorophenol	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
95-63-6	1,2,4-Trimethyl benzene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
95-94-3	1,2,4,5-Tetrachlorobenzene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
95-95-4	2,4,5-Trichlorophenol	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
96-12-8	1,2-Dibromo-3-chloropropane	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
96-18-4	1,2,3-Trichloropropane	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
96-45-7	Ethylene thiourea	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
97-63-2	Ethyl methacrylate	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
98-01-1	Furfural	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
98-06-6	tert-Butyl benzene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
98-07-7	Benzotrichloride	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
98-82-8	Cumene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X		
98-83-9	Methyl styrene (mixed isomers)	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
98-86-2	Acetophenone	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X		
98-95-3	Nitrobenzene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
99-35-4	1,3,5-Trinitrobenzene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X		
99-65-0	1,3-Dinitrobenzene	X	X	X	X	X	X	X	X	X	calc.	calc.	X	X	X	
99-87-6	p-Cymene	X	X	X	X	X	X	X	X	calc.	calc.	calc.	X	X	X	
N/A	Particulate matter															

Table 1-2 identifies available constituent uptake parameters used in the computation of produce and plant uptake of contaminants. These parameters are used in the computation of dose due to plant consumption by animals, livestock, and human receptors.

Table 1-2 Available Plant Uptake Parameters

CAS Registry Number	Constituent Name	Root Concentration Factor	Root Vegetable BCF	Wild Produce Soil-Plant BCF	Domestic Produce Soil-Plant BCF	Forage Aboveground BCF	Silage Aboveground BCF	Produce Air-Plant BCF	Forage Silage Air-Plant BCF	Wild Grain Air-Plant BCF	Domestic Grain Air-Plant BCF
100-02-7	p-Nitrophenol	X	calc.	X	X	X	X	X	X	X	X
100-21-0	Phthalic acid	calc.	calc.	X	X	X	X	calc.	calc.	X	X
100-25-4	1,4-Dinitrobenzene	calc.	calc.	X	X	X	X	calc.	calc.	X	X
100-40-3	4-Ethenylcyclohexene	calc.	calc.	calc.	calc.	calc.	X	calc.	calc.	X	X
100-41-4	Ethyl benzene	X	calc.	X	X	X	X	X	X	X	X
100-42-5	Styrene	X	calc.	X	X	X	X	X	X	X	X
100-44-7	Benzyl chloride	X	calc.	X	X	X	X	X	X	X	X
100-47-0	Benzonitrile	X	calc.	X	X	X	X	X	X	X	X
100-51-6	Benzyl alcohol	X	calc.	X	X	X	X	X	X	X	X
100-52-7	Benzaldehyde	X	calc.	X	X	X	X	X	X	X	X
10028-15-6	Ozone	calc.		calc.	calc.	calc.	calc.			calc.	calc.
10028-17-8	Tritium	calc.		X	X	X	X			X	X
10045-97-3	Cesium-137		X	X	X	X	X	X	X	X	X
10061-01-5	cis-1,3-Dichloropropene	surr.	surr.	X	X	X	X	surr.	surr.	X	X
10061-02-6	trans-1,3-Dichloropropene	calc.	calc.	X	X	X	X	calc.	calc.	X	X
10098-91-6	Yttrium-90		X	X	X	X	X	X	X	X	X
10098-97-2	Strontium-90		X	X	X	X	X	X	X	X	X
101-55-3	4-Bromophenylphenyl ether	X	calc.	X	X	X	X	X	X	X	X
101-77-9	4,4-Methylenedianiline	calc.	calc.	X	X	X	X	calc.	calc.	X	X
10102-44-0	Nitrogen dioxide	calc.		calc.	calc.	calc.	calc.			calc.	calc.
10198-40-0	Cobalt-60		X	X	X	X	X	X	X	X	X
103-33-3	Azobenzene	calc.	calc.	X	X	X	X	calc.	calc.	X	X
103-65-1	n-Propyl benzene (Isocumene)	calc.	calc.	X	X	X	X	calc.	calc.	X	X
104-51-8	n-Butylbenzene	calc.	calc.	X	X	X	X	calc.	calc.	X	X
104-76-7	2-Ethyl-1-hexanol	calc.	calc.	calc.	calc.	calc.	X	calc.	calc.	X	X
105-67-9	2,4-Dimethylphenol	X	calc.	X	X	X	X	X	X	X	X
10595-95-6	n-Nitrosomethylethylamine	calc.	calc.	X	X	X	X	calc.	calc.	X	X

Table 1-2 Available Plant Uptake Parameters

CAS Registry Number	Constituent Name	Root Concentration Factor	Root Vegetable BCF	Wild Produce Soil-Plant BCF	Domestic Produce Soil-Plant BCF	Forage Aboveground BCF	Silage Aboveground BCF	Produce Air-Plant BCF	Forage Silage Air-Plant BCF	Wild Grain Air-Plant BCF	Domestic Grain Air-Plant BCF
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	calc.	calc.	X	X	X	X	calc.	calc.	X	X
106-44-5	p-Cresol (4-methyl phenol)	X	calc.	X	X	X	X	X	X	X	X
106-46-7	1,4-Dichlorobenzene	X	calc.	X	X	X	X	X	X	X	X
106-47-8	p-Chloroaniline	X	calc.	X	X	X	X	X	X	X	X
106-49-0	p-Toluidine	calc.	calc.	X	X	X	X	calc.	calc.	X	X
106-51-4	Quinone	calc.	calc.	X	X	calc.	X	calc.	calc.	X	X
106-88-7	1,2-Epoxybutane	calc.	calc.	X	X	X	X	calc.	calc.	X	X
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	X	calc.	X	X	X	X	X	X	X	X
106-93-4	Ethylene dibromide	X	calc.	X	X	X	X	X	X	X	X
106-99-0	1,3-Butadiene	calc.	calc.	X	X	X	X	calc.	calc.	X	X
107-02-8	Acrolein	X	calc.	X	X	X	X	X	X	X	X
107-05-1	3-Chloropropene	calc.	calc.	X	X	X	X	calc.	calc.	X	X
107-06-2	1,2-Dichloroethane	X	calc.	X	X	X	X	X	X	X	X
107-12-0	Propionitrile	calc.	calc.	X	X	X	X	calc.	calc.	X	X
107-13-1	Acrylonitrile	X	calc.	X	X	X	X	X	X	X	X
107-19-7	Propargyl alcohol	calc.	calc.	X	X	X	X	calc.	calc.	X	X
107-21-1	Ethylene glycol (1,2-ethanediol)	calc.	calc.	X	X	X	X	calc.	calc.	X	X
107-98-2	Propylene glycol monomethyl ether	calc.	calc.	X	X	X	X	calc.	calc.	X	X
108-05-4	Acetic acid vinyl ester	X	calc.	X	X	X	X	X	X	X	X
108-10-1	4-Methyl-2-pentanone	X	calc.	X	X	X	X	X	X	X	X
108-39-4	m-Cresol	X	calc.	X	X	X	X	X	X	X	X
108-60-1	bis (2-Chloroisopropyl)ether	calc.	calc.	X	X	X	X	calc.	calc.	X	X
108-67-8	1,3,5-Trimethylbenzene	X	calc.	X	X	X	X	X	X	X	X
108-86-1	Bromobenzene (Phenyl bromide)	calc.	calc.	X	X	X	X	calc.	calc.	X	X
108-87-2	Methylcyclohexane	calc.	calc.	X	X	X	X	calc.	calc.	X	X
108-88-3	Toluene	X	calc.	X	X	X	X	X	X	X	X

Table 1-2 Available Plant Uptake Parameters

CAS Registry Number	Constituent Name	Root Concentration Factor	Root Vegetable BCF	Wild Produce Soil-Plant BCF	Domestic Produce Soil-Plant BCF	Forage Aboveground BCF	Silage Aboveground BCF	Produce Air-Plant BCF	Forage Silage Air-Plant BCF	Wild Grain Air-Plant BCF	Domestic Grain Air-Plant BCF
108-90-7	Chlorobenzene	X	calc.	X	X	X	X	X	X	X	X
108-94-1	Cyclohexanone	calc.	calc.	X	X	X	X	calc.	calc.	X	X
108-95-2	Phenol	X	calc.	X	X	X	X	X	X	X	X
109-74-0	n-Butanenitrile	calc.	calc.	X	X	calc.	X	calc.	calc.	X	X
109-75-1	3-Butenenitrile	calc.	calc.	X	X	calc.	X	calc.	calc.	X	X
109-77-3	Malononitrile	calc.	calc.	X	X	X	X	calc.	calc.	X	X
109-86-4	2-Methoxyethanol	calc.	calc.	X	X	X	X	calc.	calc.	X	X
109-99-9	Tetrahydrofuran	X	calc.	X	X	X	X	X	X	X	X
110-00-9	Furan	calc.	calc.	X	X	X	X	calc.	calc.	X	X
110-54-3	n-Hexane	calc.	calc.	X	X	X	X	calc.	calc.	X	X
110-59-8	Pentanenitrile	calc.	calc.	X	X	calc.	X	calc.	calc.	X	X
110-80-5	2-Ethoxyethanol	calc.	calc.	X	X	X	X	calc.	calc.	X	X
110-82-7	Cyclohexane	calc.	calc.	X	X	X	X	calc.	calc.	X	X
110-83-8	Cyclohexene	calc.	calc.	X	X	X	X	calc.	calc.	X	X
110-86-1	Pyridine	X	calc.	X	X	X	X	X	X	X	X
111-15-9	Ethylene glycol monoethyl ether acetate	calc.	calc.	X	X	X	X	calc.	calc.	X	X
111-44-4	Bis(2-chloroethyl)ether	X	calc.	X	X	X	X	X	X	X	X
111-65-9	n-Octane	calc.	calc.	calc.	calc.	calc.	X	calc.	calc.	X	X
111-76-2	2-Butoxyethanol	calc.	calc.	X	X	X	X	calc.	calc.	X	X
111-84-2	n-Nonane	calc.	calc.	X	X	X	X	calc.	calc.	X	X
111-91-1	Bis(2-chloroethoxy)methane	calc.	calc.	X	X	X	X	calc.	calc.	X	X
112-30-1	1-Decanol	calc.	calc.	X	X	X	X	calc.	calc.	X	X
112-31-2	Decanal	calc.	calc.	calc.	calc.	calc.	X	calc.	calc.	X	X
112-40-3	Dodecane	calc.	calc.	calc.	calc.	calc.	X	calc.	calc.	X	X
1120-21-4	Undecane	calc.	calc.	calc.	calc.	calc.	X	calc.	calc.	X	X
1120-71-4	1,3-Propane sultone	calc.	calc.	X	X	X	X	calc.	calc.	X	X
117-81-7	Bis(2-ethylhexyl) phthalate	X	calc.	X	X	X	X	X	X	X	X
117-84-0	Di-n-octylphthalate	X	calc.	X	X	X	X	X	X	X	X
118-74-1	Hexachlorobenzene	X	calc.	X	X	X	X	X	X	X	X

Table 1-2 Available Plant Uptake Parameters

CAS Registry Number	Constituent Name	Root Concentration Factor	Root Vegetable BCF	Wild Produce Soil-Plant BCF	Domestic Produce Soil-Plant BCF	Forage Aboveground BCF	Silage Aboveground BCF	Produce Air-Plant BCF	Forage Silage Air-Plant BCF	Wild Grain Air-Plant BCF	Domestic Grain Air-Plant BCF
119-90-4	3,3'-Dimethoxybenzidine	X	calc.	X	X	X	X	X	X	X	X
120-12-7	Anthracene	X	calc.	X	X	X	X	X	X	X	X
120-82-1	1,2,4-Trichlorobenzene	X	calc.	X	X	X	X	X	X	X	X
120-83-2	2,4-Dichlorophenol	X	calc.	X	X	X	X	X	X	X	X
121-14-2	2,4-Dinitrotoluene	X	calc.	X	X	X	X	X	X	X	X
122-39-4	N,N-Diphenylamine	calc.	calc.	X	X	X	X	calc.	calc.	X	X
122-66-7	1,2-Diphenylhydrazine	X	calc.	X	X	X	X	X	X	X	X
123-33-1	Maleic hydrazide	calc.	calc.	X	X	X	X	calc.	calc.	X	X
123-38-6	Propionaldehyde	calc.	calc.	X	X	X	X	calc.	calc.	X	X
123-72-8	Butanal	calc.	calc.	X	X	calc.	X	calc.	calc.	X	X
123-91-1	1,4-Dioxan	X	calc.	X	X	X	X	X	X	X	X
124-18-5	Decane	calc.	calc.	X	X	X	X	calc.	calc.	X	X
124-38-9	Carbon dioxide	calc.	calc.	X	X	calc.	X	calc.	calc.	X	X
124-48-1	Chlorodibromomethane	X	calc.	X	X	X	X	X	X	X	X
126-73-8	Tributyl phosphate	calc.	calc.	X	X	X	X	calc.	calc.	X	X
126-98-7	2-Methyl-2-propenenitrile	X	calc.	X	X	X	X	X	X	X	X
127-18-4	1,1,2,2-Tetrachloroethene	X	calc.	X	X	X	X	X	X	X	X
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	calc.		X	X	X	X	calc.	calc.	X	X
129-00-0	Pyrene	X	calc.	X	X	X	X	X	X	X	X
131-11-3	Dimethyl Phthalate	X	calc.	X	X	X	X	X	X	X	X
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	calc.	calc.	X	X	X	X	calc.	calc.	X	X
132-64-9	Dibenzofuran	calc.	calc.	X	X	X	X	calc.	calc.	X	X
133-06-2	Captan	calc.	calc.	X	X	X	X	calc.	calc.	X	X
1330-20-7	Xylenes (mixed isomers)	calc.	calc.	X	X	X	X	calc.	calc.	X	X
1336-36-3	Polychlorinated biphenyls	calc.	calc.	X	X	X	X	calc.	calc.	X	X
134-32-7	alpha-Naphthylamine	calc.		X	X	X	X	calc.	calc.	X	X
135-98-8	sec-Butylbenzene	calc.	calc.	X	X	X	X	calc.	calc.	X	X
13966-29-5	Uranium-234		X	X	X	X	X	X	X	X	X

Table 1-2 Available Plant Uptake Parameters

CAS Registry Number	Constituent Name	Root Concentration Factor	Root Vegetable BCF	Wild Produce Soil-Plant BCF	Domestic Produce Soil-Plant BCF	Forage Aboveground BCF	Silage Aboveground BCF	Produce Air-Plant BCF	Forage Silage Air-Plant BCF	Wild Grain Air-Plant BCF	Domestic Grain Air-Plant BCF
13967-48-1	Ruthenium-106		X	X	X	X	X	X	X	X	X
13967-70-9	Cesium-134		X	X	X	X	X	X	X	X	X
13968-55-3	Uranium-233		X	X	X	X	X	X	X	X	X
13981-15-2	Curium-244		X	X	X	X	X	X	X	X	X
13981-16-3	Plutonium-238		X	X	X	X	X	X	X	X	X
13981-37-8	Nickel-63		X	X	X	X	X	X	X	X	X
13982-10-0	Plutonium-242		X	X	X	X	X	X	X	X	X
13982-63-3	Radium-226		X	X	X	X	X	X	X	X	X
13982-70-2	Uranium-236		X	X	X	X	X	X	X	X	X
13994-20-2	Neptunium-237		X	X	X	X	X	X	X	X	X
141-78-6	Acetic acid ethyl ester	calc.	calc.	X	X	X	X	calc.	calc.	X	X
14119-32-5	Plutonium-241		X	X	X	X	X	X	X	X	X
14119-33-6	Plutonium-240		X	X	X	X	X	X	X	X	X
14133-76-7	Technetium-99		X	X	X	X	X	X	X	X	X
14158-29-3	Uranium-232		X	X	X	X	X	X	X	X	X
14234-35-6	Antimony-125		X	X	X	X	X	X	X	X	X
14265-44-2	Phosphate										
14331-85-2	Protactinium-231		X	X	X	X	X	X	X	X	X
14336-70-0	Nickel-59		X	X	X	X	X	X	X	X	X
14391-16-3	Europium-155		X	X	X	X	X	X	X	X	X
145-73-3	Endothall	calc.	calc.	X	X	X	X	calc.	calc.	X	X
14596-10-2	Americium-241		X	X	X	X	X	X	X	X	X
14683-23-9	Europium-152		X	X	X	X	X	X	X	X	X
14762-75-5	Carbon-14		X	X	X	X	X			X	X
14797-55-8	Nitrate	calc.		calc.	calc.	calc.	calc.			calc.	calc.
14797-65-0	Nitrite										
14808-79-8	Sulfate										
14952-40-0	Actinium-227		X	X	X	X	X	X	X	X	X
14993-75-0	Americium-243		X	X	X	X	X	X	X	X	X
15046-84-1	Iodine-129		X	X	X	X	X			X	X

Table 1-2 Available Plant Uptake Parameters

CAS Registry Number	Constituent Name	Root Concentration Factor	Root Vegetable BCF	Wild Produce Soil-Plant BCF	Domestic Produce Soil-Plant BCF	Forage Aboveground BCF	Silage Aboveground BCF	Produce Air-Plant BCF	Forage Silage Air-Plant BCF	Wild Grain Air-Plant BCF	Domestic Grain Air-Plant BCF
15117-48-3	Plutonium-239		X	X	X	X	X	X	X	X	X
15117-96-1	Uranium-235		X	X	X	X	X	X	X	X	X
15262-20-1	Radium-228		X	X	X	X	X	X	X	X	X
15510-73-3	Curium-242		X	X	X	X	X	X	X	X	X
15585-10-1	Europium-154		X	X	X	X	X	X	X	X	X
15594-54-4	Thorium-229		X	X	X	X	X	X	X	X	X
156-59-2	cis-1,2-Dichloroethene	X	calc.	X	X	X	X	X	X	X	X
156-60-5	1,2-trans-Dichloroethene	X	calc.	X	X	X	X	X	X	X	X
15715-94-3	Samarium-151		X	X	X	X	X	X	X	X	X
15751-77-6	Zirconium-93		X	X	X	X	X	X	X	X	X
15757-87-6	Curium-243		X	X	X	X	X	X	X	X	X
15758-45-9	Selenium-79		X	X	X	X	X	X	X	X	X
15832-50-5	Tin-126		X	X	X	X	X	X	X	X	X
1634-04-4	Methyl tert-butyl ether	calc.	calc.	X	X	X	X	calc.	calc.	X	X
16887-00-6	Chloride	calc.		calc.	calc.	calc.	calc.			calc.	calc.
16984-48-8	Fluoride			X	X	X	X			X	X
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	X	calc.	X	X	X	X	X	X	X	X
18540-29-9	Chromium(VI)	calc.	X	X	X	X	X	X	X	X	X
189-55-9	Dibenzo[a,i]pyrene	surr.	surr.	X	X	X	X	surr.	surr.	X	X
189-64-0	Dibenzo[a,h]pyrene	calc.	calc.	X	X	X	X	calc.	calc.	X	X
191-24-2	Benzo(g,h,i)perylene	calc.	calc.	X	X	X	X	calc.	calc.	X	X
191-30-0	Dibenzo(a,l)pyrene	calc.	calc.	X	X	X	X	calc.	calc.	X	X
192-65-4	Dibenzo[a,e]pyrene	calc.	calc.	X	X	X	X	calc.	calc.	X	X
192-97-2	Benzo(e)pyrene	calc.	calc.	calc.	calc.	calc.	X	calc.	calc.	X	X
193-39-5	Indeno(1,2,3-cd)pyrene	X	calc.	X	X	X	X	X	X	X	X
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	X	calc.	X	X	X	X	X	X	X	X
205-82-3	Benzo[j]fluoranthene	calc.	calc.	X	X	X	X	calc.	calc.	X	X
205-99-2	Benzo(b)fluoranthene	X	calc.	X	X	X	X	X	X	X	X

Table 1-2 Available Plant Uptake Parameters

CAS Registry Number	Constituent Name	Root Concentration Factor	Root Vegetable BCF	Wild Produce Soil-Plant BCF	Domestic Produce Soil-Plant BCF	Forage Aboveground BCF	Silage Aboveground BCF	Produce Air-Plant BCF	Forage Silage Air-Plant BCF	Wild Grain Air-Plant BCF	Domestic Grain Air-Plant BCF
206-44-0	Fluoranthene	X	calc.	X	X	X	X	X	X	X	X
207-08-9	Benzo(k)fluoranthene	X	calc.	X	X	X	X	X	X	X	X
208-96-8	Acenaphthylene	calc.	calc.	X	X	X	X	calc.	calc.	X	X
218-01-9	Chrysene	X	calc.	X	X	X	X	X	X	X	X
224-42-0	Dibenz[a,j]acridine	surr.	surr.	X	X	X	X	surr.	surr.	X	X
2245-38-7	2,3,5-Trimethylnaphthalene	calc.	calc.	calc.	calc.	calc.	X	calc.	calc.	X	X
226-36-8	Dibenz[a,h]acridine	surr.	surr.	X	X	X	X	surr.	surr.	X	X
22967-92-6	Methyl mercury		X	X	X	X	X	X	X	X	X
23950-58-5	Pronamide	X	calc.	X	X	X	X	X	X	X	X
24959-67-9	Bromide	calc.		calc.	calc.	calc.	calc.			calc.	calc.
27154-33-2	Trichlorofluoroethane	surr.	surr.	X	surr.	surr.	X	surr.	surr.	X	X
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	calc.	calc.	X	X	X	X	calc.	calc.	X	X
319-84-6	alpha-BHC	X	calc.	X	X	X	X	X	X	X	X
319-85-7	beta-BHC	X	calc.	X	X	X	X	X	X	X	X
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	calc.	calc.	X	X	X	X	calc.	calc.	X	X
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	calc.	calc.	X	X	X	X	calc.	calc.	X	X
3268-87-9	Octachlorodibenzo(p)dioxin	X	calc.	X	X	X	X	X	X	X	X
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	calc.	calc.	X	X	X	X	calc.	calc.	X	X
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	X	calc.	X	X	X	X	X	X	X	X
3697-24-3	5-Methylchrysene	surr.	surr.	X	X	X	X	surr.	surr.	X	X
378253-40-8	Barium-137m		X	X	X	X	X	X	X	X	X
378253-44-2	Cadmium-113m		X	X	X	X	X	X	X	X	X
378782-82-2	Niobium-93m		X	X	X	X	X	X	X	X	X

Table 1-2 Available Plant Uptake Parameters

CAS Registry Number	Constituent Name	Root Concentration Factor	Root Vegetable BCF	Wild Produce Soil-Plant BCF	Domestic Produce Soil-Plant BCF	Forage Aboveground BCF	Silage Aboveground BCF	Produce Air-Plant BCF	Forage Silage Air-Plant BCF	Wild Grain Air-Plant BCF	Domestic Grain Air-Plant BCF
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	calc.	calc.	X	X	X	X	calc.	calc.	X	X
39001-02-0	Octachlorodibenzofuran	X	calc.	X	X	X	X	X	X	X	X
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	X	calc.	X	X	X	X	X	X	X	X
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	calc.	calc.	X	X	X	X	calc.	calc.	X	X
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	X	calc.	X	X	X	X	X	X	X	X
4170-30-3	Crotonaldehyde (Propylene aldehyde)	calc.	calc.	X	X	X	X	calc.	calc.	X	X
41851-50-7	Chlorocyclopentadiene	calc.	calc.	X	X	X	X	calc.	calc.	X	X
460-19-5	Cyanogen (oxalonitrile)	calc.	calc.	X	X	X	X	calc.	calc.	X	X
4786-20-3	2-Butenenitrile	calc.	calc.	X	X	calc.	X	calc.	calc.	X	X
50-00-0	Formaldehyde	X	calc.	X	X	X	X	X	X	X	X
50-32-8	Benzo(a)pyrene	X	calc.	X	X	X	X	X	X	X	X
506-68-3	Cyanogen bromide (bromocyanide)	calc.	calc.	X	X	calc.	X	calc.	calc.	X	X
506-77-4	Cyanogen chloride	calc.	calc.	X	X	X	X	calc.	calc.	X	X
51-28-5	2,4-Dinitrophenol	X	calc.	X	X	X	X	X	X	X	X
51-79-6	Ethyl carbamate (urethane)	calc.	calc.	X	X	X	X	calc.	calc.	X	X
510-15-6	Chlorobenzilate	X	calc.	X	X	X	X	X	X	X	X
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	X	calc.	X	X	X	X	X	X	X	X
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	calc.	calc.	X	X	X	X	calc.	calc.	X	X
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	calc.	calc.	X	X	X	X	calc.	calc.	X	X
53-70-3	Dibenz[a,h]anthracene	X	calc.	X	X	X	X	X	X	X	X
532-27-4	2-Chloroacetophenone	calc.	calc.	X	X	X	X	calc.	calc.	X	X

Table 1-2 Available Plant Uptake Parameters

CAS Registry Number	Constituent Name	Root Concentration Factor	Root Vegetable BCF	Wild Produce Soil-Plant BCF	Domestic Produce Soil-Plant BCF	Forage Aboveground BCF	Silage Aboveground BCF	Produce Air-Plant BCF	Forage Silage Air-Plant BCF	Wild Grain Air-Plant BCF	Domestic Grain Air-Plant BCF
534-52-1	4,6-Dinitro-o-cresol	calc.	calc.	X	X	X	X	calc.	calc.	X	X
5385-75-1	Dibenzo(a,e)fluoranthene	calc.	calc.	surr.	surr.	surr.	X	calc.	calc.	X	X
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	calc.	calc.	X	X	X	X	calc.	calc.	X	X
540-73-8	1,2-Dimethylhydrazine	calc.	calc.	X	X	X	X	calc.	calc.	X	X
540-84-1	2,2,4-Trimethylpentane	calc.	calc.	X	X	X	X	calc.	calc.	X	X
541-73-1	1,3-Dichlorobenzene	X	calc.	X	X	X	X	X	X	X	X
542-75-6	1,3-Dichloropropene	X	calc.	X	X	X	X	X	X	X	X
542-88-1	Bis(chloromethyl)ether	calc.	calc.	X	X	X	X	calc.	calc.	X	X
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	X	calc.	X	X	X	X	X	X	X	X
56-23-5	Carbon tetrachloride	X	calc.	X	X	X	X	X	X	X	X
56-49-5	3-Methylcholanthrene	calc.	calc.	X	X	X	X	calc.	calc.	X	X
56-55-3	Benzo(a)anthracene	X	calc.	X	X	X	X	X	X	X	X
57-12-5	Cyanide	X	calc.	X	X	X	X	X	X	X	X
57-24-9	Strychnine	X	calc.	X	X	X	X	X	X	X	X
57-74-9	Chlordane	X	calc.	X	X	X	X	X	X	X	X
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	X	calc.	X	X	X	X	X	X	X	X
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	X	calc.	X	X	X	X	X	X	X	X
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	X	calc.	X	X	X	X	X	X	X	X
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	calc.	calc.	X	X	X	X	calc.	calc.	X	X
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	X	calc.	X	X	X	X	X	X	X	X
58-89-9	gamma-BHC (Lindane)	calc.	calc.	X	X	X	X	calc.	calc.	X	X
58-90-2	2,3,4,6-Tetrachlorophenol	X	calc.	X	X	X	X	X	X	X	X
581-42-0	2,6-Dimethylnaphthalene	calc.	calc.	calc.	calc.	calc.	X	calc.	calc.	X	X
584-84-9	2,4-Toluene diisocyanate	surr.	surr.	X	X	surr.	X	surr.	surr.	X	X

Table 1-2 Available Plant Uptake Parameters

CAS Registry Number	Constituent Name	Root Concentration Factor	Root Vegetable BCF	Wild Produce Soil-Plant BCF	Domestic Produce Soil-Plant BCF	Forage Aboveground BCF	Silage Aboveground BCF	Produce Air-Plant BCF	Forage Silage Air-Plant BCF	Wild Grain Air-Plant BCF	Domestic Grain Air-Plant BCF
589-38-8	3-Hexanone	calc.	calc.	X	X	calc.	X	calc.	calc.	X	X
59-50-7	4-Chloro-3-methylphenol	X	calc.	X	X	X	X	X	X	X	X
59-89-2	N-Nitrosomorpholine	calc.	calc.	X	X	X	X	calc.	calc.	X	X
591-50-4	Benzene, iodo-	calc.	calc.	calc.	calc.	calc.	X	calc.	calc.	X	X
591-78-6	2-Hexanone	calc.	calc.	X	X	X	X	calc.	calc.	X	X
593-60-2	Bromoethene (Vinyl bromide)	calc.	calc.	X	X	X	X	calc.	calc.	X	X
593-74-8	Dimethyl Mercury	calc.		X	X	X	X			X	X
60-11-7	Dimethyl aminoazobenzene	calc.	calc.	X	X	X	X	calc.	calc.	X	X
60-29-7	Ethyl ether	calc.	calc.	X	X	X	X	calc.	calc.	X	X
60-35-5	Acetamide	calc.	calc.	X	X	X	X	calc.	calc.	X	X
602-87-9	5-Nitroacenaphthene	surr.	surr.	X	X	X	X	surr.	surr.	X	X
606-20-2	2,6-Dinitrotoluene	X	calc.	X	X	X	X	X	X	X	X
608-93-5	Pentachlorobenzene	X	calc.	X	X	X	X	X	X	X	X
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	X	calc.	X	X	X	X	X	X	X	X
61626-71-9	Dichloropentadiene	calc.	calc.	X	X	surr.	X	calc.	calc.	X	X
62-50-0	Ethyl methanesulfonate	X	calc.	X	X	X	X	X	X	X	X
62-53-3	Aniline	X	calc.	X	X	X	X	X	X	X	X
62-75-9	N-Nitroso-N,N-dimethylamine	calc.	calc.	X	X	X	X	calc.	calc.	X	X
621-64-7	N-Nitroso-di-n-propylamine	X	calc.	X	X	X	X	X	X	X	X
624-83-9	Methyl isocyanate	surr.	surr.	X	X	X	X	surr.	surr.	X	X
628-73-9	Hexanenitrile	calc.	calc.	X	X	calc.	X	calc.	calc.	X	X
630-08-0	Carbon monoxide	calc.		X	X	X	X			X	X
630-20-6	1,1,1,2-Tetrachloroethane	X	calc.	X	X	X	X	X	X	X	X
64-18-6	Formic acid (methanoic acid)	X	calc.	X	X	X	X	X	X	X	X
65-85-0	Benzoic acid	X	calc.	X	X	X	X	X	X	X	X
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	calc.	calc.	X	X	X	X	calc.	calc.	X	X
67-56-1	Methyl alcohol	X	calc.	X	X	X	X	X	X	X	X

Table 1-2 Available Plant Uptake Parameters

CAS Registry Number	Constituent Name	Root Concentration Factor	Root Vegetable BCF	Wild Produce Soil-Plant BCF	Domestic Produce Soil-Plant BCF	Forage Aboveground BCF	Silage Aboveground BCF	Produce Air-Plant BCF	Forage Silage Air-Plant BCF	Wild Grain Air-Plant BCF	Domestic Grain Air-Plant BCF
67-63-0	2-Propyl alcohol	calc.	calc.	X	X	X	X	calc.	calc.	X	X
67-64-1	2-Propanone (Acetone)	X	calc.	X	X	X	X	X	X	X	X
67-66-3	Chloroform	X	calc.	X	X	X	X	X	X	X	X
67-72-1	Hexachloroethane	X	calc.	X	X	X	X	X	X	X	X
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	X	calc.	X	X	X	X	X	X	X	X
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	calc.	calc.	X	X	X	X	calc.	calc.	X	X
70-30-4	Hexachlorophene	X	calc.	X	X	X	X	X	X	X	X
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	calc.	calc.	X	X	X	X	calc.	calc.	X	X
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	X	calc.	X	X	X	X	X	X	X	X
71-36-3	n-Butyl alcohol	calc.	calc.	X	X	X	X	calc.	calc.	X	X
71-43-2	Benzene	X	calc.	X	X	X	X	X	X	X	X
71-55-6	1,1,1-Trichloroethane	X	calc.	X	X	X	X	X	X	X	X
72-43-5	Methoxychlor	X	calc.	X	X	X	X	X	X	X	X
72-55-9	4,4-DDE	X	calc.	X	X	X	X	X	X	X	X
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	X	calc.	X	X	X	X	X	X	X	X
74-83-9	Bromomethane	X	calc.	X	X	X	X	X	X	X	X
74-87-3	Chloromethane	X	calc.	X	X	X	X	X	X	X	X
74-88-4	Iodomethane	calc.	calc.	X	X	X	X	calc.	calc.	X	X
74-95-3	Methylene bromide	X	calc.	X	X	X	X	X	X	X	X
74-97-5	Bromochloromethane	calc.	calc.	X	X	X	X	calc.	calc.	X	X
7429-90-5	Aluminum		X	X	X	X	X	X	X	X	X
7439-89-6	Iron		X	X	X	X	X	X	X	X	X
7439-92-1	Lead	calc.	X	X	X	X	X			X	X
7439-93-2	Lithium		X	X	X	X	X	X	X	X	X
7439-95-4	Magnesium		X	X	X	X	X	X	X	X	X
7439-96-5	Manganese		X	X	X	X	X	X	X	X	X

Table 1-2 Available Plant Uptake Parameters

CAS Registry Number	Constituent Name	Root Concentration Factor	Root Vegetable BCF	Wild Produce Soil-Plant BCF	Domestic Produce Soil-Plant BCF	Forage Aboveground BCF	Silage Aboveground BCF	Produce Air-Plant BCF	Forage Silage Air-Plant BCF	Wild Grain Air-Plant BCF	Domestic Grain Air-Plant BCF
7439-97-6	Mercury	calc.	X	X	X	X	X	X	X	X	X
7439-98-7	Molybdenum		X	X	X	X	X	X	X	X	X
7440-02-0	Nickel	calc.	calc.	X	X	X	X	X	X	X	X
7440-16-6	Rhodium		X	X	X	X	X	X	X	X	X
7440-22-4	Silver	calc.	X	X	X	X	X	X	X	X	X
7440-23-5	Sodium		X	X	X	X	X	X	X	X	X
7440-24-6	Strontium (total)	calc.	X	X	X	X	X	X	X	X	X
7440-25-7	Tantalum		X	X	X	X	X	X	X	X	X
7440-28-0	Thallium	calc.	X	X	X	X	X	X	X	X	X
7440-29-1	Thorium-232		X	X	X	X	X	X	X	X	X
7440-31-5	Tin		X	X	X	X	X	X	X	X	X
7440-33-7	Tungsten		X	X	X	X	X	X	X	X	X
7440-36-0	Antimony	calc.	X	X	X	X	X	X	X	X	X
7440-38-2	Arsenic	calc.	calc.	X	X	X	X	X	X	X	X
7440-39-3	Barium	calc.	X	X	X	X	X	X	X	X	X
7440-41-7	Beryllium	calc.	X	X	X	X	X	X	X	X	X
7440-43-9	Cadmium	calc.	calc.	X	X	X	X	X	X	X	X
7440-47-3	Chromium	calc.	X	X	X	X	X	X	X	X	X
7440-48-4	Cobalt		X	X	X	X	X	X	X	X	X
7440-50-8	Copper		X	X	X	X	X	X	X	X	X
7440-61-1	Uranium		X	X	X	X	X	X	X	X	X
7440-61-1R	Uranium-238		X	X	X	X	X	X	X	X	X
7440-62-2	Vanadium		X	X	X	X	X	X	X	X	X
7440-65-5	Yttrium		X	X	X	X	X	X	X	X	X
7440-66-6	Zinc	calc.	X	X	X	X	X	X	X	X	X
7440-67-7	Zirconium		X	X	X	X	X	X	X	X	X
7446-09-5	Sulfur dioxide	calc.		calc.	calc.	calc.	calc.			calc.	calc.
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	calc.	calc.	X	X	X	X	calc.	calc.	X	X
7487-94-7	Mercuric chloride (HgCl2)	calc.	X	X	X	X	X	X	X	X	X

Table 1-2 Available Plant Uptake Parameters

CAS Registry Number	Constituent Name	Root Concentration Factor	Root Vegetable BCF	Wild Produce Soil-Plant BCF	Domestic Produce Soil-Plant BCF	Forage Aboveground BCF	Silage Aboveground BCF	Produce Air-Plant BCF	Forage Silage Air-Plant BCF	Wild Grain Air-Plant BCF	Domestic Grain Air-Plant BCF
75-00-3	Chloroethane	X	calc.	X	X	X	X	X	X	X	X
75-01-4	1-Chloroethene	X	calc.	X	X	X	X	X	X	X	X
75-02-5	Fluoroethene (vinyl fluoride)	calc.	calc.	X	X	calc.	X	calc.	calc.	X	X
75-05-8	Acetonitrile	X	calc.	X	X	X	X	X	X	X	X
75-07-0	Acetaldehyde	X	calc.	X	X	X	X	X	X	X	X
75-09-2	Dichloromethane (Methylene Chloride)	X	calc.	X	X	X	X	X	X	X	X
75-15-0	Carbon disulfide	X	calc.	X	X	X	X	X	X	X	X
75-21-8	Ethylene oxide (Oxirane)	X	calc.	X	X	X	X	X	X	X	X
75-25-2	Bromoform	X	calc.	X	X	X	X	X	X	X	X
75-27-4	Bromodichloromethane	X	calc.	X	X	X	X	X	X	X	X
75-29-6	2-Chloropropane	calc.	calc.	X	X	X	X	calc.	calc.	X	X
75-34-3	1,1-Dichloroethane	X	calc.	X	X	X	X	X	X	X	X
75-35-4	1,1-Dichloroethene	X	calc.	X	X	X	X	X	X	X	X
75-44-5	Phosgene (hydrogen phosphide)	surr.	surr.	X	X	X	X	surr.	surr.	X	X
75-45-6	Chlorodifluoromethane	X	calc.	X	X	X	X	X	X	X	X
75-50-3	Trimethylamine	calc.		X	X	calc.	X	calc.	calc.	X	X
75-69-4	Trichlorofluoromethane	X	calc.	X	X	X	X	X	X	X	X
75-71-8	Dichlorodifluoromethane	X	calc.	X	X	X	X	X	X	X	X
76-01-7	Pentachloroethane	calc.	calc.	X	X	X	X	calc.	calc.	X	X
76-13-1	1,2,2-Trichlorotrifluoroethane	calc.	calc.	X	X	X	X	calc.	calc.	X	X
76-44-8	Heptachlor	X	calc.	X	X	X	X	X	X	X	X
764-41-0	1,4-Dichloro-2-butene	calc.	calc.	X	X	X	X	calc.	calc.	X	X
7647-01-0	Hydrogen chloride										
765-34-4	Glycidylaldehyde	calc.	calc.	X	X	X	X	calc.	calc.	X	X
7664-39-3	Hydrogen Fluoride	calc.		calc.	calc.	calc.	calc.			calc.	calc.
7664-41-7	Ammonia/Ammonium	calc.		X	X	X	X			X	X
77-47-4	Hexachlorocyclopentadiene	X	calc.	X	X	X	X	X	X	X	X
77-78-1	Dimethyl sulfate	calc.	calc.	X	X	X	X	calc.	calc.	X	X

Table 1-2 Available Plant Uptake Parameters

CAS Registry Number	Constituent Name	Root Concentration Factor	Root Vegetable BCF	Wild Produce Soil-Plant BCF	Domestic Produce Soil-Plant BCF	Forage Aboveground BCF	Silage Aboveground BCF	Produce Air-Plant BCF	Forage Silage Air-Plant BCF	Wild Grain Air-Plant BCF	Domestic Grain Air-Plant BCF
7704-34-9	Total Sulfur (thermodynamically stable)	calc.		calc.	calc.	calc.	calc.	X	X	calc.	calc.
7723-14-0	Phosphorus	calc.	X	X	X	X	X			X	X
7782-41-4	Fluorine gas F2	calc.	calc.	X	X	X	X			X	X
7782-49-2	Selenium	calc.	calc.	X	X	X	X	X	X	X	X
7782-50-5	Chlorine	X	X	X	X	X	X			X	X
78-83-1	2-Methylpropyl alcohol	calc.	calc.	X	X	X	X	calc.	calc.	X	X
78-87-5	1,2-Dichloropropane	X	calc.	X	X	X	X	X	X	X	X
78-93-3	2-Butanone	X	calc.	X	X	X	X	X	X	X	X
79-00-5	1,1,2-Trichloroethane	X	calc.	X	X	X	X	X	X	X	X
79-01-6	1,1,2-Trichloroethylene	X	calc.	X	X	X	X	X	X	X	X
79-10-7	2-Propenoic acid	calc.	calc.	X	X	X	X	calc.	calc.	X	X
79-34-5	1,1,2,2-Tetrachloroethane	X	calc.	X	X	X	X	X	X	X	X
79-46-9	2-Nitropropane	calc.	calc.	X	X	X	X	calc.	calc.	X	X
80-62-6	Methyl methacrylate	calc.	calc.	X	X	X	X	calc.	calc.	X	X
82-68-8	Pentachloronitrobenzene (PCNB)	X	calc.	X	X	X	X	X	X	X	X
822-06-0	Hexamethylene-1,5-diisocyanate	calc.	calc.	X	X	X	X	calc.	calc.	X	X
823-40-5	Toluene-2,6-diamine	calc.	calc.	X	X	X	X	calc.	calc.	X	X
83-32-9	Acenaphthene	X	calc.	X	X	X	X	X	X	X	X
832-69-9	1-Methylphenanthrene	calc.	calc.	calc.	calc.	calc.	X	calc.	calc.	X	X
84-66-2	Diethyl phthalate	X	calc.	X	X	X	X	X	X	X	X
84-74-2	Di-n-butylphthalate	X	calc.	X	X	X	X	X	X	X	X
85-01-8	Phenanthrene	X	calc.	X	X	X	X	X	X	X	X
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	X	calc.	X	X	X	X	X	X	X	X
85-68-7	Butylbenzylphthalate	X	calc.	X	X	X	X	X	X	X	X
86-73-7	Fluorene	X	calc.	X	X	X	X	X	X	X	X
87-61-6	1,2,3-Trichlorobenzene	X	calc.	X	X	X	X	X	X	X	X

Table 1-2 Available Plant Uptake Parameters

CAS Registry Number	Constituent Name	Root Concentration Factor	Root Vegetable BCF	Wild Produce Soil-Plant BCF	Domestic Produce Soil-Plant BCF	Forage Aboveground BCF	Silage Aboveground BCF	Produce Air-Plant BCF	Forage Silage Air-Plant BCF	Wild Grain Air-Plant BCF	Domestic Grain Air-Plant BCF
87-68-3	Hexachlorobutadiene	X	calc.	X	X	X	X	X	X	X	X
87-86-5	Pentachlorophenol	X	calc.	X	X	X	X	X	X	X	X
88-06-2	2,4,6-Trichlorophenol	X	calc.	X	X	X	X	X	X	X	X
88-74-4	o-Nitroaniline (2-nitroaniline)	X	calc.	X	X	X	X	X	X	X	X
88-75-5	2-Nitrophenol	X	calc.	X	X	X	X	X	X	X	X
90-04-0	o-Anisidine	calc.	calc.	X	X	X	X	calc.	calc.	X	X
90-12-0	1-Methylnaphthalene	calc.	calc.	X	X	X	X	calc.	calc.	X	X
91-20-3	Naphthalene	X	calc.	X	X	X	X	X	X	X	X
91-22-5	Quinoline	calc.	calc.	X	X	X	X	calc.	calc.	X	X
91-57-6	2-Methylnaphthalene	calc.	calc.	X	X	X	X	calc.	calc.	X	X
91-58-7	2-Chloronaphthalene	X	calc.	X	X	X	X	X	X	X	X
91-94-1	3,3'-Dichlorobenzidine	X	calc.	X	X	X	X	X	X	X	X
92-52-4	1,1`-Biphenyl	calc.	calc.	X	X	X	X	calc.	calc.	X	X
924-16-3	N-Nitroso-di-n-Buetylamine	X	calc.	X	X	X	X	X	X	X	X
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	X	calc.	X	X	X	X	X	X	X	X
94-75-7	2,4-D	calc.	calc.	X	X	X	X	calc.	calc.	X	X
95-48-7	o-Cresol	X	calc.	X	X	X	X	X	X	X	X
95-49-8	o-Chlorotoluene	calc.	calc.	X	X	X	X	calc.	calc.	X	X
95-50-1	1,2-Dichlorobenzene	X	calc.	X	X	X	X	X	X	X	X
95-53-4	o-Toluidine	X	calc.	X	X	X	X	X	X	X	X
95-57-8	2-Chlorophenol	X	calc.	X	X	X	X	X	X	X	X
95-63-6	1,2,4-Trimethyl benzene	calc.	calc.	X	X	X	X	calc.	calc.	X	X
95-94-3	1,2,4,5-Tetrachlorobenzene	X	calc.	X	X	X	X	X	X	X	X
95-95-4	2,4,5-Trichlorophenol	X	calc.	X	X	X	X	X	X	X	X
96-12-8	1,2-Dibromo-3-chloropropane	X	calc.	X	X	X	X	X	X	X	X
96-18-4	1,2,3-Trichloropropane	X	calc.	X	X	X	X	X	X	X	X
96-45-7	Ethylene thiourea	calc.	calc.	X	X	X	X	calc.	calc.	X	X
97-63-2	Ethyl methacrylate	X	calc.	X	X	X	X	X	X	X	X
98-01-1	Furfural	calc.	calc.	X	X	X	X	calc.	calc.	X	X

Table 1-2 Available Plant Uptake Parameters

CAS Registry Number	Constituent Name	Root Concentration Factor	Root Vegetable BCF	Wild Produce Soil-Plant BCF	Domestic Produce Soil-Plant BCF	Forage Aboveground BCF	Silage Aboveground BCF	Produce Air-Plant BCF	Forage Silage Air-Plant BCF	Wild Grain Air-Plant BCF	Domestic Grain Air-Plant BCF
98-06-6	tert-Butyl benzene	calc.	calc.	X	X	X	X	calc.	calc.	X	X
98-07-7	Benzotrichloride	calc.	calc.	X	X	X	X	calc.	calc.	X	X
98-82-8	Cumene	X	calc.	X	X	X	X	X	X	X	X
98-83-9	Methyl styrene (mixed isomers)	calc.	calc.	X	X	X	X	calc.	calc.	X	X
98-86-2	Acetophenone	X	calc.	X	X	X	X	X	X	X	X
98-95-3	Nitrobenzene	X	calc.	X	X	X	X	X	X	X	X
99-35-4	1,3,5-Trinitrobenzene	X	calc.	X	X	X	X	X	X	X	X
99-65-0	1,3-Dinitrobenzene	X	calc.	X	X	X	X	X	X	X	X
99-87-6	p-Cymene	calc.	calc.	X	X	X	X	calc.	calc.	X	X
N/A	Particulate matter										

Table 1-3 identifies available constituent uptake parameters used in the computation of animal and fish uptake of contaminants. These parameters are used in the computation of dose due to dairy, egg, livestock, and wild game consumption by human receptors.

Table 1-3 Available Animal and Fish Uptake Parameters

CAS Registry Number	Constituent Name	Beef Biotransfer Factor	Pork Biotransfer Factor	Milk Biotransfer Factor	Poultry Biotransfer Factor	Egg Biotransfer Factor	Fish Bioconcentration Factor	Fish Bioaccumulation Factor	Fish Biota-Sediment Accumulation Factor
100-02-7	p-Nitrophenol	calc.	calc.	calc.	calc.	calc.	calc.		
100-21-0	Phthalic acid	X	calc.	X	calc.	calc.	calc.		
100-25-4	1,4-Dinitrobenzene	X	calc.	X	calc.	calc.	calc.		
100-40-3	4-Ethenylcyclohexene	calc.	calc.	calc.	calc.	calc.	calc.		
100-41-4	Ethyl benzene	calc.	calc.	calc.	calc.	calc.	calc.		
100-42-5	Styrene	calc.	calc.	calc.	calc.	calc.	calc.		
100-44-7	Benzyl chloride	calc.	calc.	calc.	calc.	calc.	calc.		
100-47-0	Benzonitrile	calc.	calc.	calc.	calc.	calc.	calc.		
100-51-6	Benzyl alcohol	calc.	calc.	calc.	calc.	calc.	calc.		
100-52-7	Benzaldehyde	calc.	calc.	calc.	calc.	calc.	calc.		
10028-15-6	Ozone						calc.		
10028-17-8	Tritium	X		X			calc.	X	
10045-97-3	Cesium-137	X	X	X	X	X		X	
10061-01-5	cis-1,3-Dichloropropene	X	surr.	X	surr.	surr.	calc.		
10061-02-6	trans-1,3-Dichloropropene	X	calc.	X	calc.	calc.	calc.		
10098-91-6	Yttrium-90	X		X	X	X		X	
10098-97-2	Strontium-90	X	X	X	X	X		X	
101-55-3	4-Bromophenylphenyl ether	calc.	calc.	calc.	calc.	calc.	calc.	calc.	
101-77-9	4,4-Methylenedianiline	X	calc.	X	calc.	calc.	calc.		
10102-44-0	Nitrogen dioxide						X	X	
10198-40-0	Cobalt-60	X	X	X	X	X		X	
103-33-3	Azobenzene	X	calc.	X	calc.	calc.	calc.		
103-65-1	n-Propyl benzene (Isocumene)	X	calc.	X	calc.	calc.	calc.		
104-51-8	n-Butylbenzene	X	calc.	X	calc.	calc.	calc.		
104-76-7	2-Ethyl-1-hexanol	calc.	calc.	calc.	calc.	calc.	calc.		
105-67-9	2,4-Dimethylphenol	calc.	calc.	calc.	calc.	calc.	calc.		
10595-95-6	n-Nitrosomethylethylamine	X	calc.	X	calc.	calc.	calc.		

Table 1-3 Available Animal and Fish Uptake Parameters

CAS Registry Number	Constituent Name	Beef Biotransfer Factor	Pork Biotransfer Factor	Milk Biotransfer Factor	Poultry Biotransfer Factor	Egg Biotransfer Factor	Fish Bioconcentration Factor	Fish Bioaccumulation Factor	Fish Biota-Sediment Accumulation Factor
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	X	calc.	X	calc.	calc.	calc.		
106-44-5	p-Cresol (4-methyl phenol)	calc.	calc.	calc.	calc.	calc.	calc.		
106-46-7	1,4-Dichlorobenzene	calc.	calc.	calc.	calc.	calc.	calc.		
106-47-8	p-Chloroaniline	calc.	calc.	calc.	calc.	calc.	calc.		
106-49-0	p-Toluidine	X	calc.	X	calc.	calc.	calc.		
106-51-4	Quinone	calc.	calc.	calc.	calc.	calc.	X		
106-88-7	1,2-Epoxybutane	X	calc.	X	calc.	calc.	calc.		
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	calc.	calc.	calc.	calc.	calc.	calc.		
106-93-4	Ethylene dibromide	calc.	calc.	calc.	calc.	calc.	calc.		
106-99-0	1,3-Butadiene	X	calc.	X	calc.	calc.	calc.		
107-02-8	Acrolein	calc.	calc.	calc.	calc.	calc.	calc.		
107-05-1	3-Chloropropene	X	calc.	X	calc.	calc.	calc.		
107-06-2	1,2-Dichloroethane	calc.	calc.	calc.	calc.	calc.	calc.		
107-12-0	Propionitrile	X	calc.	X	calc.	calc.	calc.		
107-13-1	Acrylonitrile	calc.	calc.	calc.	calc.	calc.	X		
107-19-7	Propargyl alcohol	X	calc.	X	calc.	calc.	calc.		
107-21-1	Ethylene glycol (1,2-ethanediol)	X	calc.	X	calc.	calc.	calc.		
107-98-2	Propylene glycol monomethyl ether	X	calc.	X	calc.	calc.	calc.		
108-05-4	Acetic acid vinyl ester	calc.	calc.	calc.	calc.	calc.	calc.		
108-10-1	4-Methyl-2-pentanone	calc.	calc.	calc.	calc.	calc.	calc.		
108-39-4	m-Cresol	calc.	calc.	calc.	calc.	calc.	calc.		
108-60-1	bis (2-Chloroisopropyl)ether	X	calc.	X	calc.	calc.	calc.		
108-67-8	1,3,5-Trimethylbenzene	calc.	calc.	calc.	calc.	calc.	calc.		
108-86-1	Bromobenzene (Phenyl bromide)	X	calc.	X	calc.	calc.	calc.		
108-87-2	Methylcyclohexane	X	calc.	X	calc.	calc.	calc.		
108-88-3	Toluene	calc.	calc.	calc.	calc.	calc.	calc.		
108-90-7	Chlorobenzene	calc.	calc.	calc.	calc.	calc.	calc.		
108-94-1	Cyclohexanone	X	calc.	X	calc.	calc.	calc.		
108-95-2	Phenol	calc.	calc.	calc.	calc.	calc.	calc.		

Table 1-3 Available Animal and Fish Uptake Parameters

CAS Registry Number	Constituent Name	Beef Biotransfer Factor	Pork Biotransfer Factor	Milk Biotransfer Factor	Poultry Biotransfer Factor	Egg Biotransfer Factor	Fish Bioconcentration Factor	Fish Bioaccumulation Factor	Fish Biota-Sediment Accumulation Factor
109-74-0	n-Butanenitrile	calc.	calc.	calc.	calc.	calc.	calc.		
109-75-1	3-Butenenitrile	calc.	calc.	calc.	calc.	calc.	calc.		
109-77-3	Malononitrile	X	calc.	X	calc.	calc.	calc.		
109-86-4	2-Methoxyethanol	X	calc.	X	calc.	calc.	calc.		
109-99-9	Tetrahydrofuran	calc.	calc.	calc.	calc.	calc.	calc.		
110-00-9	Furan	X	calc.	X	calc.	calc.	calc.		
110-54-3	n-Hexane	X	calc.	X	calc.	calc.	calc.		
110-59-8	Pentanenitrile	calc.	calc.	calc.	calc.	calc.	calc.		
110-80-5	2-Ethoxyethanol	X	calc.	X	calc.	calc.	calc.		
110-82-7	Cyclohexane	X	calc.	X	calc.	calc.	calc.		
110-83-8	Cyclohexene	X	calc.	X	calc.	calc.	calc.		
110-86-1	Pyridine	calc.	calc.	calc.	calc.	calc.	calc.		
111-15-9	Ethylene glycol monoethyl ether acetate	X	calc.	X	calc.	calc.	calc.		
111-44-4	Bis(2-chloroethyl)ether	calc.	calc.	calc.	calc.	calc.	calc.		
111-65-9	n-Octane	calc.	calc.	calc.	calc.	calc.	calc.		
111-76-2	2-Butoxyethanol	X	calc.	X	calc.	calc.	calc.		
111-84-2	n-Nonane	X	calc.	X	calc.	calc.	calc.		
111-91-1	Bis(2-chloroethoxy)methane	X	calc.	X	calc.	calc.	calc.		
112-30-1	1-Decanol	X	calc.	X	calc.	calc.	calc.		
112-31-2	Decanal	calc.	calc.	calc.	calc.	calc.	calc.		
112-40-3	Dodecane	calc.	calc.	calc.	calc.	calc.	calc.		
1120-21-4	Undecane	calc.	calc.	calc.	calc.	calc.	calc.		
1120-71-4	1,3-Propane sultone	X	calc.	X	calc.	calc.	calc.		
117-81-7	Bis(2-ethylhexyl) phthalate	calc.	calc.	calc.	calc.	calc.	X	calc.	
117-84-0	Di-n-octylphthalate	calc.	calc.	calc.	calc.	calc.	X	calc.	
118-74-1	Hexachlorobenzene	calc.	calc.	calc.	calc.	calc.	X	calc.	
119-90-4	3,3'-Dimethoxybenzidine	calc.	calc.	calc.	calc.	calc.	calc.		
120-12-7	Anthracene	calc.	calc.	calc.	calc.	calc.	calc.	calc.	
120-82-1	1,2,4-Trichlorobenzene	calc.	calc.	calc.	calc.	calc.	calc.		
120-83-2	2,4-Dichlorophenol	calc.	calc.	calc.	calc.	calc.	calc.		

Table 1-3 Available Animal and Fish Uptake Parameters

CAS Registry Number	Constituent Name	Beef Biotransfer Factor	Pork Biotransfer Factor	Milk Biotransfer Factor	Poultry Biotransfer Factor	Egg Biotransfer Factor	Fish Bioconcentration Factor	Fish Bioaccumulation Factor	Fish Biota-Sediment Accumulation Factor
121-14-2	2,4-Dinitrotoluene	calc.	calc.	calc.	calc.	calc.	X		
122-39-4	N,N-Diphenylamine	X	calc.	X	calc.	calc.	calc.		
122-66-7	1,2-Diphenylhydrazine	calc.	calc.	calc.	calc.	calc.	calc.		
123-33-1	Maleic hydrazide	X	calc.	X	calc.	calc.	calc.		
123-38-6	Propionaldehyde	X	calc.	X	calc.	calc.	calc.		
123-72-8	Butanal	calc.	calc.	calc.	calc.	calc.	calc.		
123-91-1	1,4-Dioxan	calc.	calc.	calc.	calc.	calc.	calc.		
124-18-5	Decane	X	calc.	X	calc.	calc.	calc.		
124-38-9	Carbon dioxide	calc.	calc.	calc.	calc.	calc.	calc.		
124-48-1	Chlorodibromomethane	calc.	calc.	calc.	calc.	calc.	calc.		
126-73-8	Tributyl phosphate	X	calc.	X	calc.	calc.	calc.		
126-98-7	2-Methyl-2-propenenitrile	calc.	calc.	calc.	calc.	calc.	calc.		
127-18-4	1,1,2,2-Tetrachloroethene	calc.	calc.	calc.	calc.	calc.	calc.		
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	X	calc.	X	calc.	calc.	calc.		
129-00-0	Pyrene	calc.	calc.	calc.	calc.	calc.	calc.	calc.	
131-11-3	Dimethyl Phthalate	calc.	calc.	calc.	calc.	calc.	calc.		
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	X	calc.	X	calc.	calc.	calc.		
132-64-9	Dibenzofuran	X	calc.	X	calc.	calc.	calc.		
133-06-2	Captan	X	calc.	X	calc.	calc.	calc.		
1330-20-7	Xylenes (mixed isomers)	X	calc.	X	calc.	calc.	calc.		
1336-36-3	Polychlorinated biphenyls	X	calc.	X	calc.	calc.	calc.		X
134-32-7	alpha-Naphthylamine	X	calc.	X	calc.	calc.	calc.		
135-98-8	sec-Butylbenzene	X	calc.	X	calc.	calc.	calc.		
13966-29-5	Uranium-234	X	X	X	X	X		X	
13967-48-1	Ruthenium-106	X		X	X	X		X	
13967-70-9	Cesium-134	X	X	X	X	X		X	
13968-55-3	Uranium-233	X	X	X	X	X		X	
13981-15-2	Curium-244	X		X	X	X		X	
13981-16-3	Plutonium-238	X	X	X	X	X		X	
13981-37-8	Nickel-63	X		X	X	X	X	X	

Table 1-3 Available Animal and Fish Uptake Parameters

CAS Registry Number	Constituent Name	Beef Biotransfer Factor	Pork Biotransfer Factor	Milk Biotransfer Factor	Poultry Biotransfer Factor	Egg Biotransfer Factor	Fish Bioconcentration Factor	Fish Bioaccumulation Factor	Fish Biota-Sediment Accumulation Factor
13982-10-0	Plutonium-242	X	X	X	X	X		X	
13982-63-3	Radium-226	X		X	X	X		X	
13982-70-2	Uranium-236	X	X	X	X	X		X	
13994-20-2	Neptunium-237	X		X	X	X		X	
141-78-6	Acetic acid ethyl ester	X	calc.	X	calc.	calc.	calc.		
14119-32-5	Plutonium-241	X	X	X	X	X		X	
14119-33-6	Plutonium-240	X	X	X	X	X		X	
14133-76-7	Technetium-99	X	X	X	X	X		X	
14158-29-3	Uranium-232	X	X	X	X	X		X	
14234-35-6	Antimony-125	X		X	X	X	X	X	
14265-44-2	Phosphate								
14331-85-2	Protactinium-231	X		X	X	X		X	
14336-70-0	Nickel-59	X		X	X	X	X	X	
14391-16-3	Europium-155	X		X	X	X		X	
145-73-3	Endothall	X	calc.	X	calc.	calc.	calc.		
14596-10-2	Americium-241	X	X	X	X	X		X	
14683-23-9	Europium-152	X		X	X	X		X	
14762-75-5	Carbon-14	X		X				X	
14797-55-8	Nitrate						X	X	
14797-65-0	Nitrite						X	X	
14808-79-8	Sulfate						X	X	
14952-40-0	Actinium-227	X		X	X	X		X	
14993-75-0	Americium-243	X	X	X	X	X		X	
15046-84-1	Iodine-129	X	X	X	X	X		X	
15117-48-3	Plutonium-239	X	X	X	X	X		X	
15117-96-1	Uranium-235	X	X	X	X	X		X	
15262-20-1	Radium-228	X		X	X	X		X	
15510-73-3	Curium-242	X		X	X	X		X	
15585-10-1	Europium-154	X		X	X	X		X	
15594-54-4	Thorium-229	X		X	X	X		X	

Table 1-3 Available Animal and Fish Uptake Parameters

CAS Registry Number	Constituent Name	Beef Biotransfer Factor	Pork Biotransfer Factor	Milk Biotransfer Factor	Poultry Biotransfer Factor	Egg Biotransfer Factor	Fish Bioconcentration Factor	Fish Bioaccumulation Factor	Fish Biota-Sediment Accumulation Factor
156-59-2	cis-1,2-Dichloroethene	calc.	calc.	calc.	calc.	calc.	calc.		
156-60-5	1,2-trans-Dichloroethene	calc.	calc.	calc.	calc.	calc.	calc.		
15715-94-3	Samarium-151	X		X	X	X		X	
15751-77-6	Zirconium-93	X		X	X	X		X	
15757-87-6	Curium-243	X		X	X	X		X	
15758-45-9	Selenium-79	X	X	X	X	X	X	X	
15832-50-5	Tin-126	X		X	X	X		X	
1634-04-4	Methyl tert-butyl ether	X	calc.	X	calc.	calc.	calc.		
16887-00-6	Chloride	X		X			X	X	
16984-48-8	Fluoride	X		X			X	X	
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	calc.	calc.	calc.	calc.	calc.	X		X
18540-29-9	Chromium(VI)	X		X	X	X	X	X	
189-55-9	Dibenzo[a,i]pyrene	X	surr.	X	surr.	surr.	surr.	surr.	
189-64-0	Dibenzo[a,h]pyrene	X	calc.	X	calc.	calc.	calc.		
191-24-2	Benzo(g,h,i)perylene	X	calc.	X	calc.	calc.	calc.		
191-30-0	Dibenzo(a,l)pyrene	X	calc.	X	calc.	calc.	calc.		
192-65-4	Dibenzo[a,e]pyrene	X	calc.	X	calc.	calc.	calc.		
192-97-2	Benzo(e)pyrene	calc.	calc.	calc.	calc.	calc.	calc.		
193-39-5	Indeno(1,2,3-cd)pyrene	calc.	calc.	calc.	calc.	calc.	X	calc.	
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	calc.	calc.	calc.	calc.	calc.	X		X
205-82-3	Benzo[j]fluoranthene	X	calc.	X	calc.	calc.	calc.		
205-99-2	Benzo(b)fluoranthene	calc.	calc.	calc.	calc.	calc.	X	calc.	
206-44-0	Fluoranthene	calc.	calc.	calc.	calc.	calc.	calc.	calc.	
207-08-9	Benzo(k)fluoranthene	calc.	calc.	calc.	calc.	calc.	X	calc.	
208-96-8	Acenaphthylene	X	calc.	X	calc.	calc.	calc.		
218-01-9	Chrysene	calc.	calc.	calc.	calc.	calc.	X	calc.	
224-42-0	Dibenz[a,j]acridine	X	surr.	X	surr.	surr.	surr.	surr.	
2245-38-7	2,3,5-Trimethylnaphthalene	calc.	calc.	calc.	calc.	calc.	calc.		

Table 1-3 Available Animal and Fish Uptake Parameters

CAS Registry Number	Constituent Name	Beef Biotransfer Factor	Pork Biotransfer Factor	Milk Biotransfer Factor	Poultry Biotransfer Factor	Egg Biotransfer Factor	Fish Bioconcentration Factor	Fish Bioaccumulation Factor	Fish Biota-Sediment Accumulation Factor
226-36-8	Dibenz[a,h]acridine	X	surr.	X	surr.	surr.	X	surr.	
22967-92-6	Methyl mercury	X	X	X	X	X		X	
23950-58-5	Pronamide	calc.	calc.	calc.	calc.	calc.	calc.		
24959-67-9	Bromide	X		X			X	X	
27154-33-2	Trichlorofluoroethane	surr.	surr.	surr.	surr.	surr.	calc.		
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	X	calc.	X	calc.	calc.	calc.	X	X
319-84-6	alpha-BHC	calc.	calc.	calc.	calc.	calc.	calc.		
319-85-7	beta-BHC	calc.	calc.	calc.	calc.	calc.	calc.		
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	X	calc.	X	calc.	calc.	calc.	surr.	X
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	X	calc.	X	calc.	calc.	calc.	X	X
3268-87-9	Octachlorodibenzo(p)dioxin	calc.	calc.	calc.	calc.	calc.	X		X
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	X	calc.	X	calc.	calc.	calc.		X
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	calc.	calc.	calc.	calc.	calc.	X		X
3697-24-3	5-Methylchrysene	X	surr.	X	surr.	surr.	surr.	surr.	
378253-40-8	Barium-137m	X		X	X	X		X	
378253-44-2	Cadmium-113m	X	X	X	X	X		X	
378782-82-2	Niobium-93m	X	X	X	X	X		X	
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	X	calc.	X	calc.	calc.	calc.		X
39001-02-0	Octachlorodibenzofuran	calc.	calc.	calc.	calc.	calc.	X		X
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	calc.	calc.	calc.	calc.	calc.	X		X
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	X	calc.	X	calc.	calc.	calc.		X
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	calc.	calc.	calc.	calc.	calc.	X		X
4170-30-3	Crotonaldehyde (Propylene aldehyde)	X	calc.	X	calc.	calc.	calc.		

Table 1-3 Available Animal and Fish Uptake Parameters

CAS Registry Number	Constituent Name	Beef Biotransfer Factor	Pork Biotransfer Factor	Milk Biotransfer Factor	Poultry Biotransfer Factor	Egg Biotransfer Factor	Fish Bioconcentration Factor	Fish Bioaccumulation Factor	Fish Biota-Sediment Accumulation Factor
41851-50-7	Chlorocyclopentadiene	X	calc.	X	calc.	calc.	calc.		
460-19-5	Cyanogen (oxalonitrile)	X	calc.	X	calc.	calc.	calc.	X	
4786-20-3	2-Butenenitrile	calc.	calc.	calc.	calc.	calc.	calc.		
50-00-0	Formaldehyde	calc.	calc.	calc.	calc.	calc.	calc.		
50-32-8	Benzo(a)pyrene	calc.	calc.	calc.	calc.	calc.	X	calc.	
506-68-3	Cyanogen bromide (bromocyanide)	calc.	calc.	calc.	calc.	calc.	calc.	X	
506-77-4	Cyanogen chloride	X	calc.	X	calc.	calc.	calc.	X	
51-28-5	2,4-Dinitrophenol	calc.	calc.	calc.	calc.	calc.	calc.		
51-79-6	Ethyl carbamate (urethane)	X	calc.	X	calc.	calc.	calc.		
510-15-6	Chlorobenzilate	calc.	calc.	calc.	calc.	calc.	calc.	calc.	
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	calc.	calc.	calc.	calc.	calc.	X		X
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	X	calc.	X	calc.	calc.	calc.		X
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	X	calc.	X	calc.	calc.	calc.		
53-70-3	Dibenz[a,h]anthracene	calc.	calc.	calc.	calc.	calc.	X	calc.	
532-27-4	2-Chloroacetophenone	X	calc.	X	calc.	calc.	calc.		
534-52-1	4,6-Dinitro-o-cresol	X	calc.	X	calc.	calc.	calc.		
5385-75-1	Dibenzo(a,e)fluoranthene	surr.	calc.	X	calc.	calc.	calc.		
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	X	calc.	X	calc.	calc.	calc.		
540-73-8	1,2-Dimethylhydrazine	X	calc.	X	calc.	calc.	calc.		
540-84-1	2,2,4-Trimethylpentane	X	calc.	X	calc.	calc.	calc.		
541-73-1	1,3-Dichlorobenzene	calc.	calc.	calc.	calc.	calc.	calc.		
542-75-6	1,3-Dichloropropene	calc.	calc.	calc.	calc.	calc.	calc.		
542-88-1	Bis(chloromethyl)ether	X	calc.	X	calc.	calc.	calc.		
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	calc.	calc.	calc.	calc.	calc.	X		X
56-23-5	Carbon tetrachloride	calc.	calc.	calc.	calc.	calc.	X		
56-49-5	3-Methylcholanthrene	X	calc.	X	calc.	calc.	calc.		
56-55-3	Benzo(a)anthracene	calc.	calc.	calc.	calc.	calc.	X	calc.	

Table 1-3 Available Animal and Fish Uptake Parameters

CAS Registry Number	Constituent Name	Beef Biotransfer Factor	Pork Biotransfer Factor	Milk Biotransfer Factor	Poultry Biotransfer Factor	Egg Biotransfer Factor	Fish Bioconcentration Factor	Fish Bioaccumulation Factor	Fish Biota-Sediment Accumulation Factor
57-12-5	Cyanide	calc.	calc.	calc.	calc.	calc.	calc.		
57-24-9	Strychnine	calc.	calc.	calc.	calc.	calc.	calc.		
57-74-9	Chlordane	calc.	calc.	calc.	calc.	calc.	calc.	calc.	
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	calc.	calc.	calc.	calc.	calc.	X		X
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	calc.	calc.	calc.	calc.	calc.	X		X
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	calc.	calc.	calc.	calc.	calc.	X		X
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	X	calc.	X	calc.	calc.	calc.	surr.	X
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	calc.	calc.	calc.	calc.	calc.	X		X
58-89-9	gamma-BHC (Lindane)	X	calc.	X	calc.	calc.	calc.		
58-90-2	2,3,4,6-Tetrachlorophenol	calc.	calc.	calc.	calc.	calc.	calc.	calc.	
581-42-0	2,6-Dimethylnaphthalene	calc.	calc.	calc.	calc.	calc.	calc.		
584-84-9	2,4-Toluene diisocyanate	surr.	surr.	surr.	surr.	surr.	surr.		
589-38-8	3-Hexanone	calc.	calc.	calc.	calc.	calc.	calc.		
59-50-7	4-Chloro-3-methylphenol	calc.	calc.	calc.	calc.	calc.	calc.		
59-89-2	N-Nitrosomorpholine	X	calc.	X	calc.	calc.	calc.		
591-50-4	Benzene, iodo-	calc.	calc.	calc.	calc.	calc.	calc.		
591-78-6	2-Hexanone	X	calc.	X	calc.	calc.	calc.		
593-60-2	Bromoethene (Vinyl bromide)	X	calc.	X	calc.	calc.	calc.		
593-74-8	Dimethyl Mercury	X		X			calc.		
60-11-7	Dimethyl aminoazobenzene	X	calc.	X	calc.	calc.	calc.		
60-29-7	Ethyl ether	X	calc.	X	calc.	calc.	calc.		
60-35-5	Acetamide	X	calc.	X	calc.	calc.	calc.		
602-87-9	5-Nitroacenaphthene	X	surr.	X	surr.	surr.	calc.		
606-20-2	2,6-Dinitrotoluene	calc.	calc.	calc.	calc.	calc.	X		
608-93-5	Pentachlorobenzene	calc.	calc.	calc.	calc.	calc.	X	calc.	
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	calc.	calc.	calc.	calc.	calc.	X		X
61626-71-9	Dichloropentadiene	surr.	calc.	surr.	calc.	calc.	calc.		

Table 1-3 Available Animal and Fish Uptake Parameters

CAS Registry Number	Constituent Name	Beef Biotransfer Factor	Pork Biotransfer Factor	Milk Biotransfer Factor	Poultry Biotransfer Factor	Egg Biotransfer Factor	Fish Bioconcentration Factor	Fish Bioaccumulation Factor	Fish Biota-Sediment Accumulation Factor
62-50-0	Ethyl methanesulfonate	calc.	calc.	calc.	calc.	calc.	calc.		
62-53-3	Aniline	calc.	calc.	calc.	calc.	calc.	calc.		
62-75-9	N-Nitroso-N,N-dimethylamine	X	calc.	X	calc.	calc.	X		
621-64-7	N-Nitroso-di-n-propylamine	calc.	calc.	calc.	calc.	calc.	calc.		
624-83-9	Methyl isocyanate	X	surr.	X	surr.	surr.	surr.		
628-73-9	Hexanenitrile	calc.	calc.	calc.	calc.	calc.	calc.		
630-08-0	Carbon monoxide	X		X			calc.		
630-20-6	1,1,1,2-Tetrachloroethane	calc.	calc.	calc.	calc.	calc.	calc.		
64-18-6	Formic acid (methanoic acid)	calc.	calc.	calc.	calc.	calc.	calc.		
65-85-0	Benzoic acid	calc.	calc.	calc.	calc.	calc.	calc.		
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	X	calc.	X	calc.	calc.	calc.	surr.	X
67-56-1	Methyl alcohol	calc.	calc.	calc.	calc.	calc.	calc.		
67-63-0	2-Propyl alcohol	X	calc.	X	calc.	calc.	calc.		
67-64-1	2-Propanone (Acetone)	calc.	calc.	calc.	calc.	calc.	calc.		
67-66-3	Chloroform	calc.	calc.	calc.	calc.	calc.	X		
67-72-1	Hexachloroethane	calc.	calc.	calc.	calc.	calc.	calc.		
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	calc.	calc.	calc.	calc.	calc.	X		X
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	X	calc.	X	calc.	calc.	X		X
70-30-4	Hexachlorophene	calc.	calc.	calc.	calc.	calc.	X	calc.	
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	X	calc.	X	calc.	calc.	calc.	surr.	X
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	calc.	calc.	calc.	calc.	calc.	X		X
71-36-3	n-Butyl alcohol	X	calc.	X	calc.	calc.	calc.		
71-43-2	Benzene	calc.	calc.	calc.	calc.	calc.	calc.		
71-55-6	1,1,1-Trichloroethane	calc.	calc.	calc.	calc.	calc.	calc.		
72-43-5	Methoxychlor	calc.	calc.	calc.	calc.	calc.	calc.	calc.	
72-55-9	4,4-DDE	calc.	calc.	calc.	calc.	calc.	X	calc.	

Table 1-3 Available Animal and Fish Uptake Parameters

CAS Registry Number	Constituent Name	Beef Biotransfer Factor	Pork Biotransfer Factor	Milk Biotransfer Factor	Poultry Biotransfer Factor	Egg Biotransfer Factor	Fish Bioconcentration Factor	Fish Bioaccumulation Factor	Fish Biota-Sediment Accumulation Factor
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	calc.	calc.	calc.	calc.	calc.	X		X
74-83-9	Bromomethane	calc.	calc.	calc.	calc.	calc.	calc.		
74-87-3	Chloromethane	calc.	calc.	calc.	calc.	calc.	calc.		
74-88-4	Iodomethane	X	calc.	X	calc.	calc.	calc.		
74-95-3	Methylene bromide	calc.	calc.	calc.	calc.	calc.	calc.		
74-97-5	Bromochloromethane	X	calc.	X	calc.	calc.	calc.		
7429-90-5	Aluminum	X		X				X	
7439-89-6	Iron	X	X	X	X	X		X	
7439-92-1	Lead	X		X	X	X	X	X	
7439-93-2	Lithium	X		X					
7439-95-4	Magnesium	X		X	X	X			
7439-96-5	Manganese	X	X	X	X	X		X	
7439-97-6	Mercury	X	X	X	X	X		X	
7439-98-7	Molybdenum	X		X	X	X		X	
7440-02-0	Nickel	X		X	X	X	X	X	
7440-16-6	Rhodium	X		X	X	X		X	
7440-22-4	Silver	X		X	X	X	X	X	
7440-23-5	Sodium	X		X	X	X		X	
7440-24-6	Strontium (total)	X		X	X	X	calc.	X	
7440-25-7	Tantalum	X		X	X	X		X	
7440-28-0	Thallium	X		X	X	X	X	X	
7440-29-1	Thorium-232	X		X	X	X		X	
7440-31-5	Tin	X		X	X	X		X	
7440-33-7	Tungsten	X		X	X	X		X	
7440-36-0	Antimony	X		X	X	X	X	X	
7440-38-2	Arsenic	X		X	X	X	X	X	
7440-39-3	Barium	X		X	X	X	calc.	X	
7440-41-7	Beryllium	X		X			X	X	
7440-43-9	Cadmium	X	X	X	X	X	X	X	
7440-47-3	Chromium	X		X			calc.		

Table 1-3 Available Animal and Fish Uptake Parameters

CAS Registry Number	Constituent Name	Beef Biotransfer Factor	Pork Biotransfer Factor	Milk Biotransfer Factor	Poultry Biotransfer Factor	Egg Biotransfer Factor	Fish Bioconcentration Factor	Fish Bioaccumulation Factor	Fish Biota-Sediment Accumulation Factor
7440-48-4	Cobalt	X	X	X	X	X		X	
7440-50-8	Copper	X	X	X	X	X	X	X	
7440-61-1	Uranium	X	X	X	X	X		X	
7440-61-1R	Uranium-238	X	X	X	X	X		X	
7440-62-2	Vanadium	X		X					
7440-65-5	Yttrium	X		X	X	X		X	
7440-66-6	Zinc	X	X	X	X	X	X	X	
7440-67-7	Zirconium	X		X	X	X		X	
7446-09-5	Sulfur dioxide						calc.		
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	X	calc.	X	calc.	calc.	calc.	surr.	X
7487-94-7	Mercuric chloride (HgCl2)	X	X	X	X	X		X	
75-00-3	Chloroethane	calc.	calc.	calc.	calc.	calc.	calc.		
75-01-4	1-Chloroethene	calc.	calc.	calc.	calc.	calc.	calc.		
75-02-5	Fluoroethene (vinyl fluoride)	calc.	calc.	calc.	calc.	calc.	calc.		
75-05-8	Acetonitrile	calc.	calc.	calc.	calc.	calc.	calc.		
75-07-0	Acetaldehyde	calc.	calc.	calc.	calc.	calc.	calc.		
75-09-2	Dichloromethane (Methylene Chloride)	calc.	calc.	calc.	calc.	calc.	calc.		
75-15-0	Carbon disulfide	calc.	calc.	calc.	calc.	calc.	calc.		
75-21-8	Ethylene oxide (Oxirane)	calc.	calc.	calc.	calc.	calc.	calc.		
75-25-2	Bromoform	calc.	calc.	calc.	calc.	calc.	calc.		
75-27-4	Bromodichloromethane	calc.	calc.	calc.	calc.	calc.	calc.		
75-29-6	2-Chloropropane	X	calc.	X	calc.	calc.	calc.		
75-34-3	1,1-Dichloroethane	calc.	calc.	calc.	calc.	calc.	calc.		
75-35-4	1,1-Dichloroethene	calc.	calc.	calc.	calc.	calc.	calc.		
75-44-5	Phosgene (hydrogen phosphide)	X	surr.	X	surr.	surr.	calc.		
75-45-6	Chlorodifluoromethane	calc.	calc.	calc.	calc.	calc.	calc.		
75-50-3	Trimethylamine	calc.	calc.	calc.	calc.	calc.	calc.		
75-69-4	Trichlorofluoromethane	calc.	calc.	calc.	calc.	calc.	calc.		
75-71-8	Dichlorodifluoromethane	calc.	calc.	calc.	calc.	calc.	calc.		

Table 1-3 Available Animal and Fish Uptake Parameters

CAS Registry Number	Constituent Name	Beef Biotransfer Factor	Pork Biotransfer Factor	Milk Biotransfer Factor	Poultry Biotransfer Factor	Egg Biotransfer Factor	Fish Bioconcentration Factor	Fish Bioaccumulation Factor	Fish Biota-Sediment Accumulation Factor
76-01-7	Pentachloroethane	X	calc.	X	calc.	calc.	calc.		
76-13-1	1,2,2-Trichlorotrifluoroethane	X	calc.	X	calc.	calc.	calc.		
76-44-8	Heptachlor	calc.	calc.	calc.	calc.	calc.	X	calc.	
764-41-0	1,4-Dichloro-2-butene	X	calc.	X	calc.	calc.	calc.		
7647-01-0	Hydrogen chloride	calc.	calc.	calc.	calc.	calc.	X	X	
765-34-4	Glycidylaldehyde	X	calc.	X	calc.	calc.	calc.		
7664-39-3	Hydrogen Fluoride						calc.		
7664-41-7	Ammonia/Ammonium	X		X			calc.		
77-47-4	Hexachlorocyclopentadiene	calc.	calc.	calc.	calc.	calc.	X	calc.	
77-78-1	Dimethyl sulfate	X	calc.	X	calc.	calc.	calc.		
7704-34-9	Total Sulfur (thermodynamically stable)	X		X			X		
7723-14-0	Phosphorus	X		X	X	X	calc.	X	
7782-41-4	Fluorine gas F2	X		X			X	X	
7782-49-2	Selenium	X	X	X	X	X	X	X	
7782-50-5	Chlorine	calc.	calc.	calc.	calc.	calc.	calc.	X	
78-83-1	2-Methylpropyl alcohol	X	calc.	X	calc.	calc.	calc.		
78-87-5	1,2-Dichloropropane	calc.	calc.	calc.	calc.	calc.	calc.		
78-93-3	2-Butanone	calc.	calc.	calc.	calc.	calc.	calc.		
79-00-5	1,1,2-Trichloroethane	calc.	calc.	calc.	calc.	calc.	calc.		
79-01-6	1,1,2-Trichloroethylene	calc.	calc.	calc.	calc.	calc.	calc.		
79-10-7	2-Propenoic acid	X	calc.	X	calc.	calc.	calc.		
79-34-5	1,1,2,2-Tetrachloroethane	calc.	calc.	calc.	calc.	calc.	calc.		
79-46-9	2-Nitropropane	X	calc.	X	calc.	calc.	calc.		
80-62-6	Methyl methacrylate	X	calc.	X	calc.	calc.	calc.		
82-68-8	Pentachloronitrobenzene (PCNB)	calc.	calc.	calc.	calc.	calc.	X	calc.	
822-06-0	Hexamethylene-1,5-diisocyanate	X	calc.	X	calc.	calc.	calc.		
823-40-5	Toluene-2,6-diamine	X	calc.	X	calc.	calc.	calc.		
83-32-9	Acenaphthene	calc.	calc.	calc.	calc.	calc.	calc.		
832-69-9	1-Methylphenanthrene	calc.	calc.	calc.	calc.	calc.	calc.		
84-66-2	Diethyl phthalate	calc.	calc.	calc.	calc.	calc.	calc.		

Table 1-3 Available Animal and Fish Uptake Parameters

CAS Registry Number	Constituent Name	Beef Biotransfer Factor	Pork Biotransfer Factor	Milk Biotransfer Factor	Poultry Biotransfer Factor	Egg Biotransfer Factor	Fish Bioconcentration Factor	Fish Bioaccumulation Factor	Fish Biota-Sediment Accumulation Factor
84-74-2	Di-n-butylphthalate	calc.	calc.	calc.	calc.	calc.	calc.	calc.	
85-01-8	Phenanthrene	calc.	calc.	calc.	calc.	calc.	calc.	calc.	
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	calc.	calc.	calc.	calc.	calc.	calc.		
85-68-7	Butylbenzylphthalate	calc.	calc.	calc.	calc.	calc.	calc.	calc.	
86-73-7	Fluorene	calc.	calc.	calc.	calc.	calc.	calc.	calc.	
87-61-6	1,2,3-Trichlorobenzene	calc.	calc.	calc.	calc.	calc.	calc.	calc.	
87-68-3	Hexachlorobutadiene	calc.	calc.	calc.	calc.	calc.	X	calc.	
87-86-5	Pentachlorophenol	calc.	calc.	calc.	calc.	calc.	X	calc.	
88-06-2	2,4,6-Trichlorophenol	calc.	calc.	calc.	calc.	calc.	calc.		
88-74-4	o-Nitroaniline (2-nitroaniline)	calc.	calc.	calc.	calc.	calc.	calc.		
88-75-5	2-Nitrophenol	calc.	calc.	calc.	calc.	calc.	calc.		
90-04-0	o-Anisidine	X	calc.	X	calc.	calc.	calc.		
90-12-0	1-Methylnaphthalene	X	calc.	X	calc.	calc.	calc.		
91-20-3	Naphthalene	calc.	calc.	calc.	calc.	calc.	calc.		
91-22-5	Quinoline	X	calc.	X	calc.	calc.	calc.		
91-57-6	2-Methylnaphthalene	X	calc.	X	calc.	calc.	calc.		
91-58-7	2-Chloronaphthalene	calc.	calc.	calc.	calc.	calc.	calc.		
91-94-1	3,3'-Dichlorobenzidine	calc.	calc.	calc.	calc.	calc.	calc.		
92-52-4	1,1`-Biphenyl	X	calc.	X	calc.	calc.	calc.		
924-16-3	N-Nitroso-di-n-Buetylamine	calc.	calc.	calc.	calc.	calc.	calc.		
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	calc.	calc.	calc.	calc.	calc.	calc.		
94-75-7	2,4-D	X	calc.	X	calc.	calc.	calc.		
95-48-7	o-Cresol	calc.	calc.	calc.	calc.	calc.	calc.		
95-49-8	o-Chlorotoluene	X	calc.	X	calc.	calc.	calc.		
95-50-1	1,2-Dichlorobenzene	calc.	calc.	calc.	calc.	calc.	calc.		
95-53-4	o-Toluidine	calc.	calc.	calc.	calc.	calc.	calc.		
95-57-8	2-Chlorophenol	calc.	calc.	calc.	calc.	calc.	calc.		
95-63-6	1,2,4-Trimethyl benzene	X	calc.	X	calc.	calc.	calc.		
95-94-3	1,2,4,5-Tetrachlorobenzene	calc.	calc.	calc.	calc.	calc.	calc.	calc.	

Table 1-3 Available Animal and Fish Uptake Parameters

CAS Registry Number	Constituent Name	Beef Biotransfer Factor	Pork Biotransfer Factor	Milk Biotransfer Factor	Poultry Biotransfer Factor	Egg Biotransfer Factor	Fish Bioconcentration Factor	Fish Bioaccumulation Factor	Fish Biota-Sediment Accumulation Factor
95-95-4	2,4,5-Trichlorophenol	calc.	calc.	calc.	calc.	calc.	calc.		
96-12-8	1,2-Dibromo-3-chloropropane	calc.	calc.	calc.	calc.	calc.	calc.		
96-18-4	1,2,3-Trichloropropane	calc.	calc.	calc.	calc.	calc.	calc.		
96-45-7	Ethylene thiourea	X	calc.	X	calc.	calc.	calc.		
97-63-2	Ethyl methacrylate	calc.	calc.	calc.	calc.	calc.	calc.		
98-01-1	Furfural	X	calc.	X	calc.	calc.	calc.		
98-06-6	tert-Butyl benzene	X	calc.	X	calc.	calc.	calc.		
98-07-7	Benzotrichloride	X	calc.	X	calc.	calc.	calc.		
98-82-8	Cumene	calc.	calc.	calc.	calc.	calc.	calc.		
98-83-9	Methyl styrene (mixed isomers)	X	calc.	X	calc.	calc.	calc.		
98-86-2	Acetophenone	calc.	calc.	calc.	calc.	calc.	calc.		
98-95-3	Nitrobenzene	calc.	calc.	calc.	calc.	calc.	X		
99-35-4	1,3,5-Trinitrobenzene	calc.	calc.	calc.	calc.	calc.	calc.		
99-65-0	1,3-Dinitrobenzene	calc.	calc.	calc.	calc.	calc.	X		
99-87-6	p-Cymene	X	calc.	X	calc.	calc.	calc.		
N/A	Particulate matter								

Table 1-4 identifies available constituent toxicity data used in quantifying the health effect and excess cancer risk to human receptors.

Table 1-4 Available Chronic Toxicity Data

CAS#	Constituent	Unit Risk Factor (URF)	Inhalation Reference Concentration (RfC)	Oral Reference Dose (RfD)	Oral Slope Factor (CSF)	Percent Gastrointestinal Absorption	Dermal Reference Dose	Dermal Slope Factor
100-02-7	p-Nitrophenol					X		X
100-21-0	Phthalic acid					X		X
100-25-4	1,4-Dinitrobenzene					X		X
100-40-3	4-Ethenylcyclohexene							X
100-41-4	Ethyl benzene	X	X			X	X	X
100-42-5	Styrene		X			X		X
100-44-7	Benzyl chloride	X	X		X	X	X	X
100-47-0	Benzonitrile							X
100-51-6	Benzyl alcohol					X		X
100-52-7	Benzaldehyde					X	X	X
10028-15-6	Ozone							X
10061-01-5	cis-1,3-Dichloropropene					surr.		X
10061-02-6	trans-1,3-Dichloropropene							X
101-55-3	4-Bromophenylphenyl ether							X
101-77-9	4,4-Methylenedianiline	X	X				X	X
10102-44-0	Nitrogen dioxide							X
103-33-3	Azobenzene	X			X		X	X
103-65-1	n-Propyl benzene (Isocumene)		X			X		X
104-51-8	n-Butylbenzene					X		X
104-76-7	2-Ethyl-1-hexanol							X
105-67-9	2,4-Dimethylphenol					X		X
10595-95-6	n-Nitrosomethylethylamine	X			X		X	X
106-43-4	4-Chlorotoluene (p-Tolyl chloride)					X		X
106-44-5	p-Cresol (4-methyl phenol)		X			X		X
106-46-7	1,4-Dichlorobenzene	X	X		X	X	X	X
106-47-8	p-Chloroaniline					X	X	X
106-49-0	p-Toluidine				X	X	X	X
106-51-4	Quinone							X
106-88-7	1,2-Epoxybutane		X					X

Table 1-4 Available Chronic Toxicity Data

CAS#	Constituent	Unit Risk Factor (URF)	Inhalation Reference Concentration (RfC)	Oral Reference Dose (RfD)	Oral Slope Factor (CSF)	Percent Gastrointestinal Absorption	Dermal Reference Dose	Dermal Slope Factor
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	X	X		X	X	X	X
106-93-4	Ethylene dibromide	X	X		X	X	X	X
106-99-0	1,3-Butadiene	X	X				X	X
107-02-8	Acrolein		X			X		X
107-05-1	3-Chloropropene	X	X				X	X
107-06-2	1,2-Dichloroethane	X	X		X	X	X	X
107-12-0	Propionitrile							X
107-13-1	Acrylonitrile	X	X		X	X	X	X
107-19-7	Propargyl alcohol					X		X
107-21-1	Ethylene glycol (1,2-ethanediol)		X			X		X
107-98-2	Propylene glycol monomethyl ether		X			X		X
108-05-4	Acetic acid vinyl ester		X			X		X
108-10-1	4-Methyl-2-pentanone		X			X		X
108-39-4	m-Cresol		X			X		X
108-60-1	bis (2-Chloroisopropyl)ether	X			X	X	X	X
108-67-8	1,3,5-Trimethylbenzene		X			X		X
108-86-1	Bromobenzene (Phenyl bromide)		X			X		X
108-87-2	Methylcyclohexane		X					X
108-88-3	Toluene		X			X		X
108-90-7	Chlorobenzene		X			X		X
108-94-1	Cyclohexanone		X			X		X
108-95-2	Phenol		X			X		X
109-74-0	n-Butanenitrile							X
109-75-1	3-Butenenitrile							X
109-77-3	Malononitrile					X		X
109-86-4	2-Methoxyethanol		X			X		X
109-99-9	Tetrahydrofuran	X	X			X	X	X
110-00-9	Furan					X		X
110-54-3	n-Hexane	X	X			X		X

Table 1-4 Available Chronic Toxicity Data

CAS#	Constituent	Unit Risk Factor (URF)	Inhalation Reference Concentration (RfC)	Oral Reference Dose (RfD)	Oral Slope Factor (CSF)	Percent Gastrointestinal Absorption	Dermal Reference Dose	Dermal Slope Factor
110-59-8	Pentanenitrile							X
110-80-5	2-Ethoxyethanol		X			X		X
110-82-7	Cyclohexane		X					X
110-83-8	Cyclohexene		X			X		X
110-86-1	Pyridine					X		X
111-15-9	Ethylene glycol monoethyl ether acetate		X			X		X
111-44-4	Bis(2-chloroethyl)ether	X			X		X	X
111-65-9	n-Octane					X		X
111-76-2	2-Butoxyethanol		X			X		X
111-84-2	n-Nonane		X			X		X
111-91-1	Bis(2-chloroethoxy)methane					X		X
112-30-1	1-Decanol							X
112-31-2	Decanal							X
112-40-3	Dodecane							X
1120-21-4	Undecane							X
1120-71-4	1,3-Propane sultone	X					X	X
117-81-7	Bis(2-ethylhexyl) phthalate	X			X	X	X	X
117-84-0	Di-n-octylphthalate					X		X
118-74-1	Hexachlorobenzene	X			X	X	X	X
119-90-4	3,3'-Dimethoxybenzidine				X		X	X
120-12-7	Anthracene					X		X
120-82-1	1,2,4-Trichlorobenzene		X			X	X	X
120-83-2	2,4-Dichlorophenol					X		X
121-14-2	2,4-Dinitrotoluene	X			X	X	X	X
122-39-4	N,N-Diphenylamine					X		X
122-66-7	1,2-Diphenylhydrazine	X			X		X	X
123-33-1	Maleic hydrazide					X		X
123-38-6	Propionaldehyde		X			X		X
123-72-8	Butanal							X
123-91-1	1,4-Dioxan	X	X		X	X	X	X
124-18-5	Decane							X

Table 1-4 Available Chronic Toxicity Data

CAS#	Constituent	Unit Risk Factor (URF)	Inhalation Reference Concentration (RfC)	Oral Reference Dose (RfD)	Oral Slope Factor (CSF)	Percent Gastrointestinal Absorption	Dermal Reference Dose	Dermal Slope Factor
124-38-9	Carbon dioxide							
124-48-1	Chlorodibromomethane	X			X	X	X	X
126-73-8	Tributyl phosphate					X	X	X
126-98-7	2-Methyl-2-propenenitrile		X			X		X
127-18-4	1,1,2,2-Tetrachloroethene	X	X		X	X	X	X
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol					X	X	X
129-00-0	Pyrene					X		X
131-11-3	Dimethyl Phthalate							X
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol					X		X
132-64-9	Dibenzofuran					X		X
133-06-2	Captan	X			X	X	X	X
1330-20-7	Xylenes (mixed isomers)		X			X		X
1336-36-3	Polychlorinated biphenyls	X				surr.	X	X
134-32-7	alpha-Naphthylamine							X
135-98-8	sec-Butylbenzene					X		X
141-78-6	Acetic acid ethyl ester		X			X		X
14265-44-2	Phosphate							X
145-73-3	Endothall					X		X
14797-55-8	Nitrate					X		X
14797-65-0	Nitrite					X		X
14808-79-8	Sulfate							X
156-59-2	cis-1,2-Dichloroethene					X		X
156-60-5	1,2-trans-Dichloroethene		X			X		X
1634-04-4	Methyl tert-butyl ether	X	X				X	X
16887-00-6	Chloride							X
16984-48-8	Fluoride		X			X		X
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	X	X		X	X	X	X
18540-29-9	Chromium(VI)	X	X			X	X	X
189-55-9	Dibenzo[a,i]pyrene	X					X	X

Table 1-4 Available Chronic Toxicity Data

CAS#	Constituent	Unit Risk Factor (URF)	Inhalation Reference Concentration (RfC)	Oral Reference Dose (RfD)	Oral Slope Factor (CSF)	Percent Gastrointestinal Absorption	Dermal Reference Dose	Dermal Slope Factor
189-64-0	Dibenzo[a,h]pyrene	X					X	X
191-24-2	Benzo(g,h,i)perylene							X
191-30-0	Dibenzo(a,l)pyrene	X					X	X
192-65-4	Dibenzo[a,e]pyrene	X					X	X
192-97-2	Benzo(e)pyrene							X
193-39-5	Indeno(1,2,3-cd)pyrene	X					X	X
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	X	X		X	X	X	X
205-82-3	Benzo[j]fluoranthene	X					X	X
205-99-2	Benzo(b)fluoranthene	X					X	X
206-44-0	Fluoranthene					X		X
207-08-9	Benzo(k)fluoranthene	X					X	X
208-96-8	Acenaphthylene							X
218-01-9	Chrysene	X					X	X
224-42-0	Dibenz[a,j]acridine	X					X	X
2245-38-7	2,3,5-Trimethylnaphthalene							X
226-36-8	Dibenz[a,h]acridine	X					X	X
22967-92-6	Methyl mercury					X		X
23950-58-5	Pronamide					X		X
24959-67-9	Bromide							X
27154-33-2	Trichlorofluoroethane		surr.			surr.		X
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	X	X			X	X	X
319-84-6	alpha-BHC	X			X	X	X	X
319-85-7	beta-BHC	X			X		X	X
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	X	X			X	X	X
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	X	X			X	X	X
3268-87-9	Octachlorodibenzo(p)dioxin	X	X		X	X	X	X
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	X	X			X	X	X

Table 1-4 Available Chronic Toxicity Data

CAS#	Constituent	Unit Risk Factor (URF)	Inhalation Reference Concentration (RfC)	Oral Reference Dose (RfD)	Oral Slope Factor (CSF)	Percent Gastrointestinal Absorption	Dermal Reference Dose	Dermal Slope Factor
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	X	X			X	X	X
3697-24-3	5-Methylchrysene	X					X	X
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	X	X			X	X	X
39001-02-0	Octachlorodibenzofuran	X	X		X	X	X	X
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	X	X			X	X	X
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	X	X			X	X	X
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	X	X			X	X	X
4170-30-3	Crotonaldehyde (Propylene aldehyde)							X
41851-50-7	Chlorocyclopentadiene							X
460-19-5	Cyanogen (oxalonitrile)					X		X
4786-20-3	2-Butenenitrile							X
50-00-0	Formaldehyde	X	X			X		X
50-32-8	Benzo(a)pyrene	X			X		X	X
506-68-3	Cyanogen bromide (bromocyanide)					X		X
506-77-4	Cyanogen chloride					X		X
51-28-5	2,4-Dinitrophenol					X		X
51-79-6	Ethyl carbamate (urethane)	X					X	X
510-15-6	Chlorobenzilate	X			X	X	X	X
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran				X			X
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	X	X			X	X	X
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)					X		X
53-70-3	Dibenz[a,h]anthracene	X					X	X
532-27-4	2-Chloroacetophenone		X					X
534-52-1	4,6-Dinitro-o-cresol					X		X

Table 1-4 Available Chronic Toxicity Data

CAS#	Constituent	Unit Risk Factor (URF)	Inhalation Reference Concentration (RfC)	Oral Reference Dose (RfD)	Oral Slope Factor (CSF)	Percent Gastrointestinal Absorption	Dermal Reference Dose	Dermal Slope Factor
5385-75-1	Dibenzo(a,e)fluoranthene							X
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)					X		X
540-73-8	1,2-Dimethylhydrazine	X					X	X
540-84-1	2,2,4-Trimethylpentane							X
541-73-1	1,3-Dichlorobenzene					X		X
542-75-6	1,3-Dichloropropene	X	X		X	X	X	X
542-88-1	Bis(chloromethyl)ether	X			X		X	X
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	X	X			X	X	X
56-23-5	Carbon tetrachloride	X	X		X	X	X	X
56-49-5	3-Methylcholanthrene	X					X	X
56-55-3	Benzo(a)anthracene	X					X	X
57-12-5	Cyanide		X			X		X
57-24-9	Strychnine					X		X
57-74-9	Chlordane	X	X		X	X	X	X
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	X	X		X	X	X	X
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	X	X		X	X	X	X
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	X	X			X	X	X
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	X	X			X	X	X
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	X	X		X	X	X	X
58-89-9	gamma-BHC (Lindane)	X			X	X	X	X
58-90-2	2,3,4,6-Tetrachlorophenol					X		X
581-42-0	2,6-Dimethylnaphthalene							X
584-84-9	2,4-Toluene diisocyanate	X	X		surr.	surr.	surr.	X
589-38-8	3-Hexanone							X
59-50-7	4-Chloro-3-methylphenol					X		X
59-89-2	N-Nitrosomorpholine	X					X	X
591-50-4	Benzene, iodo-							X

Table 1-4 Available Chronic Toxicity Data

CAS#	Constituent	Unit Risk Factor (URF)	Inhalation Reference Concentration (RfC)	Oral Reference Dose (RfD)	Oral Slope Factor (CSF)	Percent Gastrointestinal Absorption	Dermal Reference Dose	Dermal Slope Factor
591-78-6	2-Hexanone		X			X		X
593-60-2	Bromoethene (Vinyl bromide)	X	X					X
593-74-8	Dimethyl Mercury		surr.			surr.		X
60-11-7	Dimethyl aminoazobenzene	X					X	X
60-29-7	Ethyl ether					X		X
60-35-5	Acetamide	X					X	X
602-87-9	5-Nitroacenaphthene	X				surr.	X	X
606-20-2	2,6-Dinitrotoluene				X	X	X	X
608-93-5	Pentachlorobenzene					X		X
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	X	X			X	X	X
61626-71-9	Dichloropentadiene							X
62-50-0	Ethyl methanesulfonate							X
62-53-3	Aniline	X	X		X	X	X	X
62-75-9	N-Nitroso-N,N-dimethylamine	X	X		X	X	X	X
621-64-7	N-Nitroso-di-n-propylamine	X			X		X	X
624-83-9	Methyl isocyanate	surr.	X		surr.	surr.	surr.	X
628-73-9	Hexanenitrile							X
630-08-0	Carbon monoxide							X
630-20-6	1,1,1,2-Tetrachloroethane	X			X	X	X	X
64-18-6	Formic acid (methanoic acid)		X			X		X
65-85-0	Benzoic acid					X		X
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	X	X			X	X	X
67-56-1	Methyl alcohol		X			X		X
67-63-0	2-Propyl alcohol		X			X		X
67-64-1	2-Propanone (Acetone)		X			X		X
67-66-3	Chloroform	X	X		X	X	X	X
67-72-1	Hexachloroethane	X	X		X	X	X	X
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	X	X			X	X	X
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	X	X			X	X	X

Table 1-4 Available Chronic Toxicity Data

CAS#	Constituent	Unit Risk Factor (URF)	Inhalation Reference Concentration (RfC)	Oral Reference Dose (RfD)	Oral Slope Factor (CSF)	Percent Gastrointestinal Absorption	Dermal Reference Dose	Dermal Slope Factor
70-30-4	Hexachlorophene					X		X
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	X	X			X	X	X
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	X	X			X	X	X
71-36-3	n-Butyl alcohol					X		X
71-43-2	Benzene	X	X		X	X	X	X
71-55-6	1,1,1-Trichloroethane		X			X		X
72-43-5	Methoxychlor					X		X
72-55-9	4,4-DDE	X	X		X		X	X
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	X	X			X	X	X
74-83-9	Bromomethane		X			X		X
74-87-3	Chloromethane	X	X		X		X	X
74-88-4	Iodomethane							X
74-95-3	Methylene bromide		X			X		X
74-97-5	Bromochloromethane		X					X
7429-90-5	Aluminum		X			X		X
7439-89-6	Iron					X		X
7439-92-1	Lead	X	X				X	X
7439-93-2	Lithium					X		X
7439-95-4	Magnesium							X
7439-96-5	Manganese		X			X		X
7439-97-6	Mercury		X					X
7439-98-7	Molybdenum					X		X
7440-02-0	Nickel	X	X			X		X
7440-16-6	Rhodium							X
7440-22-4	Silver					X		X
7440-23-5	Sodium							X
7440-24-6	Strontium (total)					X		X
7440-25-7	Tantalum							X
7440-28-0	Thallium					X		X
7440-31-5	Tin					X		X

Table 1-4 Available Chronic Toxicity Data

CAS#	Constituent	Unit Risk Factor (URF)	Inhalation Reference Concentration (RfC)	Oral Reference Dose (RfD)	Oral Slope Factor (CSF)	Percent Gastrointestinal Absorption	Dermal Reference Dose	Dermal Slope Factor
7440-33-7	Tungsten					X		X
7440-36-0	Antimony					X		X
7440-38-2	Arsenic	X	X		X	X	X	X
7440-39-3	Barium		X			X		X
7440-41-7	Beryllium	X	X		X	X		X
7440-43-9	Cadmium	X	X			X	X	X
7440-47-3	Chromium					X		X
7440-48-4	Cobalt	X	X			X		X
7440-50-8	Copper					X		X
7440-61-1	Uranium		X			X		X
7440-62-2	Vanadium		X			X		X
7440-65-5	Yttrium							X
7440-66-6	Zinc					X		X
7440-67-7	Zirconium					X		X
7446-09-5	Sulfur dioxide							X
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	X	X			X	X	X
7487-94-7	Mercuric chloride (HgCl2)		X			X		X
75-00-3	Chloroethane		X			X		X
75-01-4	1-Chloroethene	X	X		X	X	X	X
75-02-5	Fluoroethene (vinyl fluoride)							X
75-05-8	Acetonitrile		X					X
75-07-0	Acetaldehyde	X	X			X		X
75-09-2	Dichloromethane (Methylene Chloride)	X	X		X	X	X	X
75-15-0	Carbon disulfide		X			X		X
75-21-8	Ethylene oxide (Oxirane)	X	X		X		X	X
75-25-2	Bromoform	X			X	X	X	X
75-27-4	Bromodichloromethane	X			X	X	X	X
75-29-6	2-Chloropropane		X					X
75-34-3	1,1-Dichloroethane	X	X			X	X	X
75-35-4	1,1-Dichloroethene	X	X		X	X		X

Table 1-4 Available Chronic Toxicity Data

CAS#	Constituent	Unit Risk Factor (URF)	Inhalation Reference Concentration (RfC)	Oral Reference Dose (RfD)	Oral Slope Factor (CSF)	Percent Gastrointestinal Absorption	Dermal Reference Dose	Dermal Slope Factor
75-44-5	Phosgene (hydrogen phosphide)		X			surr.		X
75-45-6	Chlorodifluoromethane		X					X
75-50-3	Trimethylamine							X
75-69-4	Trichlorofluoromethane		X			X		X
75-71-8	Dichlorodifluoromethane		X			X		X
76-01-7	Pentachloroethane					X	X	X
76-13-1	1,2,2-Trichlorotrifluoroethane		X			X		X
76-44-8	Heptachlor	X			X	X	X	X
764-41-0	1,4-Dichloro-2-butene	X						X
7647-01-0	Hydrogen chloride		X					X
765-34-4	Glycidylaldehyde		X			X		X
7664-39-3	Hydrogen Fluoride		X			X		X
7664-41-7	Ammonia/Ammonium		X			X		X
77-47-4	Hexachlorocyclopentadiene		X			X		X
77-78-1	Dimethyl sulfate							X
7704-34-9	Total Sulfur (thermodynamically stable)							X
7723-14-0	Phosphorus					X		X
7782-41-4	Fluorine gas F2		X			X		X
7782-49-2	Selenium		X			X		X
7782-50-5	Chlorine		X			X		X
78-83-1	2-Methylpropyl alcohol					X		X
78-87-5	1,2-Dichloropropane	X	X		X	X	X	X
78-93-3	2-Butanone		X			X		X
79-00-5	1,1,2-Trichloroethane	X	X		X	X	X	X
79-01-6	1,1,2-Trichloroethylene	X	X			X	X	X
79-10-7	2-Propenoic acid		X			X		X
79-34-5	1,1,2,2-Tetrachloroethane	X			X	X	X	X
79-46-9	2-Nitropropane	X	X					X
80-62-6	Methyl methacrylate		X			X		X
82-68-8	Pentachloronitrobenzene (PCNB)				X	X	X	X

Table 1-4 Available Chronic Toxicity Data

CAS#	Constituent	Unit Risk Factor (URF)	Inhalation Reference Concentration (RfC)	Oral Reference Dose (RfD)	Oral Slope Factor (CSF)	Percent Gastrointestinal Absorption	Dermal Reference Dose	Dermal Slope Factor
822-06-0	Hexamethylene-1,5-diisocyanate		X			X		X
823-40-5	Toluene-2,6-diamine					X		X
83-32-9	Acenaphthene					X		X
832-69-9	1-Methylphenanthrene							X
84-66-2	Diethyl phthalate					X		X
84-74-2	Di-n-butylphthalate					X		X
85-01-8	Phenanthrene							X
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)		X			X		X
85-68-7	Butylbenzylphthalate					X	X	X
86-73-7	Fluorene					X		X
87-61-6	1,2,3-Trichlorobenzene					X		X
87-68-3	Hexachlorobutadiene	X			X	X	X	X
87-86-5	Pentachlorophenol	X			X	X	X	X
88-06-2	2,4,6-Trichlorophenol	X			X	X	X	X
88-74-4	o-Nitroaniline (2-nitroaniline)		X			X		X
88-75-5	2-Nitrophenol							X
90-04-0	o-Anisidine	X					X	X
90-12-0	1-Methylnaphthalene					X	X	X
91-20-3	Naphthalene	X	X			X		X
91-22-5	Quinoline				X		X	X
91-57-6	2-Methylnaphthalene					X		X
91-58-7	2-Chloronaphthalene					X		X
91-94-1	3,3'-Dichlorobenzidine	X			X		X	X
92-52-4	1,1`-Biphenyl		X			X	X	X
924-16-3	N-Nitroso-di-n-Buetylamine	X			X		X	X
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	X					X	X
94-75-7	2,4-D					X		X
95-48-7	o-Cresol		X			X		X
95-49-8	o-Chlorotoluene					X		X
95-50-1	1,2-Dichlorobenzene		X			X		X

Table 1-4 Available Chronic Toxicity Data

CAS#	Constituent	Unit Risk Factor (URF)	Inhalation Reference Concentration (RfC)	Oral Reference Dose (RfD)	Oral Slope Factor (CSF)	Percent Gastrointestinal Absorption	Dermal Reference Dose	Dermal Slope Factor
95-53-4	o-Toluidine	X			X		X	X
95-57-8	2-Chlorophenol					X		X
95-63-6	1,2,4-Trimethyl benzene		X			X		X
95-94-3	1,2,4,5-Tetrachlorobenzene					X		X
95-95-4	2,4,5-Trichlorophenol					X		X
96-12-8	1,2-Dibromo-3-chloropropane	X	X		X	X	X	X
96-18-4	1,2,3-Trichloropropane		X		X	X	X	X
96-45-7	Ethylene thiourea	X			X	X	X	X
97-63-2	Ethyl methacrylate		X			X		X
98-01-1	Furfural		X			X		X
98-06-6	tert-Butyl benzene					X		X
98-07-7	Benzotrichloride				X		X	X
98-82-8	Cumene		X			X		X
98-83-9	Methyl styrene (mixed isomers)		X			X		X
98-86-2	Acetophenone					X		X
98-95-3	Nitrobenzene	X	X			X		X
99-35-4	1,3,5-Trinitrobenzene					X		X
99-65-0	1,3-Dinitrobenzene					X		X
99-87-6	p-Cymene					X		X
N/A	Particulate matter							

Table 1-5 identifies available radiological constituent slope factors used in quantifying the excess cancer risk to human receptors from exposure to radionuclides.

Table 1-5 Available Radiological Slope Factors

CAS#	Constituent	Food Ingestion Slope Factor	Soil Ingestion Slope Factor	Water Ingestion Slope Factor	Inhalation Slope Factor	External Exposure to Soil Slope Factor	External Exposure to Air Slope Factor
10028-17-8	Tritium	X	X	X	X	X	X
10045-97-3	Cesium-137	X	X	X	X	X	X
10098-91-6	Yttrium-90	X	X	X	X	X	X
10098-97-2	Strontium-90	X	X	X	X	X	X
10198-40-0	Cobalt-60	X	X	X	X	X	X
13966-29-5	Uranium-234	X	X	X	X	X	X
13967-48-1	Ruthenium-106					X	X
13967-70-9	Cesium-134	X	X	X	X	X	X
13968-55-3	Uranium-233	X	X	X	X	X	X
13981-15-2	Curium-244	X	X	X	X	X	X
13981-16-3	Plutonium-238	X	X	X	X	X	X
13981-37-8	Nickel-63				X		X
13982-10-0	Plutonium-242	X	X	X	X	X	X
13982-63-3	Radium-226	X	X	X	X	X	X
13982-70-2	Uranium-236	X	X	X	X	X	X
13994-20-2	Neptunium-237	X	X	X	X	X	X
14119-32-5	Plutonium-241	X	X	X	X	X	X
14119-33-6	Plutonium-240	X	X	X	X	X	X
14133-76-7	Technetium-99	X	X	X	X	X	X
14158-29-3	Uranium-232	X	X	X	X	X	X
14234-35-6	Antimony-125	X	X	X	X	X	X
14331-85-2	Protactinium-231	X	X	X	X	X	X
14336-70-0	Nickel-59				X		X
14391-16-3	Europium-155	X	X	X	X	X	X
14596-10-2	Americium-241	X	X	X	X	X	X
14683-23-9	Europium-152	X	X	X	X	X	X
14762-75-5	Carbon-14	X	X	X	X	X	X
14952-40-0	Actinium-227	X	X	X	X	X	X
14993-75-0	Americium-243	X	X	X	X	X	X
15046-84-1	Iodine-129	X	X	X	X	X	X

Table 1-5 Available Radiological Slope Factors

CAS#	Constituent	Food Ingestion Slope Factor	Soil Ingestion Slope Factor	Water Ingestion Slope Factor	Inhalation Slope Factor	External Exposure to Soil Slope Factor	External Exposure to Air Slope Factor
15117-48-3	Plutonium-239	X	X	X	X	X	X
15117-96-1	Uranium-235	X	X	X	X	X	X
15262-20-1	Radium-228	X	X	X	X	X	X
15510-73-3	Curium-242	X	X	X	X	X	X
15585-10-1	Europium-154	X	X	X	X	X	X
15594-54-4	Thorium-229	X	X	X	X	X	X
15715-94-3	Samarium-151	X	X	X	X	X	X
15751-77-6	Zirconium-93	X	X	X	X	X	X
15757-87-6	Curium-243	X	X	X	X	X	X
15758-45-9	Selenium-79	X	X	X	X	X	X
15832-50-5	Tin-126	X	X	X	X	X	X
378253-40-8	Barium-137m					X	X
378253-44-2	Cadmium-113m	X	X	X	X	X	X
378782-82-2	Niobium-93m	X	X	X	X	X	X
7440-29-1	Thorium-232	X	X	X	X	X	X
7440-61-1R	Uranium-238	X	X	X	X	X	X

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2 Constituent Physical Parameters

Table 2-1 provides data on constituent molar weight, vapor pressure, and solubility. These constituent parameters are used to compute various quantities in the environmental risk assessment such as Henry's Law Constants, vapor partitioning coefficient, and exposure concentrations in a sweat lodge when references are unavailable. Blank entries in the table indicate where data are not available.

Table 2-1 Molar Weight, Vapor Pressure and Solubility

CAS Registry Number	Constituent Name	Molecular Weight	Units for Molecular Weight	Reference	Vapor Pressure	Units for Vapor Pressure	Reference	Solubility	Units for Solubility	Reference
100-02-7	p-Nitrophenol	1.39E+02	g/mol	[1]	5.39E-08	atm	[3]	1.16E+04	mg/L	[6]
100-21-0	Phthalic acid	1.66E+02	g/mol	[1]	1.21E-08	atm	[12]	1.50E+01	mg/L	[7]
100-25-4	1,4-Dinitrobenzene	1.68E+02	g/mol	[1]	3.43E-08	atm	[10]	6.90E+01	mg/L	[7]
100-40-3	4-Ethenylcyclohexene	1.08E+02	g/mol	[1]	2.07E-02	atm	[4]	5.00E+01	mg/L	[7]
100-41-4	Ethyl benzene	1.06E+02	g/mol	[1]	1.26E-02	atm	[3]	1.70E+02	mg/L	[6]
100-42-5	Styrene	1.04E+02	g/mol	[1]	8.03E-03	atm	[3]	3.10E+02	mg/L	[6]
100-44-7	Benzyl chloride	1.27E+02	g/mol	[1]	1.72E-03	atm	[3]	5.25E+02	mg/L	[6]
100-47-0	Benzonitrile	1.03E+02	g/mol	[1]	1.01E-03	atm	[3]	2.00E+03	mg/L	[13]
100-51-6	Benzyl alcohol	1.08E+02	g/mol	[1]	8.24E-05	atm	[3]	4.00E+04	mg/L	[6]
100-52-7	Benzaldehyde	1.06E+02	g/mol	[1]	1.67E-03	atm	[3]	3.00E+03	mg/L	[6]
10028-15-6	Ozone	4.80E+01	g/mol	[1]	3.14E-11	atm	[11]	7.44E+05	mg/L	[13]
10028-17-8	Tritium	1.80E+01	g/mol	[1]	3.13E-02		[10]	1.00E+06		[13]
10045-97-3	Cesium-137	1.37E+02	g/mol	[2]				.		
10061-01-5	cis-1,3-Dichloropropene	1.11E+02	g/mol	[1]	3.46E-02	atm	[11]	2.18E+03	mg/L	[13]
10061-02-6	trans-1,3-Dichloropropene	1.11E+02	g/mol	[1]	4.47E-02	atm	[11]	2.80E+03	mg/L	[13]
10098-91-6	Yttrium-90	8.99E+01	g/mol	[2]				.		
10098-97-2	Strontium-90	8.99E+01	g/mol	[2]				.		
101-55-3	4-Bromophenylphenyl ether	2.49E+02	g/mol	[1]	1.97E-06	atm	[3]	4.60E+00	mg/L	[6]
101-77-9	4,4-Methylenedianiline	1.98E+02	g/mol	[1]	1.82E-02	atm	[12]	1.00E+03	mg/L	[7]
10102-44-0	Nitrogen dioxide	4.60E+01	g/mol	[1]	1.18E+00	atm	[11]	1.71E+05	mg/L	[13]
10198-40-0	Cobalt-60	5.99E+01	g/mol	[2]				.		
103-33-3	Azobenzene	1.82E+02	g/mol	[1]	4.75E-07	atm	[10]	6.40E+00	mg/L	[7]

Table 2-1 Molar Weight, Vapor Pressure and Solubility

CAS Registry Number	Constituent Name	Molecular Weight	Units for Molecular Weight	Reference	Vapor Pressure	Units for Vapor Pressure	Reference	Solubility	Units for Solubility	Reference
103-65-1	n-Propyl benzene (Isocumene)	1.20E+02	g/mol	[1]	4.50E-03	atm	[12]	5.22E+01	mg/L	[7]
104-51-8	n-Butylbenzene	1.34E+02	g/mol	[1]	1.39E-03	atm	[10]	1.18E+01	mg/L	[7]
104-76-7	2-Ethyl-1-hexanol	1.30E+02	g/mol	[1]	1.79E-04	atm	[4]	8.80E+02	mg/L	[7]
105-67-9	2,4-Dimethylphenol	1.22E+02	g/mol	[1]	1.29E-04	atm	[3]	7.90E+03	mg/L	[6]
10595-95-6	n-Nitrosomethylethylamine	8.81E+01	g/mol	[1]	2.75E-03	atm	[8]	3.00E+05	mg/L	[7]
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	1.27E+02	g/mol	[1]	3.54E-03	atm	[12]	1.06E+02	mg/L	[7]
106-44-5	p-Cresol (4-methyl phenol)	1.08E+02	g/mol	[1]	1.45E-04	atm	[3]	2.20E+04	mg/L	[6]
106-46-7	1,4-Dichlorobenzene	1.47E+02	g/mol	[1]	1.32E-03	atm	[3]	7.90E+01	mg/L	[6]
106-47-8	p-Chloroaniline	1.28E+02	g/mol	[1]	1.62E-05	atm	[3]	5.30E+03	mg/L	[6]
106-49-0	p-Toluidine	1.07E+02	g/mol	[1]	3.76E-04	atm	[10]	6.50E+03	mg/L	[7]
106-51-4	Quinone	1.08E+02	g/mol	[1]	1.18E-04	atm	[12]	1.11E+04	mg/L	[7]
106-88-7	1,2-Epoxybutane	7.21E+01	g/mol	[1]	2.37E-01	atm	[12]	9.50E+04	mg/L	[7]
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	9.25E+01	g/mol	[1]	2.16E-02	atm	[3]	6.59E+04	mg/L	[6]
106-93-4	Ethylene dibromide	1.88E+02	g/mol	[1]	1.71E-02	atm	[3]	4.00E+03	mg/L	[6]
106-99-0	1,3-Butadiene	5.41E+01	g/mol	[1]	2.78E+00	atm	[12]	7.35E+02	mg/L	[7]
107-02-8	Acrolein	5.61E+01	g/mol	[1]	3.55E-01	atm	[3]	2.10E+05	mg/L	[6]
107-05-1	3-Chloropropene	7.65E+01	g/mol	[1]	4.84E-01	atm	[12]	3.37E+03	mg/L	[7]
107-06-2	1,2-Dichloroethane	9.90E+01	g/mol	[1]	1.04E-01	atm	[3]	8.50E+03	mg/L	[6]
107-12-0	Propionitrile	5.51E+01	g/mol	[1]	6.24E-02	atm	[12]	1.03E+05	mg/L	[7]
107-13-1	Acrylonitrile	5.31E+01	g/mol	[1]	1.43E-01	atm	[3]	7.40E+04	mg/L	[6]
107-19-7	Propargyl alcohol	5.61E+01	g/mol	[1]	2.05E-02	atm	[12]	1.00E+06	mg/L	[7]
107-21-1	Ethylene glycol (1,2-ethanediol)	6.21E+01	g/mol	[1]	1.21E-04	atm	[12]	1.00E+06	mg/L	[7]
107-98-2	Propylene glycol monomethyl ether	9.01E+01	g/mol	[1]	1.64E-02	atm	[12]	1.00E+06	mg/L	[7]
108-05-4	Acetic acid vinyl ester	8.61E+01	g/mol	[1]	1.18E-01	atm	[3]	2.00E+04	mg/L	[6]
108-10-1	4-Methyl-2-pentanone	1.00E+02	g/mol	[1]	2.63E-02	atm	[3]	1.90E+04	mg/L	[6]

Table 2-1 Molar Weight, Vapor Pressure and Solubility

CAS Registry Number	Constituent Name	Molecular Weight	Units for Molecular Weight	Reference	Vapor Pressure	Units for Vapor Pressure	Reference	Solubility	Units for Solubility	Reference
108-39-4	m-Cresol	1.08E+02	g/mol	[1]	1.82E-04	atm	[3]	2.27E+04	mg/L	[6]
108-60-1	bis (2-Chloroisopropyl)ether	1.71E+02	g/mol	[1]	7.37E-04	atm	[12]	1.70E+03	mg/L	[7]
108-67-8	1,3,5-Trimethylbenzene	1.20E+02	g/mol	[1]	3.26E-03	atm	[10]	4.82E+01	mg/L	[13]
108-86-1	Bromobenzene (Phenyl bromide)	1.57E+02	g/mol	[1]	5.50E-03	atm	[10]	4.46E+02	mg/L	[7]
108-87-2	Methylcyclohexane	9.82E+01	g/mol	[1]	6.05E-02	atm	[10]	1.40E+01	mg/L	[7]
108-88-3	Toluene	9.21E+01	g/mol	[1]	3.68E-02	atm	[3]	5.30E+02	mg/L	[6]
108-90-7	Chlorobenzene	1.13E+02	g/mol	[1]	1.58E-02	atm	[3]	4.70E+02	mg/L	[6]
108-94-1	Cyclohexanone	9.81E+01	g/mol	[1]	5.70E-03	atm	[12]	2.50E+04	mg/L	[7]
108-95-2	Phenol	9.41E+01	g/mol	[1]	3.68E-04	atm	[3]	8.30E+04	mg/L	[6]
109-74-0	n-Butanenitrile	6.91E+01	g/mol	[1]	2.57E-02	atm	[4]	3.30E+04	mg/L	[7]
109-75-1	3-Butenenitrile	6.71E+01	g/mol	[1]	2.43E-02	atm	[10]	3.37E+04	mg/L	[13]
109-77-3	Malononitrile	6.61E+01	g/mol	[1]	2.63E-04	atm	[10]	1.33E+05	mg/L	[7]
109-86-4	2-Methoxyethanol	7.61E+01	g/mol	[1]	1.25E-02	atm	[12]	1.00E+06	mg/L	[7]
109-99-9	Tetrahydrofuran	7.21E+01	g/mol	[1]	2.13E-01	atm	[3]	1.00E+06	mg/L	[13]
110-00-9	Furan	6.81E+01	g/mol	[1]	7.89E-01	atm	[5]	1.00E+04	mg/L	[7]
110-54-3	n-Hexane	8.62E+01	g/mol	[1]	1.99E-01	atm	[11]	9.50E+00	mg/L	[13]
110-59-8	Pentanenitrile	8.31E+01	g/mol	[1]	9.61E-03	atm	[4]	7.75E+03	mg/L	[13]
110-80-5	2-Ethoxyethanol	9.01E+01	g/mol	[1]	6.99E-03	atm	[12]	1.00E+06	mg/L	[7]
110-82-7	Cyclohexane	8.42E+01	g/mol	[1]	1.28E-01	atm	[12]	5.50E+01	mg/L	[7]
110-83-8	Cyclohexene	8.21E+01	g/mol	[1]	1.17E-01	atm	[10]	2.13E+02	mg/L	[7]
110-86-1	Pyridine	7.91E+01	g/mol	[1]	2.74E-02	atm	[3]	1.00E+06	mg/L	[13]
111-15-9	Ethylene glycol monoethyl ether acetate	1.32E+02	g/mol	[1]	3.08E-03	atm	[12]	2.47E+05	mg/L	[7]
111-44-4	Bis(2-chloroethyl)ether	1.43E+02	g/mol	[1]	2.04E-03	atm	[3]	1.72E+04	mg/L	[6]
111-65-9	n-Octane	1.14E+02	g/mol	[1]	1.86E-02	atm	[10]	6.60E-01	mg/L	[7]
111-76-2	2-Butoxyethanol	1.18E+02	g/mol	[1]	1.16E-03	atm	[12]	1.00E+06	mg/L	[7]
111-84-2	n-Nonane	1.28E+02	g/mol	[1]	5.86E-03	atm	[11]	2.20E-01	mg/L	[13]

Table 2-1 Molar Weight, Vapor Pressure and Solubility

CAS Registry Number	Constituent Name	Molecular Weight	Units for Molecular Weight	Reference	Vapor Pressure	Units for Vapor Pressure	Reference	Solubility	Units for Solubility	Reference
111-91-1	Bis(2-chloroethoxy)methane	1.73E+02	g/mol	[1]	1.74E-04	atm	[12]	7.80E+03	mg/L	[7]
112-30-1	1-Decanol	1.58E+02	g/mol	[1]	1.12E-05	atm	[10]	3.70E+01	mg/L	[13]
112-31-2	Decanal	1.56E+02	g/mol	[1]	1.36E-04	atm	[10]	6.08E+01	mg/L	[13]
112-40-3	Dodecane	1.70E+02	g/mol	[1]	1.78E-04	atm	[10]	3.70E-03	mg/L	[13]
1120-21-4	Undecane	1.56E+02	g/mol	[1]	5.42E-04	atm	[10]	4.40E-03	mg/L	[13]
1120-71-4	1,3-Propane sultone	1.22E+02	g/mol	[1]	3.55E-04	atm	[11]	1.71E+05	mg/L	[13]
117-81-7	Bis(2-ethylhexyl) phthalate	3.91E+02	g/mol	[1]	8.95E-11	atm	[3]	3.40E-01	mg/L	[6]
117-84-0	Di-n-octylphthalate	3.91E+02	g/mol	[1]	3.42E-09	atm	[3]	2.00E-02	mg/L	[6]
118-74-1	Hexachlorobenzene	2.85E+02	g/mol	[1]	2.37E-08	atm	[3]	6.20E-06	mg/L	[6]
119-90-4	3,3'-Dimethoxybenzidine	2.44E+02	g/mol	[1]	2.79E-10	atm	[3]	6.00E+01	mg/L	[6]
120-12-7	Anthracene	1.78E+02	g/mol	[1]	3.55E-09	atm	[3]	4.30E-02	mg/L	[6]
120-82-1	1,2,4-Trichlorobenzene	1.81E+02	g/mol	[1]	5.66E-04	atm	[3]	3.50E+01	mg/L	[6]
120-83-2	2,4-Dichlorophenol	1.63E+02	g/mol	[1]	8.82E-05	atm	[3]	4.50E+03	mg/L	[6]
121-14-2	2,4-Dinitrotoluene	1.82E+02	g/mol	[1]	1.93E-07	atm	[3]	2.70E+02	mg/L	[6]
122-39-4	N,N-Diphenylamine	1.69E+02	g/mol	[1]	1.06E-06	atm	[12]	5.30E+01	mg/L	[7]
122-66-7	1,2-Diphenylhydrazine	1.84E+02	g/mol	[1]	5.66E-07	atm	[3]	6.80E+01	mg/L	[6]
123-33-1	Maleic hydrazide	1.12E+02	g/mol	[1]	3.64E-09	atm	[10]	4.51E+03	mg/L	[7]
123-38-6	Propionaldehyde	5.81E+01	g/mol	[1]	4.17E-01	atm	[12]	3.06E+05	mg/L	[7]
123-72-8	Butanal	7.21E+01	g/mol	[1]	1.47E-01	atm	[4]	7.10E+04	mg/L	[7]
123-91-1	1,4-Dioxan	8.81E+01	g/mol	[1]	5.01E-02	atm	[3]	1.00E+06	mg/L	[13]
124-18-5	Decane	1.42E+02	g/mol	[1]	1.88E-03	atm	[10]	5.20E-02	mg/L	[13]
124-38-9	Carbon dioxide	4.40E+01	g/mol	[1]	6.36E+01	atm	[5]	1.48E+03	mg/L	[7]
124-48-1	Chlorodibromomethane	2.08E+02	g/mol	[1]	6.45E-03	atm	[3]	2.60E+03	mg/L	[6]
126-73-8	Tributyl phosphate	2.66E+02	g/mol	[1]	1.49E-06	atm	[12]	2.80E+02	mg/L	[7]
126-98-7	2-Methyl-2-propenenitrile	6.71E+01	g/mol	[1]	9.37E-02	atm	[3]	2.54E+04	mg/L	[6]
127-18-4	1,1,2,2-Tetrachloroethene	1.66E+02	g/mol	[1]	2.50E-02	atm	[3]	2.00E+02	mg/L	[6]

Table 2-1 Molar Weight, Vapor Pressure and Solubility

CAS Registry Number	Constituent Name	Molecular Weight	Units for Molecular Weight	Reference	Vapor Pressure	Units for Vapor Pressure	Reference	Solubility	Units for Solubility	Reference
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	2.20E+02	g/mol	[1]	6.79E-06	atm	[11]	6.00E-01	mg/L	[13]
129-00-0	Pyrene	2.02E+02	g/mol	[1]	6.05E-09	atm	[3]	1.40E+00	mg/L	[6]
131-11-3	Dimethyl Phthalate	1.94E+02	g/mol	[1]	2.17E-06	atm	[3]	4.00E+03	mg/L	[6]
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	2.66E+02	g/mol	[1]	5.51E-11	atm	[10]	1.50E+01	mg/L	[7]
132-64-9	Dibenzofuran	1.68E+02	g/mol	[1]	3.26E-06	atm	[10]	3.10E+00	mg/L	[7]
133-06-2	Captan	3.01E+02	g/mol	[1]	1.18E-10	atm	[12]	5.10E+00	mg/L	[7]
1330-20-7	Xylenes (mixed isomers)	1.06E+02	g/mol	[1]	8.70E-03	atm	[5]	1.06E+02	mg/L	[7]
1336-36-3	Polychlorinated biphenyls	3.61E+02	g/mol	[1]	6.50E-07	atm	[12]	7.00E-01	mg/L	[7]
134-32-7	alpha-Naphthylamine	1.43E+02	g/mol	[1]	5.50E-06	atm	[11]	1.70E+03	mg/L	[13]
135-98-8	sec-Butylbenzene	1.34E+02	g/mol	[1]	2.30E-03	atm	[10]	1.76E+01	mg/L	[7]
13966-29-5	Uranium-234	2.34E+02	g/mol	[2]				.		
13967-48-1	Ruthenium-106	1.06E+02	g/mol	[2]				.		
13967-70-9	Cesium-134	1.34E+02	g/mol	[2]				.		
13968-55-3	Uranium-233	2.33E+02	g/mol	[2]				.		
13981-15-2	Curium-244	2.44E+02	g/mol	[2]				.		
13981-16-3	Plutonium-238	2.38E+02	g/mol	[2]				.		
13981-37-8	Nickel-63	6.29E+01	g/mol	[1]				.		
13982-10-0	Plutonium-242	2.42E+02	g/mol	[2]				.		
13982-63-3	Radium-226	2.26E+02	g/mol	[2]				.		
13982-70-2	Uranium-236	2.36E+02	g/mol	[2]				.		
13994-20-2	Neptunium-237	2.37E+02	g/mol	[2]				.		
141-78-6	Acetic acid ethyl ester	8.81E+01	g/mol	[1]	1.23E-01	atm	[12]	8.00E+04	mg/L	[7]
14119-32-5	Plutonium-241	2.41E+02	g/mol	[2]				.		
14119-33-6	Plutonium-240	2.40E+02	g/mol	[2]				.		
14133-76-7	Technetium-99	9.89E+01	g/mol	[2]				.		
14158-29-3	Uranium-232	2.32E+02	g/mol	[2]				.		
14234-35-6	Antimony-125	1.25E+02	g/mol	[2]				.		
14265-44-2	Phosphate	9.50E+01	g/mol	[1]				.		

Table 2-1 Molar Weight, Vapor Pressure and Solubility

CAS Registry Number	Constituent Name	Molecular Weight	Units for Molecular Weight	Reference	Vapor Pressure	Units for Vapor Pressure	Reference	Solubility	Units for Solubility	Reference
14331-85-2	Protactinium-231	2.31E+02	g/mol	[2]				.		
14336-70-0	Nickel-59	5.89E+01	g/mol	[2]				.		
14391-16-3	Europium-155	1.55E+02	g/mol	[2]				.		
145-73-3	Endothall	1.86E+02	g/mol	[1]	3.08E-07	atm	[10]	1.00E+05	mg/L	[7]
14596-10-2	Americium-241	2.41E+02	g/mol	[2]				.		
14683-23-9	Europium-152	1.52E+02	g/mol	[2]				.		
14762-75-5	Carbon-14	1.39E+01	g/mol	[2]				.		
14797-55-8	Nitrate	6.20E+01	g/mol	[1]	8.30E-02	atm	[14]	9.09E+04	mg/L	[15]
14797-65-0	Nitrite	4.60E+01	g/mol	[1]				.		
14808-79-8	Sulfate	6.41E+01	g/mol	[1]	7.80E-08	atm	[5]	1.00E+06	mg/L	[7]
14952-40-0	Actinium-227	2.27E+02	g/mol	[2]				.		
14993-75-0	Americium-243	2.43E+02	g/mol	[2]				.		
15046-84-1	Iodine-129	1.29E+02	g/mol	[2]	3.07E-04	atm	[10]	.		
15117-48-3	Plutonium-239	2.39E+02	g/mol	[2]				.		
15117-96-1	Uranium-235	2.35E+02	g/mol	[2]				.		
15262-20-1	Radium-228	2.28E+02	g/mol	[2]				.		
15510-73-3	Curium-242	2.42E+02	g/mol	[2]				.		
15585-10-1	Europium-154	1.54E+02	g/mol	[2]				.		
15594-54-4	Thorium-229	2.29E+02	g/mol	[2]				.		
156-59-2	cis-1,2-Dichloroethene	9.69E+01	g/mol	[1]	2.63E-01	atm	[3]	3.50E+03	mg/L	[6]
156-60-5	1,2-trans-Dichloroethene	9.69E+01	g/mol	[1]	4.34E-01	atm	[3]	6.30E+03	mg/L	[6]
15715-94-3	Samarium-151	1.51E+02	g/mol	[2]				.		
15751-77-6	Zirconium-93	9.29E+01	g/mol	[2]				.		
15757-87-6	Curium-243	2.43E+02	g/mol	[2]				.		
15758-45-9	Selenium-79	7.89E+01	g/mol	[2]				.		
15832-50-5	Tin-126	1.26E+02	g/mol	[2]				.		
1634-04-4	Methyl tert-butyl ether	8.81E+01	g/mol	[1]	3.29E-01	atm	[12]	5.10E+04	mg/L	[7]
16887-00-6	Chloride	3.55E+01	g/mol	[1]	5.47E-11	atm	[11]	4.24E+04	mg/L	[13]
16984-48-8	Fluoride	1.90E+01	g/mol	[1]				1.69E+00	mg/L	[7]

Table 2-1 Molar Weight, Vapor Pressure and Solubility

CAS Registry Number	Constituent Name	Molecular Weight	Units for Molecular Weight	Reference	Vapor Pressure	Units for Vapor Pressure	Reference	Solubility	Units for Solubility	Reference
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	3.22E+02	g/mol	[1]	1.97E-12	atm	[3]	1.93E-05	mg/L	[6]
18540-29-9	Chromium(VI)	5.19E+01	g/mol	[1]	0.00E+00	atm	[3]	0.00E+00	mg/L	[6]
189-55-9	Dibenzo[a,i]pyrene	3.02E+02	g/mol	[1]	2.34E-14	atm	[11]	5.54E-04	mg/L	[13]
189-64-0	Dibenzo[a,h]pyrene	3.02E+02	g/mol	[1]	8.43E-15	atm	[11]	3.50E-05	mg/L	[13]
191-24-2	Benzo(g,h,i)perylene	2.76E+02	g/mol	[1]	3.29E-01	atm	[12]	2.60E-04	mg/L	[7]
191-30-0	Dibenzo(a,l)pyrene	3.02E+02	g/mol	[1]	6.32E-13	atm	[11]	3.60E-04	mg/L	[13]
192-65-4	Dibenzo[a,e]pyrene	3.02E+02	g/mol	[1]	9.25E-14	atm	[11]	8.02E-05	mg/L	[13]
192-97-2	Benzo(e)pyrene	2.52E+02	g/mol	[1]	7.50E-12	atm	[10]	6.30E-03	mg/L	[7]
193-39-5	Indeno(1,2,3-cd)pyrene	2.76E+02	g/mol	[1]	1.32E-13	atm	[3]	2.20E-05	mg/L	[6]
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	3.91E+02	g/mol	[1]	6.45E-14	atm	[3]	4.40E-06	mg/L	[6]
205-82-3	Benzo[j]fluoranthene	2.52E+02	g/mol	[1]	3.45E-11	atm	[11]	2.50E-03	mg/L	[13]
205-99-2	Benzo(b)fluoranthene	2.52E+02	g/mol	[1]	6.58E-10	atm	[3]	1.50E-03	mg/L	[6]
206-44-0	Fluoranthene	2.02E+02	g/mol	[1]	1.03E-08	atm	[3]	2.10E-01	mg/L	[6]
207-08-9	Benzo(k)fluoranthene	2.52E+02	g/mol	[1]	2.63E-12	atm	[3]	8.00E-04	mg/L	[6]
208-96-8	Acenaphthylene	1.52E+02	g/mol	[1]	1.20E-06	atm	[12]	1.61E+01	mg/L	[7]
218-01-9	Chrysene	2.28E+02	g/mol	[1]	8.16E-12	atm	[3]	6.30E-03	mg/L	[6]
224-42-0	Dibenz[a,j]acridine	2.79E+02	g/mol	[1]	2.43E-12	atm	[11]	1.80E-02	mg/L	[13]
2245-38-7	2,3,5-Trimethylnaphthalene	1.70E+02	g/mol	[1]	3.32E-06	atm	[10]	4.78E+00	mg/L	[13]
226-36-8	Dibenz[a,h]acridine	2.79E+02	g/mol	[1]	2.43E-12	atm	[10]	1.59E-01	mg/L	[7]
22967-92-6	Methyl mercury	2.16E+02	g/mol	[1]	1.12E-05	atm	[1]	0.00E+00	mg/L	[6]
23950-58-5	Pronamide	2.56E+02	g/mol	[1]	5.72E-10	atm	[10]	1.50E+01	mg/L	[13]
24959-67-9	Bromide	7.99E+01	g/mol	[1]	1.04E-11	atm	[11]	3.80E+04	mg/L	[13]
27154-33-2	Trichlorofluoroethane	1.51E+02	g/mol	[1]	7.51E-02	atm	[15]	1.10E+03	mg/L	[12]

Table 2-1 Molar Weight, Vapor Pressure and Solubility

CAS Registry Number	Constituent Name	Molecular Weight	Units for Molecular Weight	Reference	Vapor Pressure	Units for Vapor Pressure	Reference	Solubility	Units for Solubility	Reference
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	3.26E+02	g/mol	[1]	1.18E-08	atm	[2]	1.34E-02	mg/L	[7]
319-84-6	alpha-BHC	2.91E+02	g/mol	[1]	5.92E-08	atm	[3]	2.00E+00	mg/L	[6]
319-85-7	beta-BHC	2.91E+02	g/mol	[1]	6.18E-10	atm	[3]	2.40E-01	mg/L	[6]
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	2.92E+02	g/mol	[1]	2.16E-08	atm	[2]	5.69E-04	mg/L	[7]
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	3.26E+02	g/mol	[1]	8.59E-09	atm	[2]	3.40E-03	mg/L	[7]
3268-87-9	Octachlorodibenzo(p)dioxin	4.60E+02	g/mol	[1]	1.09E-15	atm	[3]	7.40E-08	mg/L	[6]
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	3.61E+02	g/mol	[1]	8.59E-09	atm	[2]	5.10E-04	mg/L	[13]
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	4.25E+02	g/mol	[1]	7.37E-15	atm	[3]	2.40E-06	mg/L	[6]
3697-24-3	5-Methylchrysene	2.42E+02	g/mol	[1]	7.28E-09	atm	[11]	6.20E-02	mg/L	[13]
378253-40-8	Barium-137m	1.37E+02	g/mol	[2]				.		
378253-44-2	Cadmium-113m	1.13E+02	g/mol	[2]				.		
378782-82-2	Niobium-93m	9.29E+01	g/mol	[2]				.		
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	3.61E+02	g/mol	[1]	2.12E-09	atm	[2]	5.33E-03	mg/L	[7]
39001-02-0	Octachlorodibenzofuran	4.44E+02	g/mol	[1]	4.93E-15	atm	[3]	1.16E-06	mg/L	[6]
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	3.91E+02	g/mol	[1]	5.00E-14	atm	[3]	4.42E-06	mg/L	[6]
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	3.95E+02	g/mol	[1]	1.71E-10	atm	[11]	7.53E-04	mg/L	[13]
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	3.56E+02	g/mol	[1]	5.79E-13	atm	[3]	1.18E-04	mg/L	[6]

Table 2-1 Molar Weight, Vapor Pressure and Solubility

CAS Registry Number	Constituent Name	Molecular Weight	Units for Molecular Weight	Reference	Vapor Pressure	Units for Vapor Pressure	Reference	Solubility	Units for Solubility	Reference
4170-30-3	Crotonaldehyde (Propylene aldehyde)	7.01E+01	g/mol	[1]	3.95E-02	atm	[11]	1.81E+05	mg/L	[13]
41851-50-7	Chlorocyclopentadiene	1.01E+02	g/mol	[1]	2.12E-09	atm	[10]	9.49E+02	mg/L	[8]
460-19-5	Cyanogen (oxalonitrile)	5.20E+01	g/mol	[1]	5.66E+00	atm	[12]	9.49E+03	mg/L	[8]
4786-20-3	2-Butenenitrile	6.71E+01	g/mol	[1]	4.21E-02	atm	[10]	2.50E+04	mg/L	[13]
50-00-0	Formaldehyde	3.00E+01	g/mol	[1]	6.89E+00	atm	[3]	5.50E+05	mg/L	[6]
50-32-8	Benzo(a)pyrene	2.52E+02	g/mol	[1]	7.24E-12	atm	[3]	1.60E-03	mg/L	[6]
506-68-3	Cyanogen bromide (bromocyanide)	1.06E+02	g/mol	[1]	1.60E-01	atm	[11]	1.08E+05	mg/L	[13]
506-77-4	Cyanogen chloride	6.15E+01	g/mol	[1]	1.61E+00	atm	[11]	6.00E+04	mg/L	[13]
51-28-5	2,4-Dinitrophenol	1.84E+02	g/mol	[1]	6.71E-06	atm	[3]	2.79E+03	mg/L	[6]
51-79-6	Ethyl carbamate (urethane)	8.91E+01	g/mol	[1]	3.45E-04	atm	[12]	4.80E+05	mg/L	[7]
510-15-6	Chlorobenzilate	3.25E+02	g/mol	[1]	2.89E-09	atm	[3]	1.30E+01	mg/L	[6]
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	3.06E+02	g/mol	[1]	1.97E-11	atm	[3]	4.19E-04	mg/L	[6]
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	3.61E+02	g/mol	[1]	7.64E-10	atm	[2]	2.23E-03	mg/L	[7]
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	1.68E+02	g/mol	[1]	5.99E-08	atm	[10]	1.33E+02	mg/L	[7]
53-70-3	Dibenz[a,h]anthracene	2.78E+02	g/mol	[1]	1.32E-13	atm	[3]	2.50E-03	mg/L	[6]
532-27-4	2-Chloroacetophenone	1.55E+02	g/mol	[1]	7.11E-06	atm	[12]	1.10E+03	mg/L	[8]
534-52-1	4,6-Dinitro-o-cresol	1.98E+02	g/mol	[1]	1.39E-07	atm	[12]	1.98E+02	mg/L	[7]
5385-75-1	Dibenzo(a,e)fluoranthene	3.02E+02	g/mol	[1]	9.64E-14	atm	[11]	2.12E-04	mg/L	[13]
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	9.69E+01	g/mol	[1]	2.64E-01	atm	[12]	3.50E+03	mg/L	[7]
540-73-8	1,2-Dimethylhydrazine	6.01E+01	g/mol	[1]	9.20E-02	atm	[12]	1.00E+06	mg/L	[7]

Table 2-1 Molar Weight, Vapor Pressure and Solubility

CAS Registry Number	Constituent Name	Molecular Weight	Units for Molecular Weight	Reference	Vapor Pressure	Units for Vapor Pressure	Reference	Solubility	Units for Solubility	Reference
540-84-1	2,2,4-Trimethylpentane	1.14E+02	g/mol	[1]	6.49E-02	atm	[11]	2.44E+00	mg/L	[13]
541-73-1	1,3-Dichlorobenzene	1.47E+02	g/mol	[1]	2.83E-03	atm	[3]	1.34E+02	mg/L	[6]
542-75-6	1,3-Dichloropropene	1.11E+02	g/mol	[1]	4.47E-02	atm	[3]	2.80E+03	mg/L	[6]
542-88-1	Bis(chloromethyl)ether	1.15E+02	g/mol	[1]	3.87E-02	atm	[12]	2.20E+04	mg/L	[7]
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	4.09E+02	g/mol	[1]	4.04E-13	atm	[3]	1.40E-06	mg/L	[6]
56-23-5	Carbon tetrachloride	1.54E+02	g/mol	[1]	1.58E-01	atm	[3]	7.90E+02	mg/L	[6]
56-49-5	3-Methylcholanthrene	2.68E+02	g/mol	[1]	2.63E-11	atm	[12]	2.90E-03	mg/L	[7]
56-55-3	Benzo(a)anthracene	2.28E+02	g/mol	[1]	1.45E-10	atm	[3]	9.40E-03	mg/L	[6]
57-12-5	Cyanide	2.60E+01	g/mol	[1]	4.08E-01	atm	[3]	9.54E+04	mg/L	[13]
57-24-9	Strychnine	3.34E+02	g/mol	[1]	1.24E-14	atm	[3]	1.60E+02	mg/L	[6]
57-74-9	Chlordane	4.10E+02	g/mol	[1]	1.28E-08	atm	[11]	5.60E-02	mg/L	[13]
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	3.40E+02	g/mol	[1]	3.42E-12	atm	[3]	2.36E-04	mg/L	[6]
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	3.40E+02	g/mol	[1]	2.23E-12	atm	[3]	2.40E-04	mg/L	[6]
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	3.75E+02	g/mol	[1]	2.89E-13	atm	[3]	1.77E-05	mg/L	[6]
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	3.26E+02	g/mol	[1]	3.89E-10	atm	[2]	1.34E-02	mg/L	[9]
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	3.91E+02	g/mol	[1]	4.73E-14	atm	[3]	4.40E-06	mg/L	[6]
58-89-9	gamma-BHC (Lindane)	2.91E+02	g/mol	[1]	2.07E-01	atm	[12]	7.30E+00	mg/L	[7]
58-90-2	2,3,4,6-Tetrachlorophenol	2.32E+02	g/mol	[1]	1.89E-06	atm	[3]	1.00E+02	mg/L	[6]
581-42-0	2,6-Dimethylnaphthalene	1.56E+02	g/mol	[1]	5.67E-03	atm	[10]	2.00E+00	mg/L	[13]

Table 2-1 Molar Weight, Vapor Pressure and Solubility

CAS Registry Number	Constituent Name	Molecular Weight	Units for Molecular Weight	Reference	Vapor Pressure	Units for Vapor Pressure	Reference	Solubility	Units for Solubility	Reference
584-84-9	2,4-Toluene diisocyanate	1.58E+02	g/mol	[1]	1.05E-05	atm	[11]	3.56E+01	mg/L	[13]
589-38-8	3-Hexanone	1.00E+02	g/mol	[1]	1.83E-02	atm	[11]	1.47E+04	mg/L	[13]
59-50-7	4-Chloro-3-methylphenol	1.43E+02	g/mol	[1]	6.58E-05	atm	[10]	3.83E+03	mg/L	[13]
59-89-2	N-Nitrosomorpholine	1.16E+02	g/mol	[1]	4.74E-05	atm	[12]	1.00E+06	mg/L	[7]
591-50-4	Benzene, iodo-	2.04E+02	g/mol	[1]	1.39E-03	atm	[10]	3.40E+02	mg/L	[13]
591-78-6	2-Hexanone	1.00E+02	g/mol	[1]	1.53E-02	atm	[12]	1.72E+04	mg/L	[7]
593-60-2	Bromoethene (Vinyl bromide)	1.07E+02	g/mol	[1]	1.36E+00	atm	[12]	1.04E+04	mg/L	[8]
593-74-8	Dimethyl Mercury	2.31E+02	g/mol	[1]	8.19E-02	atm	[6]	1.00E+03	mg/L	[1]
60-11-7	Dimethyl aminoazobenzene	2.25E+02	g/mol	[1]	9.21E-11	atm	[11]	2.30E-01	mg/L	[13]
60-29-7	Ethyl ether	7.41E+01	g/mol	[1]	7.08E-01	atm	[12]	6.04E+04	mg/L	[7]
60-35-5	Acetamide	5.91E+01	g/mol	[1]	5.26E-05	atm	[12]	2.25E+06	mg/L	[7]
602-87-9	5-Nitroacenaphthene	1.99E+02	g/mol	[1]	3.49E-08	atm	[11]	9.10E-01	mg/L	[13]
606-20-2	2,6-Dinitrotoluene	1.82E+02	g/mol	[1]	7.46E-07	atm	[3]	1.82E+02	mg/L	[6]
608-93-5	Pentachlorobenzene	2.50E+02	g/mol	[1]	2.88E-06	atm	[3]	1.33E+00	mg/L	[6]
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	3.75E+02	g/mol	[1]	2.63E-13	atm	[3]	1.30E-05	mg/L	[6]
61626-71-9	Dichloropentadiene	1.43E+02	g/mol	[1]	2.12E-09	atm	[9]	9.49E+02	mg/L	[11]
62-50-0	Ethyl methanesulfonate	1.24E+02	g/mol	[1]	2.71E-04	atm	[3]	6.30E+03	mg/L	[6]
62-53-3	Aniline	9.31E+01	g/mol	[1]	6.45E-04	atm	[3]	3.60E+04	mg/L	[6]
62-75-9	N-Nitroso-N,N-dimethylamine	7.41E+01	g/mol	[1]	3.55E-03	atm	[11]	1.00E+06	mg/L	[13]
621-64-7	N-Nitroso-di-n-propylamine	1.30E+02	g/mol	[1]	1.71E-04	atm	[3]	9.89E+03	mg/L	[6]
624-83-9	Methyl isocyanate	5.71E+01	g/mol	[1]	4.58E-01	atm	[13]	2.92E+04	mg/L	[14]
628-73-9	Hexanenitrile	9.72E+01	g/mol	[1]	3.75E-03	atm	[4]	2.48E+03	mg/L	[13]
630-08-0	Carbon monoxide	2.80E+01	g/mol	[1]	2.04E+06	atm	[13]	2.29E+03	mg/L	[14]
630-20-6	1,1,1,2-Tetrachloroethane	1.68E+02	g/mol	[1]	1.58E-02	atm	[3]	1.10E+03	mg/L	[6]

Table 2-1 Molar Weight, Vapor Pressure and Solubility

CAS Registry Number	Constituent Name	Molecular Weight	Units for Molecular Weight	Reference	Vapor Pressure	Units for Vapor Pressure	Reference	Solubility	Units for Solubility	Reference
64-18-6	Formic acid (methanoic acid)	4.60E+01	g/mol	[1]	5.60E-02	atm	[3]	1.00E+06	mg/L	[13]
65-85-0	Benzoic acid	1.22E+02	g/mol	[1]	9.21E-07	atm	[10]	3.40E+03	mg/L	[13]
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	3.26E+02	g/mol	[1]	1.16E-09	atm	[2]	1.60E-02	mg/L	[7]
67-56-1	Methyl alcohol	3.20E+01	g/mol	[1]	1.66E-01	atm	[3]	1.00E+06	mg/L	[13]
67-63-0	2-Propyl alcohol	6.01E+01	g/mol	[1]	3.55E-03	atm	[12]	1.00E+06	mg/L	[8]
67-64-1	2-Propanone (Acetone)	5.81E+01	g/mol	[1]	3.03E-01	atm	[3]	1.00E+06	mg/L	[6]
67-66-3	Chloroform	1.19E+02	g/mol	[1]	2.63E-01	atm	[3]	7.90E+03	mg/L	[6]
67-72-1	Hexachloroethane	2.37E+02	g/mol	[1]	2.76E-04	atm	[3]	5.00E+01	mg/L	[6]
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	4.09E+02	g/mol	[1]	4.61E-14	atm	[3]	1.35E-06	mg/L	[6]
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	3.61E+02	g/mol	[1]	7.20E-11	atm	[2]	5.10E-04	mg/L	[10]
70-30-4	Hexachlorophene	4.07E+02	g/mol	[1]	1.97E-13	atm	[3]	1.40E+02	mg/L	[6]
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	2.92E+02	g/mol	[1]	1.03E-09	atm	[2]	1.34E-02	mg/L	[9]
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	3.75E+02	g/mol	[1]	3.16E-13	atm	[3]	8.25E-06	mg/L	[6]
71-36-3	n-Butyl alcohol	7.41E+01	g/mol	[1]	3.55E-03	atm	[12]	6.32E+04	mg/L	[7]
71-43-2	Benzene	7.81E+01	g/mol	[1]	1.25E-01	atm	[3]	1.80E+03	mg/L	[6]
71-55-6	1,1,1-Trichloroethane	1.33E+02	g/mol	[1]	1.58E-01	atm	[3]	1.30E+03	mg/L	[6]
72-43-5	Methoxychlor	3.46E+02	g/mol	[1]	7.89E-10	atm	[3]	4.50E-02	mg/L	[6]
72-55-9	4,4-DDE	3.18E+02	g/mol	[1]	7.89E-09	atm	[3]	1.20E-01	mg/L	[6]
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	3.75E+02	g/mol	[1]	3.68E-13	atm	[3]	1.30E-05	mg/L	[6]
74-83-9	Bromomethane	9.49E+01	g/mol	[1]	2.13E+00	atm	[3]	1.52E+04	mg/L	[6]
74-87-3	Chloromethane	5.05E+01	g/mol	[1]	5.66E+00	atm	[3]	5.33E+03	mg/L	[6]
74-88-4	Iodomethane	1.42E+02	g/mol	[1]	5.33E-01	atm	[12]	1.38E+04	mg/L	[7]

Table 2-1 Molar Weight, Vapor Pressure and Solubility

CAS Registry Number	Constituent Name	Molecular Weight	Units for Molecular Weight	Reference	Vapor Pressure	Units for Vapor Pressure	Reference	Solubility	Units for Solubility	Reference
74-95-3	Methylene bromide	1.74E+02	g/mol	[1]	5.84E-02	atm	[3]	1.19E+04	mg/L	[6]
74-97-5	Bromochloromethane	1.29E+02	g/mol	[1]	1.88E-01	atm	[10]	1.67E+04	mg/L	[7]
7429-90-5	Aluminum	2.70E+01	g/mol	[1]	0.00E+00	atm	[7]	0.00E+00	mg/L	[4]
7439-89-6	Iron	5.58E+01	g/mol	[1]	5.58E-12	atm	[5]	0.00E+00	mg/L	[2]
7439-92-1	Lead	2.07E+02	g/mol	[1]	3.97E-12	atm	[10]	9.58E+03	mg/L	[13]
7439-93-2	Lithium	6.94E+00	g/mol	[1]	0.00E+00	atm	[7]	0.00E+00	mg/L	[3]
7439-95-4	Magnesium	2.43E+01	g/mol	[1]	0.00E+00	atm	[7]	0.00E+00	mg/L	[5]
7439-96-5	Manganese	5.49E+01	g/mol	[1]	0.00E+00	atm	[7]	0.00E+00	mg/L	[3]
7439-97-6	Mercury	2.01E+02	g/mol	[1]	2.63E-06	atm	[3]	6.00E-02	mg/L	[13]
7439-98-7	Molybdenum	9.59E+01	g/mol	[1]	0.00E+00	atm	[7]	0.00E+00	mg/L	[4]
7440-02-0	Nickel	5.87E+01	g/mol	[1]	5.58E-12	atm	[10]	4.22E+05	mg/L	[13]
7440-16-6	Rhodium	1.03E+02	g/mol	[1]				.		
7440-22-4	Silver	1.08E+02	g/mol	[1]	5.58E-12	atm	[10]	7.05E+04	mg/L	[13]
7440-23-5	Sodium	2.30E+01	g/mol	[1]				0.00E+00	mg/L	[3]
7440-24-6	Strontium (total)	8.76E+01	g/mol	[1]	5.58E-12	atm	[11]	8.04E+04	mg/L	[13]
7440-25-7	Tantalum	1.81E+02	g/mol	[1]				.		
7440-28-0	Thallium	2.04E+02	g/mol	[1]	5.58E-12	atm	[10]	2.65E+04	mg/L	[13]
7440-29-1	Thorium-232	2.32E+02	g/mol	[1]				0.00E+00	mg/L	[4]
7440-31-5	Tin	1.19E+02	g/mol	[1]	0.00E+00	atm	[7]	0.00E+00	mg/L	[4]
7440-33-7	Tungsten	1.84E+02	g/mol	[1]	0.00E+00	atm	[7]	0.00E+00	mg/L	[4]
7440-36-0	Antimony	1.22E+02	g/mol	[1]	9.00E-01	atm	[10]	2.30E+04	mg/L	[13]
7440-38-2	Arsenic	3.99E+01	g/mol	[1]	3.30E-12	atm	[10]	3.47E+04	mg/L	[13]
7440-39-3	Barium	1.37E+02	g/mol	[1]	5.58E-12	atm	[10]	5.48E+04	mg/L	[13]
7440-41-7	Beryllium	9.01E+00	g/mol	[1]	5.58E-12	atm	[10]	1.49E+05	mg/L	[13]
7440-43-9	Cadmium	1.12E+02	g/mol	[1]	5.45E-12	atm	[10]	1.23E+05	mg/L	[13]
7440-47-3	Chromium	5.20E+01	g/mol	[1]	5.58E-12	atm	[10]	8.67E+04	mg/L	[13]
7440-48-4	Cobalt	5.89E+01	g/mol	[1]	0.00E+00	atm	[7]	0.00E+00	mg/L	[5]
7440-50-8	Copper	6.35E+01	g/mol	[1]	0.00E+00	atm	[7]	0.00E+00	mg/L	[5]
7440-61-1	Uranium	2.38E+02	g/mol	[1]	0.00E+00	atm	[7]	0.00E+00	mg/L	[4]
7440-61-1R	Uranium-238	2.38E+02	g/mol	[2]				.		
7440-62-2	Vanadium	5.09E+01	g/mol	[1]	0.00E+00	atm	[7]	0.00E+00	mg/L	[4]
7440-65-5	Yttrium	8.89E+01	g/mol	[1]				.		

Table 2-1 Molar Weight, Vapor Pressure and Solubility

CAS Registry Number	Constituent Name	Molecular Weight	Units for Molecular Weight	Reference	Vapor Pressure	Units for Vapor Pressure	Reference	Solubility	Units for Solubility	Reference
7440-66-6	Zinc	6.54E+01	g/mol	[1]	5.09E-12	atm	[10]	3.44E+05	mg/L	[13]
7440-67-7	Zirconium	9.12E+01	g/mol	[1]	0.00E+00	atm	[7]	0.00E+00	mg/L	[4]
7446-09-5	Sulfur dioxide	6.41E+01	g/mol	[1]	3.95E+00	atm	[11]	1.07E+05	mg/L	[13]
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	3.26E+02	g/mol	[1]	5.50E-10	atm	[2]	1.60E-02	mg/L	[7]
7487-94-7	Mercuric chloride (HgCl2)	2.71E+02	g/mol	[1]	1.20E-04	atm	[3]	6.90E+04	mg/L	[13]
75-00-3	Chloroethane	6.45E+01	g/mol	[1]	1.32E+00	atm	[3]	5.70E+03	mg/L	[6]
75-01-4	1-Chloroethene	6.25E+01	g/mol	[1]	3.95E+00	atm	[3]	8.80E+03	mg/L	[6]
75-02-5	Fluoroethene (vinyl fluoride)	4.60E+01	g/mol	[1]	2.61E+01	atm	[11]	1.29E+04	mg/L	[13]
75-05-8	Acetonitrile	4.11E+01	g/mol	[1]	1.20E-01	atm	[3]	7.40E+04	mg/L	[6]
75-07-0	Acetaldehyde	4.41E+01	g/mol	[1]	1.19E+00	atm	[3]	1.00E+06	mg/L	[13]
75-09-2	Dichloromethane (Methylene Chloride)	8.49E+01	g/mol	[1]	5.66E-01	atm	[3]	1.30E+04	mg/L	[6]
75-15-0	Carbon disulfide	7.61E+01	g/mol	[1]	4.74E-01	atm	[3]	1.20E+03	mg/L	[6]
75-21-8	Ethylene oxide (Oxirane)	4.41E+01	g/mol	[1]	1.73E+00	atm	[3]	1.00E+06	mg/L	[13]
75-25-2	Bromoform	2.53E+02	g/mol	[1]	7.25E-03	atm	[3]	3.10E+03	mg/L	[6]
75-27-4	Bromodichloromethane	1.64E+02	g/mol	[1]	6.58E-02	atm	[3]	6.70E+03	mg/L	[6]
75-29-6	2-Chloropropane	7.85E+01	g/mol	[1]	6.78E-01	atm	[10]	3.10E+03	mg/L	[7]
75-34-3	1,1-Dichloroethane	9.90E+01	g/mol	[1]	3.03E-01	atm	[3]	5.10E+03	mg/L	[6]
75-35-4	1,1-Dichloroethene	9.69E+01	g/mol	[1]	7.89E-01	atm	[3]	2.30E+03	mg/L	[6]
75-44-5	Phosgene (hydrogen phosphide)	9.89E+01	g/mol	[1]	1.87E+00	atm	[11]	5.94E+03	mg/L	[13]
75-45-6	Chlorodifluoromethane	8.65E+01	g/mol	[1]	9.54E+00	atm	[10]	2.77E+03	mg/L	[13]
75-50-3	Trimethylamine	5.91E+01	g/mol	[1]	2.11E+00	atm	[11]	8.90E+05	mg/L	[13]
75-69-4	Trichlorofluoromethane	1.37E+02	g/mol	[1]	1.05E+00	atm	[3]	1.10E+03	mg/L	[6]
75-71-8	Dichlorodifluoromethane	1.21E+02	g/mol	[1]	6.38E+00	atm	[3]	2.80E+02	mg/L	[6]
76-01-7	Pentachloroethane	2.02E+02	g/mol	[1]	4.61E-03	atm	[12]	4.80E+02	mg/L	[7]

Table 2-1 Molar Weight, Vapor Pressure and Solubility

CAS Registry Number	Constituent Name	Molecular Weight	Units for Molecular Weight	Reference	Vapor Pressure	Units for Vapor Pressure	Reference	Solubility	Units for Solubility	Reference
76-13-1	1,2,2-Trichlorotrifluoroethane	1.87E+02	g/mol	[1]	4.78E-01	atm	[12]	1.70E+02	mg/L	[7]
76-44-8	Heptachlor	3.73E+02	g/mol	[1]	5.26E-07	atm	[3]	1.80E-01	mg/L	[6]
764-41-0	1,4-Dichloro-2-butene	1.25E+02	g/mol	[1]	3.95E-03	atm	[10]	5.80E+02	mg/L	[7]
7647-01-0	Hydrogen chloride	3.65E+01	g/mol	[1]	4.66E+01	atm	[3]	7.20E+05	mg/L	[6]
765-34-4	Glycidylaldehyde	7.21E+01	g/mol	[1]	5.96E-02	atm	[12]	1.00E+06	mg/L	[7]
7664-39-3	Hydrogen Fluoride	2.00E+01	g/mol	[1]	1.21E+00	atm	[11]	1.00E+06	mg/L	[13]
7664-41-7	Ammonia/Ammonium	1.70E+01	g/mol	[1]	9.88E+00	atm	[12]	8.99E+05	mg/L	[8]
77-47-4	Hexachlorocyclopentadiene	2.73E+02	g/mol	[1]	7.89E-05	atm	[3]	1.80E+00	mg/L	[6]
77-78-1	Dimethyl sulfate	1.26E+02	g/mol	[1]	8.91E-04	atm	[12]	2.80E+04	mg/L	[7]
7704-34-9	Total Sulfur (thermodynamically stable)	3.21E+01	g/mol	[1]				.		
7723-14-0	Phosphorus	3.10E+01	g/mol	[1]	3.86E+01	atm	[5]	3.30E+00	mg/L	[7]
7782-41-4	Fluorine gas F2	3.80E+01	g/mol	[1]	2.66E+05	atm	[11]	1.69E+00	mg/L	[7]
7782-49-2	Selenium	7.90E+01	g/mol	[1]	1.87E-13	atm	[10]	2.06E+03	mg/L	[13]
7782-50-5	Chlorine	7.09E+01	g/mol	[1]	7.70E+00	atm	[3]	6.30E+03	mg/L	[13]
78-83-1	2-Methylpropyl alcohol	7.41E+01	g/mol	[1]	8.91E-04	atm	[12]	8.50E+04	mg/L	[7]
78-87-5	1,2-Dichloropropane	1.13E+02	g/mol	[1]	6.84E-02	atm	[3]	2.80E+03	mg/L	[6]
78-93-3	2-Butanone	7.21E+01	g/mol	[1]	1.25E-01	atm	[3]	2.20E+05	mg/L	[6]
79-00-5	1,1,2-Trichloroethane	1.33E+02	g/mol	[1]	3.03E-02	atm	[3]	4.40E+03	mg/L	[6]
79-01-6	1,1,2-Trichloroethylene	1.31E+02	g/mol	[1]	9.61E-02	atm	[3]	1.50E+03	mg/L	[6]
79-10-7	2-Propenoic acid	7.21E+01	g/mol	[1]	5.22E-03	atm	[12]	1.00E+06	mg/L	[7]
79-34-5	1,1,2,2-Tetrachloroethane	1.68E+02	g/mol	[1]	6.05E-03	atm	[3]	3.00E+03	mg/L	[6]
79-46-9	2-Nitropropane	8.91E+01	g/mol	[1]	2.26E-02	atm	[5]	1.70E+04	mg/L	[7]
80-62-6	Methyl methacrylate	1.00E+02	g/mol	[1]	5.07E-02	atm	[12]	1.50E+04	mg/L	[7]
82-68-8	Pentachloronitrobenzene (PCNB)	2.95E+02	g/mol	[1]	1.49E-07	atm	[3]	5.50E-01	mg/L	[6]

Table 2-1 Molar Weight, Vapor Pressure and Solubility

CAS Registry Number	Constituent Name	Molecular Weight	Units for Molecular Weight	Reference	Vapor Pressure	Units for Vapor Pressure	Reference	Solubility	Units for Solubility	Reference
822-06-0	Hexamethylene-1,5-diisocyanate	1.68E+02	g/mol	[1]	3.95E-05	atm	[12]	1.79E+02	mg/L	[8]
823-40-5	Toluene-2,6-diamine	1.22E+02	g/mol	[1]	3.24E-06	atm	[12]	1.38E+04	mg/L	[8]
83-32-9	Acenaphthene	1.54E+02	g/mol	[1]	3.29E-06	atm	[3]	3.60E+00	mg/L	[6]
832-69-9	1-Methylphenanthrene	1.92E+02	g/mol	[1]	1.97E-08	atm	[10]	2.69E-01	mg/L	[13]
84-66-2	Diethyl phthalate	2.22E+02	g/mol	[1]	2.11E-06	atm	[3]	1.10E+03	mg/L	[6]
84-74-2	Di-n-butylphthalate	2.78E+02	g/mol	[1]	9.61E-08	atm	[3]	1.10E+01	mg/L	[6]
85-01-8	Phenanthrene	1.78E+02	g/mol	[1]	1.45E-07	atm	[3]	1.10E+00	mg/L	[6]
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	1.48E+02	g/mol	[1]	6.80E-07	atm	[3]	6.20E+03	mg/L	[6]
85-68-7	Butylbenzylphthalate	3.12E+02	g/mol	[1]	1.09E-08	atm	[3]	2.70E+00	mg/L	[6]
86-73-7	Fluorene	1.66E+02	g/mol	[1]	8.29E-07	atm	[3]	2.00E+00	mg/L	[6]
87-61-6	1,2,3-Trichlorobenzene	1.81E+02	g/mol	[1]	2.76E-04	atm	[3]	1.80E+01	mg/L	[6]
87-68-3	Hexachlorobutadiene	2.61E+02	g/mol	[1]	2.89E-04	atm	[3]	3.20E+00	mg/L	[6]
87-86-5	Pentachlorophenol	2.66E+02	g/mol	[1]	4.21E-08	atm	[3]	2.00E+03	mg/L	[6]
88-06-2	2,4,6-Trichlorophenol	1.97E+02	g/mol	[1]	3.16E-05	atm	[3]	8.00E+02	mg/L	[6]
88-74-4	o-Nitroaniline (2-nitroaniline)	1.38E+02	g/mol	[1]	1.16E-06	atm	[3]	1.47E+03	mg/L	[6]
88-75-5	2-Nitrophenol	1.39E+02	g/mol	[1]	1.49E-04	atm	[3]	2.19E+03	mg/L	[6]
90-04-0	o-Anisidine	1.23E+02	g/mol	[1]	1.05E-04	atm	[12]	1.26E+04	mg/L	[13]
90-12-0	1-Methylnaphthalene	1.42E+02	g/mol	[1]	8.82E-05	atm	[5]	2.58E+01	mg/L	[7]
91-20-3	Naphthalene	1.28E+02	g/mol	[1]	1.12E-04	atm	[3]	3.10E+01	mg/L	[6]
91-22-5	Quinoline	1.29E+02	g/mol	[1]	7.89E-05	atm	[12]	6.11E+03	mg/L	[7]
91-57-6	2-Methylnaphthalene	1.42E+02	g/mol	[1]	7.24E-05	atm	[12]	2.46E+01	mg/L	[7]
91-58-7	2-Chloronaphthalene	1.63E+02	g/mol	[1]	1.05E-05	atm	[3]	1.17E+01	mg/L	[6]
91-94-1	3,3'-Dichlorobenzidine	2.53E+02	g/mol	[1]	4.88E-11	atm	[3]	3.10E+00	mg/L	[6]

Table 2-1 Molar Weight, Vapor Pressure and Solubility

CAS Registry Number	Constituent Name	Molecular Weight	Units for Molecular Weight	Reference	Vapor Pressure	Units for Vapor Pressure	Reference	Solubility	Units for Solubility	Reference
92-52-4	1,1`-Biphenyl	1.54E+02	g/mol	[1]	1.18E-05	atm	[12]	6.94E+00	mg/L	[7]
924-16-3	N-Nitroso-di-n-Buetylamine	1.58E+02	g/mol	[1]	3.95E-05	atm	[3]	1.27E+03	mg/L	[6]
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	1.62E+02	g/mol	[1]	9.29E-05	atm	[3]	8.11E+02	mg/L	[6]
94-75-7	2,4-D	2.21E+02	g/mol	[1]	1.09E-07	atm	[12]	6.77E+02	mg/L	[7]
95-48-7	o-Cresol	1.08E+02	g/mol	[1]	3.93E-04	atm	[3]	2.60E+04	mg/L	[6]
95-49-8	o-Chlorotoluene	1.27E+02	g/mol	[1]	4.51E-03	atm	[12]	3.74E+02	mg/L	[7]
95-50-1	1,2-Dichlorobenzene	1.47E+02	g/mol	[1]	1.79E-03	atm	[3]	1.56E+02	mg/L	[6]
95-53-4	o-Toluidine	1.07E+02	g/mol	[1]	4.21E-04	atm	[3]	1.66E+04	mg/L	[6]
95-57-8	2-Chlorophenol	1.29E+02	g/mol	[1]	3.08E-03	atm	[3]	2.20E+04	mg/L	[6]
95-63-6	1,2,4-Trimethyl benzene	1.20E+02	g/mol	[1]	2.76E-03	atm	[12]	5.70E+01	mg/L	[7]
95-94-3	1,2,4,5-Tetrachlorobenzene	2.16E+02	g/mol	[1]	7.11E-06	atm	[3]	5.90E-01	mg/L	[6]
95-95-4	2,4,5-Trichlorophenol	1.97E+02	g/mol	[1]	2.63E-05	atm	[3]	1.20E+03	mg/L	[6]
96-12-8	1,2-Dibromo-3-chloropropane	2.36E+02	g/mol	[1]	7.63E-04	atm	[3]	1.20E+03	mg/L	[6]
96-18-4	1,2,3-Trichloropropane	1.47E+02	g/mol	[1]	4.87E-03	atm	[3]	1.80E+03	mg/L	[6]
96-45-7	Ethylene thiourea	1.02E+02	g/mol	[1]	2.66E-09	atm	[12]	2.00E+04	mg/L	[7]
97-63-2	Ethyl methacrylate	1.14E+02	g/mol	[1]	2.71E-02	atm	[3]	3.67E+03	mg/L	[6]
98-01-1	Furfural	9.61E+01	g/mol	[1]	2.91E-03	atm	[12]	7.41E+04	mg/L	[7]
98-06-6	tert-Butyl benzene	1.34E+02	g/mol	[1]	2.89E-03	atm	[10]	2.95E+01	mg/L	[7]
98-07-7	Benzotrichloride	1.95E+02	g/mol	[1]	5.45E-04	atm	[12]	5.30E+01	mg/L	[7]
98-82-8	Cumene	1.20E+02	g/mol	[1]	5.92E-03	atm	[3]	6.10E+01	mg/L	[6]
98-83-9	Methyl styrene (mixed isomers)	1.18E+02	g/mol	[1]	2.50E-03	atm	[12]	1.16E+02	mg/L	[7]
98-86-2	Acetophenone	1.20E+02	g/mol	[1]	5.22E-04	atm	[3]	6.13E+03	mg/L	[6]
98-95-3	Nitrobenzene	1.23E+02	g/mol	[1]	3.22E-04	atm	[3]	2.09E+03	mg/L	[6]
99-35-4	1,3,5-Trinitrobenzene	2.13E+02	g/mol	[1]	8.42E-09	atm	[3]	2.80E+02	mg/L	[6]
99-65-0	1,3-Dinitrobenzene	1.68E+02	g/mol	[1]	1.18E-06	atm	[3]	8.60E+02	mg/L	[6]
99-87-6	p-Cymene	1.34E+02	g/mol	[1]	1.92E-03	atm	[12]	2.34E+01	mg/L	[7]

Reference	Reference (source) for Molecular Weight
[1]	ChemicaLogic, *Molecular Weight Calculator*, Copyright © 1996 ChemicaLogic Corporation.
[2]	LANL. 2002. *Map of the Nuclides, Los Alamos National Laboratory*, University of California, Los Alamos, NM (http://t2.lanl.gov/data/map.html, accessed April 2011).

Reference	Reference (source) for Vapor Pressure
[1]	EPA. 2001. *Water Quality Criterion for the Protection of Human Health: Methylmercury [Final]*, EPA-823-R-01-001, Office of Science and Technology, Office of Water, U.S. Environmental Protection Agency Washington, DC, January 2001. (units converted from mm-Hg to atm) (units converted from mm-Hg to atm)
[2]	EPA. 2003. *Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds*. NAS Review Draft. US Environmental Protection Agency, Office of Research and Development. Washington, D.C. EPA/600/P-00/001 Cb. December 2003 (refer to CCN 129507).
[3]	EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013).
[4]	EPA. 2012. *Estimation Programs Interface (EPI) Suite*, v 4.11, Copyright © 2000-2012, US Environmental Protection Agency, Office of Polution Prevention Toxics and Syracuse Research Corporation, Washington, DC (http://www.epa.gov/oppt/exposure/docs/episuite.htm, values in database).
[5]	EPA. 2012. *Estimation Programs Interface (EPI) Suite*, v 4.11, Copyright © 2000-2012, US Environmental Protection Agency, Office of Polution Prevention Toxics and Syracuse Research Corporation, Washington, DC (http://www.epa.gov/oppt/exposure/docs/episuite.htm, values in database). (units converted from mm-Hg to atm)
[6]	ESFA. 2008. "Opinion of the Scientific Panel on Contaminants in the Food chain on a Request from the European Commission on Mercury as Undesirable Substance in Feed," *The EFSA Journal* (2008) 654, 1-74., European Food Safety Authority, February 2008 (units converted from mm-Hg to atm). (units converted from mm-Hg to atm)
[7]	NIOSH. 2007. *Pocket Guide to Chemical Hazards*, Publication No. 2005-149, National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services, Centers for Disease Control and Prevention, Cincinnati, OH. (units converted from mm-Hg to atm)
[8]	ORNL. *The Risk Assessment Information System (RAIS) Database*. Copyright © 2013 Oak Ridge National Laboratory and The University of Tennessee, Oak Ridge, TN (http://rais.ornl.gov, accessed April 2014).
[9]	Surrogate value from Chlorocyclopentadiene.
[10]	Syracuse Research Corporation (SRC). *FatePointers Search Module*, Copyright © 2014 SRC, Inc., North Syracuse, NY (http://esc.syrres.com/fatepointer/search.asp).
[11]	Syracuse Research Corporation (SRC). *FatePointers Search Module*, Copyright © 2014 SRC, Inc., North Syracuse, NY (http://esc.syrres.com/fatepointer/search.asp). (units converted from mm-Hg to atm)
[12]	Syracuse Research Corporation (SRC). *FatePointers Search Module*, Copyright © 2014 SRC, Inc., North Syracuse, NY (http://esc.syrres.com/fatepointer/search.asp, refer to CCN 129507).
[13]	Syracuse Research Corporation (SRC). *FatePointers Search Module*, Copyright © 2014 SRC, Inc., North Syracuse, NY (http://esc.syrres.com/fatepointer/search.asp, value reported as <25 deg C). (units converted from mm-Hg to atm)
[14]	Syracuse Research Corporation (SRC). *FatePointers Search Module*, Copyright © 2014 SRC, Inc., North Syracuse, NY (http://esc.syrres.com/fatepointer/search.asp, values reported here are for nitric acid, CAS 7697-37-2). (units converted from mm-Hg to atm)

Reference	Reference (source) for Vapor Pressure
[15]	Yaws 1999, Yaws, C.L., *Chemical Properties Handbook*, Chapter 7 Table: "Vapor Pressure: Organic Compounds", McGraw-Hill (http://www.knovel.com/knovel2) (refer to CCN 129507).

Reference	Reference (source) for Solubility
[1]	Committee on the Toxicological Effects of Methylmercury, Board on Environmental Studies and Toxicology, Commission on Life Sciences, and National Research Council. 2000. *Toxicological Effects of Methylmercury*, National Academy Press, Washington, DC
[2]	Dean JA (ed.). 1999. *Lange's Handbook of Chemistry (15th Edition)*, ISBN 0-07-016384-7,. McGraw-Hill, New York, NY (Table 3.2 Physical Constants of Inorganic Compounds).
[3]	Dean JA (ed.). 1999. *Lange's Handbook of Chemistry (15th Edition)*, ISBN 0-07-016384-7,. McGraw-Hill, New York, NY (Table 3.2 Physical Constants of Inorganic Compounds, assigned a water solubility value of 0 because the chemical reacts in water and/or decomposes.).
[4]	Dean JA (ed.). 1999. *Lange's Handbook of Chemistry (15th Edition)*, ISBN 0-07-016384-7,. McGraw-Hill, New York, NY (Table 3.2 Physical Constants of Inorganic Compounds, assigned a water solubility value of 0 because the solubility in other solvents was provided, but the description did not mention that the chemical is soluble in water.).
[5]	Dean JA (ed.). 1999. *Lange's Handbook of Chemistry (15th Edition)*, ISBN 0-07-016384-7,. McGraw-Hill, New York, NY (Table 3.2 Physical Constants of Inorganic Compounds, insoluble, therefore, a value of 0 was given.).
[6]	EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013).
[7]	EPA. 2012. *Estimation Programs Interface (EPI) Suite*, v 4.11, Copyright © 2000-2012, US Environmental Protection Agency, Office of Polution Prevention Toxics and Syracuse Research Corporation, Washington, DC (http://www.epa.gov/oppt/exposure/docs/episuite.htm, values in database).
[8]	ORNL. *The Risk Assessment Information System (RAIS) Database*. Copyright © 2013 Oak Ridge National Laboratory and The University of Tennessee, Oak Ridge, TN (http://rais.ornl.gov, accessed April 2014).
[9]	Surrogate value from 2,3',4,4',5-Pentachlorobiphenyl (PCB 118).
[10]	Surrogate value from 3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169).
[11]	Surrogate value from Chlorocyclopentadiene.
[12]	Surrogate value from Trichlorofluoromethane.
[13]	Syracuse Research Corporation (SRC). *FatePointers Search Module*, Copyright © 2014 SRC, Inc., North Syracuse, NY (http://esc.syrres.com/fatepointer/search.asp).
[14]	Syracuse Research Corporation (SRC). *FatePointers Search Module*, Copyright © 2014 SRC, Inc., North Syracuse, NY (http://esc.syrres.com/fatepointer/search.asp, value reported as <25 deg C).
[15]	Syracuse Research Corporation (SRC). *FatePointers Search Module*, Copyright © 2014 SRC, Inc., North Syracuse, NY (http://esc.syrres.com/fatepointer/search.asp, values reported here are for nitric acid, CAS 7697-37-2).

Table 2-2 provides data on constituent vapor partitioning coefficient, and the Henry's Law Constant. These constituent parameters are used to compute various quantities in the environmental risk assessment such as deposition, and losses due to volatilization and diffusion. Note that vapor partitioning coefficients that are less than 0.05 are set to zero (in the risk model) to represent particles in accordance with RAWP Section 5.2. Blank entries in the table indicate where data are not available.

Table 2-2 Vapor Partitioning Coefficient, Henry's Law Constant

CAS Registry Number	Constituent Name	Vapor Partitioning Coefficient (*Fv*)	Units for Vapor Partitioning Coefficient	Reference	Henry's Law Constant	Units for Henry's Law Constant	Reference
100-02-7	p-Nitrophenol	9.99E-01	unitless	[5]	4.15E-10	atm·m^3/mol	[2]
100-21-0	Phthalic acid	1.00E+00	unitless	[2]	3.89E-13	atm·m^3/mol	[6]
100-25-4	1,4-Dinitrobenzene	9.99E-01	unitless	[2]	3.69E-07	atm·m^3/mol	[6]
100-40-3	4-Ethenylcyclohexene	1.00E+00	unitless	[2]	4.48E-02	atm·m^3/mol	[3]
100-41-4	Ethyl benzene	1.00E+00	unitless	[5]	7.90E-03	atm·m^3/mol	[2]
100-42-5	Styrene	1.00E+00	unitless	[5]	2.70E-03	atm·m^3/mol	[2]
100-44-7	Benzyl chloride	1.00E+00	unitless	[5]	4.15E-04	atm·m^3/mol	[2]
100-47-0	Benzonitrile	1.00E+00	unitless	[5]	5.21E-05	atm·m^3/mol	[7]
100-51-6	Benzyl alcohol	1.00E+00	unitless	[5]	3.37E-07	atm·m^3/mol	[7]
100-52-7	Benzaldehyde	1.00E+00	unitless	[5]	2.67E-05	atm·m^3/mol	[7]
10028-15-6	Ozone	5.02E-02	unitless	[4]	2.03E-15	atm·m^3/mol	[1]
10028-17-8	Tritium	1.00E+00	unitless	[2]	5.64E-07	atm·m^3/mol	[1]
10045-97-3	Cesium-137	0.00E+00	unitless	[2]			
10061-01-5	cis-1,3-Dichloropropene	1.00E+00	unitless	[2]	2.71E-03	atm·m^3/mol	[7]
10061-02-6	trans-1,3-Dichloropropene	1.00E+00	unitless	[2]	8.71E-04	atm·m^3/mol	[7]
10098-91-6	Yttrium-90	0.00E+00	unitless	[2]			
10098-97-2	Strontium-90	0.00E+00	unitless	[2]			
101-55-3	4-Bromophenylphenyl ether	1.00E+00	unitless	[5]	1.17E-04	atm·m^3/mol	[2]
101-77-9	4,4-Methylenedianiline	1.00E+00	unitless	[2]	1.58E-11	atm·m^3/mol	[6]
10102-44-0	Nitrogen dioxide	1.00E+00	unitless	[2]	2.45E-02	atm·m^3/mol	[7]
10198-40-0	Cobalt-60	0.00E+00	unitless	[2]			
103-33-3	Azobenzene	1.00E+00	unitless	[2]	1.35E-05	atm·m^3/mol	[6]
103-65-1	n-Propyl benzene (Isocumene)	1.00E+00	unitless	[2]	1.05E-02	atm·m^3/mol	[3]
104-51-8	n-Butylbenzene	1.00E+00	unitless	[2]	1.59E-02	atm·m^3/mol	[3]
104-76-7	2-Ethyl-1-hexanol	1.00E+00	unitless	[2]	2.65E-05	atm·m^3/mol	[3]
105-67-9	2,4-Dimethylphenol	1.00E+00	unitless	[5]	2.00E-06	atm·m^3/mol	[2]

Table 2-2 Vapor Partitioning Coefficient, Henry's Law Constant

CAS Registry Number	Constituent Name	Vapor Partitioning Coefficient (*Fv*)	Units for Vapor Partitioning Coefficient	Reference	Henry's Law Constant	Units for Henry's Law Constant	Reference
10595-95-6	n-Nitrosomethylethylamine	1.00E+00	unitless	[2]	1.44E-06	atm·m^3/mol	[6]
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	1.00E+00	unitless	[2]	4.38E-03	atm·m^3/mol	[3]
106-44-5	p-Cresol (4-methyl phenol)	1.00E+00	unitless	[5]	7.90E-07	atm·m^3/mol	[2]
106-46-7	1,4-Dichlorobenzene	1.00E+00	unitless	[5]	2.40E-03	atm·m^3/mol	[2]
106-47-8	p-Chloroaniline	1.00E+00	unitless	[5]	1.16E-06	atm·m^3/mol	[7]
106-49-0	p-Toluidine	1.00E+00	unitless	[2]	2.02E-06	atm·m^3/mol	[6]
106-51-4	Quinone	1.00E+00	unitless	[2]	4.79E-04	atm·m^3/mol	[3]
106-88-7	1,2-Epoxybutane	1.00E+00	unitless	[2]	1.80E-04	atm·m^3/mol	[6]
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	1.00E+00	unitless	[5]	3.04E-05	atm·m^3/mol	[2]
106-93-4	Ethylene dibromide	1.00E+00	unitless	[5]	7.40E-04	atm·m^3/mol	[2]
106-99-0	1,3-Butadiene	1.00E+00	unitless	[2]	7.36E-02	atm·m^3/mol	[6]
107-02-8	Acrolein	1.00E+00	unitless	[5]	1.20E-04	atm·m^3/mol	[2]
107-05-1	3-Chloropropene	1.00E+00	unitless	[2]	1.10E-02	atm·m^3/mol	[6]
107-06-2	1,2-Dichloroethane	1.00E+00	unitless	[5]	9.80E-04	atm·m^3/mol	[2]
107-12-0	Propionitrile	1.00E+00	unitless	[2]	3.70E-05	atm·m^3/mol	[3]
107-13-1	Acrylonitrile	1.00E+00	unitless	[5]	1.03E-04	atm·m^3/mol	[2]
107-19-7	Propargyl alcohol	1.00E+00	unitless	[2]	1.15E-06	atm·m^3/mol	[6]
107-21-1	Ethylene glycol (1,2-ethanediol)	1.00E+00	unitless	[2]	5.99E-08	atm·m^3/mol	[6]
107-98-2	Propylene glycol monomethyl ether	1.00E+00	unitless	[2]	9.20E-07	atm·m^3/mol	[6]
108-05-4	Acetic acid vinyl ester	1.00E+00	unitless	[5]	5.10E-04	atm·m^3/mol	[2]
108-10-1	4-Methyl-2-pentanone	1.00E+00	unitless	[5]	1.40E-04	atm·m^3/mol	[2]
108-39-4	m-Cresol	1.00E+00	unitless	[5]	8.65E-07	atm·m^3/mol	[2]
108-60-1	bis (2-Chloroisopropyl)ether	1.00E+00	unitless	[2]	7.41E-05	atm·m^3/mol	[6]
108-67-8	1,3,5-Trimethylbenzene	1.00E+00	unitless	[5]	8.77E-03	atm·m^3/mol	[7]
108-86-1	Bromobenzene (Phenyl bromide)	1.00E+00	unitless	[2]	2.47E-03	atm·m^3/mol	[6]
108-87-2	Methylcyclohexane	1.00E+00	unitless	[2]	4.31E-01	atm·m^3/mol	[6]
108-88-3	Toluene	1.00E+00	unitless	[5]	6.60E-03	atm·m^3/mol	[2]
108-90-7	Chlorobenzene	1.00E+00	unitless	[5]	3.70E-03	atm·m^3/mol	[2]

Table 2-2 Vapor Partitioning Coefficient, Henry's Law Constant

CAS Registry Number	Constituent Name	Vapor Partitioning Coefficient (*Fv*)	Units for Vapor Partitioning Coefficient	Reference	Henry's Law Constant	Units for Henry's Law Constant	Reference
108-94-1	Cyclohexanone	1.00E+00	unitless	[2]	9.00E-06	atm·m^3/mol	[6]
108-95-2	Phenol	1.00E+00	unitless	[5]	4.00E-07	atm·m^3/mol	[2]
109-74-0	n-Butanenitrile	1.00E+00	unitless	[2]	5.23E-05	atm·m^3/mol	[3]
109-75-1	3-Butenenitrile	1.00E+00	unitless	[4]	4.01E-05	atm·m^3/mol	[7]
109-77-3	Malononitrile	1.00E+00	unitless	[2]	1.31E-07	atm·m^3/mol	[6]
109-86-4	2-Methoxyethanol	1.00E+00	unitless	[2]	3.30E-07	atm·m^3/mol	[6]
109-99-9	Tetrahydrofuran	1.00E+00	unitless	[5]	7.05E-05	atm·m^3/mol	[7]
110-00-9	Furan	1.00E+00	unitless	[4]	5.41E-03	atm·m^3/mol	[6]
110-54-3	n-Hexane	1.00E+00	unitless	[2]	1.80E+00	atm·m^3/mol	[7]
110-59-8	Pentanenitrile	1.00E+00	unitless	[2]	7.15E-05	atm·m^3/mol	[7]
110-80-5	2-Ethoxyethanol	1.00E+00	unitless	[2]	4.70E-07	atm·m^3/mol	[6]
110-82-7	Cyclohexane	1.00E+00	unitless	[2]	1.50E-01	atm·m^3/mol	[3]
110-83-8	Cyclohexene	1.00E+00	unitless	[2]	4.55E-02	atm·m^3/mol	[3]
110-86-1	Pyridine	1.00E+00	unitless	[5]	8.88E-06	atm·m^3/mol	[2]
111-15-9	Ethylene glycol monoethyl ether acetate	1.00E+00	unitless	[2]	3.20E-06	atm·m^3/mol	[6]
111-44-4	Bis(2-chloroethyl)ether	1.00E+00	unitless	[5]	1.80E-05	atm·m^3/mol	[2]
111-65-9	n-Octane	1.00E+00	unitless	[2]	3.21E+00	atm·m^3/mol	[3]
111-76-2	2-Butoxyethanol	1.00E+00	unitless	[2]	1.60E-06	atm·m^3/mol	[6]
111-84-2	n-Nonane	1.00E+00	unitless	[2]	3.40E+00	atm·m^3/mol	[7]
111-91-1	Bis(2-chloroethoxy)methane	9.97E-01	unitless	[2]	3.84E-06	atm·m^3/mol	[6]
112-30-1	1-Decanol	1.00E+00	unitless	[4]	3.20E-05	atm·m^3/mol	[7]
112-31-2	Decanal	1.00E+00	unitless	[4]	1.80E-03	atm·m^3/mol	[7]
112-40-3	Dodecane	1.00E+00	unitless	[4]	8.18E+00	atm·m^3/mol	[7]
1120-21-4	Undecane	1.00E+00	unitless	[4]	1.93E+00	atm·m^3/mol	[7]
1120-71-4	1,3-Propane sultone	1.00E+00	unitless	[2]	2.36E-06	atm·m^3/mol	[7]
117-81-7	Bis(2-ethylhexyl) phthalate	1.31E-01	unitless	[5]	1.00E-07	atm·m^3/mol	[2]
117-84-0	Di-n-octylphthalate	8.52E-01	unitless	[5]	6.70E-05	atm·m^3/mol	[2]
118-74-1	Hexachlorobenzene	1.00E+00	unitless	[5]	1.30E-03	atm·m^3/mol	[2]
119-90-4	3,3'-Dimethoxybenzidine	8.59E-01	unitless	[5]	1.81E-13	atm·m^3/mol	[2]
120-12-7	Anthracene	9.98E-01	unitless	[5]	6.50E-05	atm·m^3/mol	[2]
120-82-1	1,2,4-Trichlorobenzene	1.00E+00	unitless	[5]	1.40E-03	atm·m^3/mol	[2]

Table 2-2 Vapor Partitioning Coefficient, Henry's Law Constant

CAS Registry Number	Constituent Name	Vapor Partitioning Coefficient (*Fv*)	Units for Vapor Partitioning Coefficient	Reference	Henry's Law Constant	Units for Henry's Law Constant	Reference
120-83-2	2,4-Dichlorophenol	1.00E+00	unitless	[5]	3.20E-06	atm·m^3/mol	[2]
121-14-2	2,4-Dinitrotoluene	9.99E-01	unitless	[5]	9.26E-08	atm·m^3/mol	[2]
122-39-4	N,N-Diphenylamine	1.00E+00	unitless	[2]	2.69E-06	atm·m^3/mol	[6]
122-66-7	1,2-Diphenylhydrazine	1.00E+00	unitless	[5]	1.50E-06	atm·m^3/mol	[2]
123-33-1	Maleic hydrazide	1.00E+00	unitless	[2]	2.64E-11	atm·m^3/mol	[6]
123-38-6	Propionaldehyde	1.00E+00	unitless	[2]	7.34E-05	atm·m^3/mol	[3]
123-72-8	Butanal	1.00E+00	unitless	[2]	1.15E-04	atm·m^3/mol	[3]
123-91-1	1,4-Dioxan	1.00E+00	unitless	[5]	4.80E-06	atm·m^3/mol	[2]
124-18-5	Decane	1.00E+00	unitless	[4]	5.15E+00	atm·m^3/mol	[7]
124-38-9	Carbon dioxide	1.00E+00	unitless	[3]	1.89E+00	atm·m^3/mol	[1]
124-48-1	Chlorodibromomethane	1.00E+00	unitless	[5]	7.83E-04	atm·m^3/mol	[2]
126-73-8	Tributyl phosphate	9.96E-01	unitless	[2]	1.41E-06	atm·m^3/mol	[6]
126-98-7	2-Methyl-2-propenenitrile	1.00E+00	unitless	[5]	2.47E-04	atm·m^3/mol	[2]
127-18-4	1,1,2,2-Tetrachloroethene	1.00E+00	unitless	[5]	1.80E-02	atm·m^3/mol	[2]
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	1.00E+00	unitless	[2]	4.12E-06	atm·m^3/mol	[7]
129-00-0	Pyrene	9.94E-01	unitless	[5]	1.10E-05	atm·m^3/mol	[2]
131-11-3	Dimethyl Phthalate	1.00E+00	unitless	[5]	1.05E-07	atm·m^3/mol	[2]
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	3.75E-01	unitless	[2]	3.38E-11	atm·m^3/mol	[6]
132-64-9	Dibenzofuran	9.99E-01	unitless	[2]	2.13E-04	atm·m^3/mol	[6]
133-06-2	Captan	1.00E+00	unitless	[2]	7.00E-09	atm·m^3/mol	[6]
1330-20-7	Xylenes (mixed isomers)	1.00E+00	unitless	[4]	5.19E-03	atm·m^3/mol	[6]
1336-36-3	Polychlorinated biphenyls	1.00E+00	unitless	[2]	1.90E-04	atm·m^3/mol	[6]
134-32-7	alpha-Naphthylamine	1.00E+00	unitless	[2]	1.11E-07	atm·m^3/mol	[7]
135-98-8	sec-Butylbenzene	1.00E+00	unitless	[2]	1.76E-02	atm·m^3/mol	[3]
13966-29-5	Uranium-234	0.00E+00	unitless	[2]			
13967-48-1	Ruthenium-106	0.00E+00	unitless	[2]			
13967-70-9	Cesium-134	0.00E+00	unitless	[2]			
13968-55-3	Uranium-233	0.00E+00	unitless	[2]			
13981-15-2	Curium-244	0.00E+00	unitless	[2]			
13981-16-3	Plutonium-238	0.00E+00	unitless	[2]			

Table 2-2 Vapor Partitioning Coefficient, Henry's Law Constant

CAS Registry Number	Constituent Name	Vapor Partitioning Coefficient (*Fv*)	Units for Vapor Partitioning Coefficient	Reference	Henry's Law Constant	Units for Henry's Law Constant	Reference
13981-37-8	Nickel-63	0.00E+00	unitless	[2]			
13982-10-0	Plutonium-242	0.00E+00	unitless	[2]			
13982-63-3	Radium-226	0.00E+00	unitless	[2]			
13982-70-2	Uranium-236	0.00E+00	unitless	[2]			
13994-20-2	Neptunium-237	0.00E+00	unitless	[2]			
141-78-6	Acetic acid ethyl ester	1.00E+00	unitless	[2]	1.34E-04	atm·m^3/mol	[6]
14119-32-5	Plutonium-241	0.00E+00	unitless	[2]			
14119-33-6	Plutonium-240	0.00E+00	unitless	[2]			
14133-76-7	Technetium-99	0.00E+00	unitless	[2]			
14158-29-3	Uranium-232	0.00E+00	unitless	[2]			
14234-35-6	Antimony-125	0.00E+00	unitless	[2]			
14265-44-2	Phosphate	0.00E+00	unitless	[2]			
14331-85-2	Protactinium-231	0.00E+00	unitless	[2]			
14336-70-0	Nickel-59	0.00E+00	unitless	[2]			
14391-16-3	Europium-155	0.00E+00	unitless	[2]			
145-73-3	Endothall	0.00E+00	unitless	[1]	3.84E-16	atm·m^3/mol	[6]
14596-10-2	Americium-241	0.00E+00	unitless	[2]			
14683-23-9	Europium-152	0.00E+00	unitless	[2]			
14762-75-5	Carbon-14	1.00E+00	unitless	[2]			
14797-55-8	Nitrate	0.00E+00	unitless	[2]	2.45E-02	atm·m^3/mol	[8]
14797-65-0	Nitrite	0.00E+00	unitless	[2]			
14808-79-8	Sulfate	0.00E+00	unitless	[2]	5.00E-12	atm·m^3/mol	[1]
14952-40-0	Actinium-227	0.00E+00	unitless	[2]			
14993-75-0	Americium-243	0.00E+00	unitless	[2]			
15046-84-1	Iodine-129	1.00E+00	unitless	[2]			
15117-48-3	Plutonium-239	0.00E+00	unitless	[2]			
15117-96-1	Uranium-235	0.00E+00	unitless	[2]			
15262-20-1	Radium-228	0.00E+00	unitless	[2]			
15510-73-3	Curium-242	0.00E+00	unitless	[2]			
15585-10-1	Europium-154	0.00E+00	unitless	[2]			
15594-54-4	Thorium-229	0.00E+00	unitless	[2]			
156-59-2	cis-1,2-Dichloroethene	1.00E+00	unitless	[5]	4.10E-03	atm·m^3/mol	[2]

Table 2-2 Vapor Partitioning Coefficient, Henry's Law Constant

CAS Registry Number	Constituent Name	Vapor Partitioning Coefficient (*Fv*)	Units for Vapor Partitioning Coefficient	Reference	Henry's Law Constant	Units for Henry's Law Constant	Reference
156-60-5	1,2-trans-Dichloroethene	1.00E+00	unitless	[5]	9.40E-03	atm·m^3/mol	[2]
15715-94-3	Samarium-151	0.00E+00	unitless	[2]			
15751-77-6	Zirconium-93	0.00E+00	unitless	[2]			
15757-87-6	Curium-243	0.00E+00	unitless	[2]			
15758-45-9	Selenium-79	0.00E+00	unitless	[2]			
15832-50-5	Tin-126	0.00E+00	unitless	[2]			
1634-04-4	Methyl tert-butyl ether	1.00E+00	unitless	[2]	5.87E-04	atm·m^3/mol	[6]
16887-00-6	Chloride	0.00E+00	unitless	[2]	7.73E-03	atm·m^3/mol	[7]
16984-48-8	Fluoride	0.00E+00	unitless	[2]			
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	6.64E-01	unitless	[5]	3.29E-05	atm·m^3/mol	[2]
18540-29-9	Chromium(VI)	0.00E+00	unitless	[5]	0.00E+00	atm·m^3/mol	[2]
189-55-9	Dibenzo[a,i]pyrene	0.00E+00	unitless	[1]	1.41E-08	atm·m^3/mol	[7]
189-64-0	Dibenzo[a,h]pyrene	0.00E+00	unitless	[1]	1.41E-08	atm·m^3/mol	[7]
191-24-2	Benzo(g,h,i)perylene	6.50E-02	unitless	[2]	3.30E-07	atm·m^3/mol	[6]
191-30-0	Dibenzo(a,l)pyrene	0.00E+00	unitless	[1]	1.41E-08	atm·m^3/mol	[7]
192-65-4	Dibenzo[a,e]pyrene	0.00E+00	unitless	[1]	1.41E-08	atm·m^3/mol	[7]
192-97-2	Benzo(e)pyrene	8.93E-01	unitless	[2]	3.00E-07	atm·m^3/mol	[3]
193-39-5	Indeno(1,2,3-cd)pyrene	0.00E+00	unitless	[1]	1.60E-06	atm·m^3/mol	[2]
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	0.00E+00	unitless	[1]	1.10E-05	atm·m^3/mol	[2]
205-82-3	Benzo[j]fluoranthene	5.90E-01	unitless	[2]	2.03E-07	atm·m^3/mol	[7]
205-99-2	Benzo(b)fluoranthene	9.66E-01	unitless	[5]	1.11E-04	atm·m^3/mol	[2]
206-44-0	Fluoranthene	9.92E-01	unitless	[5]	1.60E-05	atm·m^3/mol	[2]
207-08-9	Benzo(k)fluoranthene	2.73E-01	unitless	[5]	8.30E-07	atm·m^3/mol	[2]
208-96-8	Acenaphthylene	1.00E+00	unitless	[2]	1.14E-04	atm·m^3/mol	[6]
218-01-9	Chrysene	7.44E-01	unitless	[5]	9.50E-05	atm·m^3/mol	[2]
224-42-0	Dibenz[a,j]acridine	2.41E-01	unitless	[2]	1.90E-09	atm·m^3/mol	[7]
2245-38-7	2,3,5-Trimethylnaphthalene	1.00E+00	unitless	[4]	7.07E-04	atm·m^3/mol	[7]
226-36-8	Dibenz[a,h]acridine	2.85E-01	unitless	[2]	1.90E-09	atm·m^3/mol	[7]
22967-92-6	Methyl mercury	0.00E+00	unitless	[5]	4.70E-07	atm·m^3/mol	[2]

Table 2-2 Vapor Partitioning Coefficient, Henry's Law Constant

CAS Registry Number	Constituent Name	Vapor Partitioning Coefficient (*Fv*)	Units for Vapor Partitioning Coefficient	Reference	Henry's Law Constant	Units for Henry's Law Constant	Reference
23950-58-5	Pronamide	9.49E-01	unitless	[5]	9.77E-09	atm·m^3/mol	[7]
24959-67-9	Bromide	1.70E-02	unitless	[2]	2.45E-02	atm·m^3/mol	[7]
27154-33-2	Trichlorofluoroethane	1.00E+00	unitless	[2]	1.03E-02	atm·m^3/mol	[1]
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	8.38E-01	unitless	[2]	2.88E-04	atm·m^3/mol	[3]
319-84-6	alpha-BHC	1.00E+00	unitless	[5]	1.10E-05	atm·m^3/mol	[2]
319-85-7	beta-BHC	9.99E-01	unitless	[5]	7.40E-07	atm·m^3/mol	[2]
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	9.72E-01	unitless	[2]	9.40E-06	atm·m^3/mol	[3]
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	9.38E-01	unitless	[2]	8.25E-04	atm·m^3/mol	[3]
3268-87-9	Octachlorodibenzo(p)dioxin	0.00E+00	unitless	[1]	6.75E-06	atm·m^3/mol	[2]
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	9.64E-01	unitless	[2]	6.85E-05	atm·m^3/mol	[7]
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	0.00E+00	unitless	[1]	1.20E-05	atm·m^3/mol	[2]
3697-24-3	5-Methylchrysene	8.23E-01	unitless	[2]	5.53E-06	atm·m^3/mol	[7]
378253-40-8	Barium-137m	0.00E+00	unitless	[2]			
378253-44-2	Cadmium-113m	0.00E+00	unitless	[2]			
378782-82-2	Niobium-93m	0.00E+00	unitless	[2]			
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	7.84E-01	unitless	[2]	1.43E-04	atm·m^3/mol	[3]
39001-02-0	Octachlorodibenzofuran	0.00E+00	unitless	[1]	1.88E-06	atm·m^3/mol	[2]
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	0.00E+00	unitless	[1]	1.07E-05	atm·m^3/mol	[2]
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	4.02E-01	unitless	[2]	5.07E-05	atm·m^3/mol	[7]

Table 2-2 Vapor Partitioning Coefficient, Henry's Law Constant

CAS Registry Number	Constituent Name	Vapor Partitioning Coefficient (*Fv*)	Units for Vapor Partitioning Coefficient	Reference	Henry's Law Constant	Units for Henry's Law Constant	Reference
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	1.17E-01	unitless	[5]	2.60E-06	atm·m^3/mol	[2]
4170-30-3	Crotonaldehyde (Propylene aldehyde)	1.00E+00	unitless	[2]	9.68E-06	atm·m^3/mol	[7]
41851-50-7	Chlorocyclopentadiene	1.00E+00	unitless	[2]	2.24E-02	atm·m^3/mol	[6]
460-19-5	Cyanogen (oxalonitrile)	1.00E+00	unitless	[2]	5.41E-03	atm·m^3/mol	[6]
4786-20-3	2-Butenenitrile	1.00E+00	unitless	[4]	1.12E-04	atm·m^3/mol	[7]
50-00-0	Formaldehyde	1.00E+00	unitless	[5]	3.36E-07	atm·m^3/mol	[2]
50-32-8	Benzo(a)pyrene	2.94E-01	unitless	[5]	1.10E-06	atm·m^3/mol	[2]
506-68-3	Cyanogen bromide (bromocyanide)	1.00E+00	unitless	[2]	1.56E-04	atm·m^3/mol	[1]
506-77-4	Cyanogen chloride	1.00E+00	unitless	[2]	2.45E-02	atm·m^3/mol	[7]
51-28-5	2,4-Dinitrophenol	1.00E+00	unitless	[5]	4.43E-07	atm·m^3/mol	[2]
51-79-6	Ethyl carbamate (urethane)	1.00E+00	unitless	[2]	6.43E-08	atm·m^3/mol	[3]
510-15-6	Chlorobenzilate	8.62E-01	unitless	[5]	7.24E-08	atm·m^3/mol	[2]
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	7.70E-01	unitless	[5]	1.44E-05	atm·m^3/mol	[2]
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	8.15E-01	unitless	[2]	6.85E-05	atm·m^3/mol	[7]
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	9.99E-01	unitless	[2]	5.33E-08	atm·m^3/mol	[6]
53-70-3	Dibenz[a,h]anthracene	5.50E-02	unitless	[5]	1.50E-08	atm·m^3/mol	[2]
532-27-4	2-Chloroacetophenone	1.00E+00	unitless	[2]	3.30E-06	atm·m^3/mol	[6]
534-52-1	4,6-Dinitro-o-cresol	1.00E+00	unitless	[2]	1.40E-06	atm·m^3/mol	[6]
5385-75-1	Dibenzo(a,e)fluoranthene	0.00E+00	unitless	[1]	7.91E-08	atm·m^3/mol	[7]
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	1.00E+00	unitless	[2]	4.09E-03	atm·m^3/mol	[6]
540-73-8	1,2-Dimethylhydrazine	1.00E+00	unitless	[2]	6.95E-08	atm·m^3/mol	[6]
540-84-1	2,2,4-Trimethylpentane	1.00E+00	unitless	[2]	3.04E+00	atm·m^3/mol	[7]
541-73-1	1,3-Dichlorobenzene	1.00E+00	unitless	[5]	3.10E-03	atm·m^3/mol	[2]
542-75-6	1,3-Dichloropropene	1.00E+00	unitless	[5]	1.80E-02	atm·m^3/mol	[2]
542-88-1	Bis(chloromethyl)ether	1.00E+00	unitless	[2]	4.35E-03	atm·m^3/mol	[6]

Table 2-2 Vapor Partitioning Coefficient, Henry's Law Constant

CAS Registry Number	Constituent Name	Vapor Partitioning Coefficient (*Fv*)	Units for Vapor Partitioning Coefficient	Reference	Henry's Law Constant	Units for Henry's Law Constant	Reference
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	5.70E-02	unitless	[5]	1.40E-05	atm·m^3/mol	[2]
56-23-5	Carbon tetrachloride	1.00E+00	unitless	[5]	3.00E-02	atm·m^3/mol	[2]
56-49-5	3-Methylcholanthrene	3.64E-01	unitless	[2]	5.24E-06	atm·m^3/mol	[7]
56-55-3	Benzo(a)anthracene	4.83E-01	unitless	[5]	3.40E-06	atm·m^3/mol	[2]
57-12-5	Cyanide	1.00E+00	unitless	[2]	2.40E-02	atm·m^3/mol	[2]
57-24-9	Strychnine	0.00E+00	unitless	[1]	7.56E-14	atm·m^3/mol	[2]
57-74-9	Chlordane	9.93E-01	unitless	[5]	4.86E-05	atm·m^3/mol	[7]
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	2.21E-01	unitless	[5]	4.98E-06	atm·m^3/mol	[2]
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	2.68E-01	unitless	[5]	5.00E-06	atm·m^3/mol	[2]
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	5.20E-02	unitless	[5]	7.31E-06	atm·m^3/mol	[2]
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	9.36E-01	unitless	[2]	9.49E-06	atm·m^3/mol	[1]
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	0.00E+00	unitless	[1]	1.10E-05	atm·m^3/mol	[2]
58-89-9	gamma-BHC (Lindane)	1.00E+00	unitless	[2]	5.14E-06	atm·m^3/mol	[6]
58-90-2	2,3,4,6-Tetrachlorophenol	1.00E+00	unitless	[5]	4.39E-06	atm·m^3/mol	[2]
581-42-0	2,6-Dimethylnaphthalene	1.00E+00	unitless	[4]	6.41E-04	atm·m^3/mol	[7]
584-84-9	2,4-Toluene diisocyanate	1.00E+00	unitless	[2]	1.11E-05	atm·m^3/mol	[7]
589-38-8	3-Hexanone	1.00E+00	unitless	[2]	1.25E-04	atm·m^3/mol	[7]
59-50-7	4-Chloro-3-methylphenol	1.00E+00	unitless	[5]	2.45E-06	atm·m^3/mol	[7]
59-89-2	N-Nitrosomorpholine	1.00E+00	unitless	[2]	2.45E-08	atm·m^3/mol	[3]
591-50-4	Benzene, iodo-	1.00E+00	unitless	[4]	8.37E-04	atm·m^3/mol	[7]
591-78-6	2-Hexanone	1.00E+00	unitless	[2]	9.32E-05	atm·m^3/mol	[6]
593-60-2	Bromoethene (Vinyl bromide)	1.00E+00	unitless	[2]	1.23E-02	atm·m^3/mol	[6]
593-74-8	Dimethyl Mercury	1.00E+00	unitless	[4]	6.38E-03	atm·m^3/mol	[4]
60-11-7	Dimethyl aminoazobenzene	5.40E-01	unitless	[2]	4.00E-10	atm·m^3/mol	[7]
60-29-7	Ethyl ether	1.00E+00	unitless	[2]	1.23E-03	atm·m^3/mol	[6]

Table 2-2 Vapor Partitioning Coefficient, Henry's Law Constant

CAS Registry Number	Constituent Name	Vapor Partitioning Coefficient (*Fv*)	Units for Vapor Partitioning Coefficient	Reference	Henry's Law Constant	Units for Henry's Law Constant	Reference
60-35-5	Acetamide	1.00E+00	unitless	[2]	4.41E-09	atm·m^3/mol	[3]
602-87-9	5-Nitroacenaphthene	9.97E-01	unitless	[2]	1.11E-06	atm·m^3/mol	[7]
606-20-2	2,6-Dinitrotoluene	1.00E+00	unitless	[5]	7.47E-07	atm·m^3/mol	[2]
608-93-5	Pentachlorobenzene	1.00E+00	unitless	[5]	7.10E-04	atm·m^3/mol	[2]
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	5.50E-02	unitless	[5]	1.10E-05	atm·m^3/mol	[2]
61626-71-9	Dichloropentadiene	1.00E+00	unitless	[2]	3.19E-10	atm·m^3/mol	[1]
62-50-0	Ethyl methanesulfonate	1.00E+00	unitless	[5]	5.35E-06	atm·m^3/mol	[2]
62-53-3	Aniline	1.00E+00	unitless	[5]	1.90E-06	atm·m^3/mol	[2]
62-75-9	N-Nitroso-N,N-dimethylamine	1.00E+00	unitless	[2]	1.82E-06	atm·m^3/mol	[7]
621-64-7	N-Nitroso-di-n-propylamine	1.00E+00	unitless	[5]	2.25E-06	atm·m^3/mol	[2]
624-83-9	Methyl isocyanate	1.00E+00	unitless	[4]	9.26E-04	atm·m^3/mol	[7]
628-73-9	Hexanenitrile	1.00E+00	unitless	[2]	9.49E-05	atm·m^3/mol	[7]
630-08-0	Carbon monoxide	1.00E+00	unitless	[2]	1.13E+00	atm·m^3/mol	[6]
630-20-6	1,1,1,2-Tetrachloroethane	1.00E+00	unitless	[5]	2.42E-03	atm·m^3/mol	[2]
64-18-6	Formic acid (methanoic acid)	1.00E+00	unitless	[5]	1.67E-07	atm·m^3/mol	[2]
65-85-0	Benzoic acid	1.00E+00	unitless	[5]	2.87E-06	atm·m^3/mol	[2]
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	9.60E-01	unitless	[2]	2.36E-05	atm·m^3/mol	[1]
67-56-1	Methyl alcohol	1.00E+00	unitless	[5]	4.55E-06	atm·m^3/mol	[2]
67-63-0	2-Propyl alcohol	1.00E+00	unitless	[2]	8.10E-06	atm·m^3/mol	[6]
67-64-1	2-Propanone (Acetone)	1.00E+00	unitless	[5]	3.90E-05	atm·m^3/mol	[2]
67-66-3	Chloroform	1.00E+00	unitless	[5]	3.70E-03	atm·m^3/mol	[2]
67-72-1	Hexachloroethane	1.00E+00	unitless	[5]	3.89E-03	atm·m^3/mol	[2]
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	0.00E+00	unitless	[1]	1.41E-05	atm·m^3/mol	[2]
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	7.33E-01	unitless	[2]	5.09E-05	atm·m^3/mol	[1]
70-30-4	Hexachlorophene	0.00E+00	unitless	[1]	5.48E-13	atm·m^3/mol	[2]

Table 2-2 Vapor Partitioning Coefficient, Henry's Law Constant

CAS Registry Number	Constituent Name	Vapor Partitioning Coefficient (*Fv*)	Units for Vapor Partitioning Coefficient	Reference	Henry's Law Constant	Units for Henry's Law Constant	Reference
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	9.76E-01	unitless	[2]	2.25E-05	atm·m^3/mol	[1]
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	0.00E+00	unitless	[1]	1.43E-05	atm·m^3/mol	[2]
71-36-3	n-Butyl alcohol	1.00E+00	unitless	[2]	8.81E-06	atm·m^3/mol	[6]
71-43-2	Benzene	1.00E+00	unitless	[5]	5.60E-03	atm·m^3/mol	[2]
71-55-6	1,1,1-Trichloroethane	1.00E+00	unitless	[5]	1.70E-02	atm·m^3/mol	[2]
72-43-5	Methoxychlor	8.45E-01	unitless	[5]	1.60E-05	atm·m^3/mol	[2]
72-55-9	4,4-DDE	9.83E-01	unitless	[5]	2.10E-05	atm·m^3/mol	[2]
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	9.00E-02	unitless	[5]	1.10E-05	atm·m^3/mol	[2]
74-83-9	Bromomethane	1.00E+00	unitless	[5]	6.24E-03	atm·m^3/mol	[2]
74-87-3	Chloromethane	1.00E+00	unitless	[5]	8.82E-03	atm·m^3/mol	[2]
74-88-4	Iodomethane	1.00E+00	unitless	[2]	5.26E-03	atm·m^3/mol	[3]
74-95-3	Methylene bromide	1.00E+00	unitless	[5]	8.61E-04	atm·m^3/mol	[2]
74-97-5	Bromochloromethane	1.00E+00	unitless	[2]	1.46E-03	atm·m^3/mol	[6]
7429-90-5	Aluminum	0.00E+00	unitless	[2]	0.00E+00	atm·m^3/mol	[5]
7439-89-6	Iron	0.00E+00	unitless	[2]	0.00E+00	atm·m^3/mol	[5]
7439-92-1	Lead	7.00E-03	unitless	[5]	2.50E-02	atm·m^3/mol	[2]
7439-93-2	Lithium	0.00E+00	unitless	[2]			
7439-95-4	Magnesium	0.00E+00	unitless	[2]			
7439-96-5	Manganese	0.00E+00	unitless	[2]	0.00E+00	atm·m^3/mol	[5]
7439-97-6	Mercury	1.00E+00	unitless	[5]	7.10E-03	atm·m^3/mol	[2]
7439-98-7	Molybdenum	0.00E+00	unitless	[2]	0.00E+00	atm·m^3/mol	[5]
7440-02-0	Nickel	9.00E-03	unitless	[5]	2.50E-02	atm·m^3/mol	[2]
7440-16-6	Rhodium	0.00E+00	unitless	[2]			
7440-22-4	Silver	9.00E-03	unitless	[5]	0.00E+00	atm·m^3/mol	[2]
7440-23-5	Sodium	0.00E+00	unitless	[2]			
7440-24-6	Strontium (total)	0.00E+00	unitless	[2]	0.00E+00	atm·m^3/mol	[5]
7440-25-7	Tantalum	0.00E+00	unitless	[2]			
7440-28-0	Thallium	9.00E-03	unitless	[5]	0.00E+00	atm·m^3/mol	[2]
7440-29-1	Thorium-232	0.00E+00	unitless	[2]			

Table 2-2 Vapor Partitioning Coefficient, Henry's Law Constant

CAS Registry Number	Constituent Name	Vapor Partitioning Coefficient (*Fv*)	Units for Vapor Partitioning Coefficient	Reference	Henry's Law Constant	Units for Henry's Law Constant	Reference
7440-31-5	Tin	0.00E+00	unitless	[2]	0.00E+00	atm·m^3/mol	[5]
7440-33-7	Tungsten	0.00E+00	unitless	[2]			
7440-36-0	Antimony	1.00E+00	unitless	[5]	2.50E-02	atm·m^3/mol	[2]
7440-38-2	Arsenic	6.00E-03	unitless	[5]	7.70E-01	atm·m^3/mol	[2]
7440-39-3	Barium	9.00E-03	unitless	[5]	0.00E+00	atm·m^3/mol	[2]
7440-41-7	Beryllium	9.00E-03	unitless	[5]	1.50E-02	atm·m^3/mol	[2]
7440-43-9	Cadmium	9.00E-03	unitless	[5]	3.10E-02	atm·m^3/mol	[2]
7440-47-3	Chromium	9.00E-03	unitless	[5]	0.00E+00	atm·m^3/mol	[2]
7440-48-4	Cobalt	0.00E+00	unitless	[2]			
7440-50-8	Copper	0.00E+00	unitless	[2]	0.00E+00	atm·m^3/mol	[5]
7440-61-1	Uranium	0.00E+00	unitless	[2]			
7440-61-1R	Uranium-238	0.00E+00	unitless	[2]			
7440-62-2	Vanadium	0.00E+00	unitless	[2]	0.00E+00	atm·m^3/mol	[5]
7440-65-5	Yttrium	0.00E+00	unitless	[2]			
7440-66-6	Zinc	8.00E-03	unitless	[5]	2.50E-02	atm·m^3/mol	[2]
7440-67-7	Zirconium	0.00E+00	unitless	[2]			
7446-09-5	Sulfur dioxide	1.00E+00	unitless	[2]	8.10E-04	atm·m^3/mol	[7]
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	8.33E-01	unitless	[2]	9.24E-05	atm·m^3/mol	[7]
7487-94-7	Mercuric chloride (HgCl2)	8.50E-01	unitless	[5]	7.10E-10	atm·m^3/mol	[2]
75-00-3	Chloroethane	1.00E+00	unitless	[5]	8.80E-03	atm·m^3/mol	[2]
75-01-4	1-Chloroethene	1.00E+00	unitless	[5]	2.70E-02	atm·m^3/mol	[2]
75-02-5	Fluoroethene (vinyl fluoride)	1.00E+00	unitless	[2]	1.18E-01	atm·m^3/mol	[7]
75-05-8	Acetonitrile	1.00E+00	unitless	[5]	3.46E-05	atm·m^3/mol	[2]
75-07-0	Acetaldehyde	1.00E+00	unitless	[5]	7.89E-05	atm·m^3/mol	[2]
75-09-2	Dichloromethane (Methylene Chloride)	1.00E+00	unitless	[5]	2.20E-03	atm·m^3/mol	[2]
75-15-0	Carbon disulfide	1.00E+00	unitless	[5]	3.00E-02	atm·m^3/mol	[2]
75-21-8	Ethylene oxide (Oxirane)	1.00E+00	unitless	[5]	1.48E-04	atm·m^3/mol	[2]
75-25-2	Bromoform	1.00E+00	unitless	[5]	6.50E+00	atm·m^3/mol	[2]
75-27-4	Bromodichloromethane	1.00E+00	unitless	[5]	1.60E-03	atm·m^3/mol	[2]

Table 2-2 Vapor Partitioning Coefficient, Henry's Law Constant

CAS Registry Number	Constituent Name	Vapor Partitioning Coefficient (*Fv*)	Units for Vapor Partitioning Coefficient	Reference	Henry's Law Constant	Units for Henry's Law Constant	Reference
75-29-6	2-Chloropropane	1.00E+00	unitless	[2]	1.75E-02	atm·m^3/mol	[6]
75-34-3	1,1-Dichloroethane	1.00E+00	unitless	[5]	5.60E-03	atm·m^3/mol	[2]
75-35-4	1,1-Dichloroethene	1.00E+00	unitless	[5]	2.60E-02	atm·m^3/mol	[2]
75-44-5	Phosgene (hydrogen phosphide)	1.00E+00	unitless	[2]	1.67E-02	atm·m^3/mol	[7]
75-45-6	Chlorodifluoromethane	1.00E+00	unitless	[5]	4.06E-02	atm·m^3/mol	[7]
75-50-3	Trimethylamine	1.00E+00	unitless	[2]	1.04E-04	atm·m^3/mol	[7]
75-69-4	Trichlorofluoromethane	1.00E+00	unitless	[5]	9.70E-02	atm·m^3/mol	[2]
75-71-8	Dichlorodifluoromethane	1.00E+00	unitless	[5]	3.43E-01	atm·m^3/mol	[2]
76-01-7	Pentachloroethane	1.00E+00	unitless	[2]	1.94E-03	atm·m^3/mol	[3]
76-13-1	1,2,2-Trichlorotrifluoroethane	1.00E+00	unitless	[2]	5.26E-01	atm·m^3/mol	[6]
76-44-8	Heptachlor	1.00E+00	unitless	[5]	1.50E+00	atm·m^3/mol	[2]
764-41-0	1,4-Dichloro-2-butene	1.00E+00	unitless	[2]	6.63E-04	atm·m^3/mol	[6]
7647-01-0	Hydrogen chloride	1.00E+00	unitless	[5]	2.36E-03	atm·m^3/mol	[1]
765-34-4	Glycidylaldehyde	1.00E+00	unitless	[2]	7.85E-07	atm·m^3/mol	[6]
7664-39-3	Hydrogen Fluoride	1.00E+00	unitless	[2]	1.04E-04	atm·m^3/mol	[7]
7664-41-7	Ammonia/Ammonium	1.00E+00	unitless	[2]	1.61E-05	atm·m^3/mol	[7]
77-47-4	Hexachlorocyclopentadiene	1.00E+00	unitless	[5]	2.70E-02	atm·m^3/mol	[2]
77-78-1	Dimethyl sulfate	1.00E+00	unitless	[2]	4.01E-06	atm·m^3/mol	[6]
7704-34-9	Total Sulfur (thermodynamically stable)	0.00E+00	unitless	[6]			
7723-14-0	Phosphorus	0.00E+00	unitless	[2]	2.44E-02	atm·m^3/mol	[7]
7782-41-4	Fluorine gas F2	1.00E+00	unitless	[5]	8.26E-02	atm·m^3/mol	[7]
7782-49-2	Selenium	0.00E+00	unitless	[5]	9.70E-03	atm·m^3/mol	[2]
7782-50-5	Chlorine	1.00E+00	unitless	[5]	1.17E-02	atm·m^3/mol	[7]
78-83-1	2-Methylpropyl alcohol	1.00E+00	unitless	[2]	9.79E-06	atm·m^3/mol	[6]
78-87-5	1,2-Dichloropropane	1.00E+00	unitless	[5]	2.80E-03	atm·m^3/mol	[2]
78-93-3	2-Butanone	1.00E+00	unitless	[5]	5.60E-05	atm·m^3/mol	[2]
79-00-5	1,1,2-Trichloroethane	1.00E+00	unitless	[5]	9.10E-04	atm·m^3/mol	[2]
79-01-6	1,1,2-Trichloroethylene	1.00E+00	unitless	[5]	1.00E-02	atm·m^3/mol	[2]
79-10-7	2-Propenoic acid	1.00E+00	unitless	[2]	3.69E-07	atm·m^3/mol	[6]

Table 2-2 Vapor Partitioning Coefficient, Henry's Law Constant

CAS Registry Number	Constituent Name	Vapor Partitioning Coefficient (*Fv*)	Units for Vapor Partitioning Coefficient	Reference	Henry's Law Constant	Units for Henry's Law Constant	Reference
79-34-5	1,1,2,2-Tetrachloroethane	1.00E+00	unitless	[5]	3.40E-04	atm·m^3/mol	[2]
79-46-9	2-Nitropropane	1.00E+00	unitless	[2]	1.19E-04	atm·m^3/mol	[6]
80-62-6	Methyl methacrylate	1.00E+00	unitless	[2]	3.18E-04	atm·m^3/mol	[6]
82-68-8	Pentachloronitrobenzene (PCNB)	1.00E+00	unitless	[5]	3.80E-04	atm·m^3/mol	[2]
822-06-0	Hexamethylene-1,5-diisocyanate	1.00E+00	unitless	[2]	4.80E-05	atm·m^3/mol	[6]
823-40-5	Toluene-2,6-diamine	1.00E+00	unitless	[2]	9.52E-10	atm·m^3/mol	[6]
83-32-9	Acenaphthene	1.00E+00	unitless	[5]	1.60E-04	atm·m^3/mol	[2]
832-69-9	1-Methylphenanthrene	9.71E-01	unitless	[4]	4.93E-05	atm·m^3/mol	[7]
84-66-2	Diethyl phthalate	1.00E+00	unitless	[5]	4.50E-07	atm·m^3/mol	[2]
84-74-2	Di-n-butylphthalate	9.94E-01	unitless	[5]	1.80E-06	atm·m^3/mol	[2]
85-01-8	Phenanthrene	9.99E-01	unitless	[5]	2.30E-05	atm·m^3/mol	[2]
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	1.00E+00	unitless	[5]	1.63E-08	atm·m^3/mol	[2]
85-68-7	Butylbenzylphthalate	9.48E-01	unitless	[5]	1.30E-06	atm·m^3/mol	[2]
86-73-7	Fluorene	1.00E+00	unitless	[5]	6.40E-05	atm·m^3/mol	[2]
87-61-6	1,2,3-Trichlorobenzene	1.00E+00	unitless	[5]	1.25E-03	atm·m^3/mol	[2]
87-68-3	Hexachlorobutadiene	1.00E+00	unitless	[5]	8.10E-03	atm·m^3/mol	[2]
87-86-5	Pentachlorophenol	9.99E-01	unitless	[5]	2.40E-08	atm·m^3/mol	[2]
88-06-2	2,4,6-Trichlorophenol	1.00E+00	unitless	[5]	7.80E-06	atm·m^3/mol	[2]
88-74-4	o-Nitroaniline (2-nitroaniline)	1.00E+00	unitless	[5]	1.09E-07	atm·m^3/mol	[2]
88-75-5	2-Nitrophenol	1.00E+00	unitless	[5]	9.47E-06	atm·m^3/mol	[2]
90-04-0	o-Anisidine	1.00E+00	unitless	[2]	9.26E-07	atm·m^3/mol	[7]
90-12-0	1-Methylnaphthalene	1.00E+00	unitless	[4]	5.14E-04	atm·m^3/mol	[6]
91-20-3	Naphthalene	1.00E+00	unitless	[5]	4.80E-04	atm·m^3/mol	[2]
91-22-5	Quinoline	1.00E+00	unitless	[2]	1.67E-06	atm·m^3/mol	[6]
91-57-6	2-Methylnaphthalene	1.00E+00	unitless	[2]	5.19E-04	atm·m^3/mol	[6]
91-58-7	2-Chloronaphthalene	1.00E+00	unitless	[5]	3.14E-04	atm·m^3/mol	[2]
91-94-1	3,3'-Dichlorobenzidine	4.82E-01	unitless	[5]	4.00E-09	atm·m^3/mol	[2]
92-52-4	1,1`-Biphenyl	1.00E+00	unitless	[2]	3.08E-04	atm·m^3/mol	[6]

Table 2-2 Vapor Partitioning Coefficient, Henry's Law Constant

CAS Registry Number	Constituent Name	Vapor Partitioning Coefficient (*Fv*)	Units for Vapor Partitioning Coefficient	Reference	Henry's Law Constant	Units for Henry's Law Constant	Reference
924-16-3	N-Nitroso-di-n-Buetylamine	1.00E+00	unitless	[5]	3.16E-04	atm·m^3/mol	[2]
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	1.00E+00	unitless	[5]	1.86E-05	atm·m^3/mol	[2]
94-75-7	2,4-D	9.49E-01	unitless	[2]	3.55E-08	atm·m^3/mol	[6]
95-48-7	o-Cresol	1.00E+00	unitless	[5]	1.20E-06	atm·m^3/mol	[2]
95-49-8	o-Chlorotoluene	1.00E+00	unitless	[2]	3.57E-03	atm·m^3/mol	[6]
95-50-1	1,2-Dichlorobenzene	1.00E+00	unitless	[5]	1.90E-03	atm·m^3/mol	[2]
95-53-4	o-Toluidine	1.00E+00	unitless	[5]	2.72E-06	atm·m^3/mol	[2]
95-57-8	2-Chlorophenol	1.00E+00	unitless	[5]	3.91E-04	atm·m^3/mol	[2]
95-63-6	1,2,4-Trimethyl benzene	1.00E+00	unitless	[2]	6.17E-03	atm·m^3/mol	[6]
95-94-3	1,2,4,5-Tetrachlorobenzene	1.00E+00	unitless	[5]	2.60E-03	atm·m^3/mol	[2]
95-95-4	2,4,5-Trichlorophenol	1.00E+00	unitless	[5]	4.33E-06	atm·m^3/mol	[2]
96-12-8	1,2-Dibromo-3-chloropropane	1.00E+00	unitless	[5]	1.50E-04	atm·m^3/mol	[2]
96-18-4	1,2,3-Trichloropropane	1.00E+00	unitless	[5]	4.10E-04	atm·m^3/mol	[2]
96-45-7	Ethylene thiourea	1.00E+00	unitless	[2]	3.35E-07	atm·m^3/mol	[6]
97-63-2	Ethyl methacrylate	1.00E+00	unitless	[5]	8.42E-04	atm·m^3/mol	[2]
98-01-1	Furfural	1.00E+00	unitless	[2]	3.77E-06	atm·m^3/mol	[6]
98-06-6	tert-Butyl benzene	1.00E+00	unitless	[2]	1.32E-02	atm·m^3/mol	[3]
98-07-7	Benzotrichloride	1.00E+00	unitless	[2]	2.59E-04	atm·m^3/mol	[6]
98-82-8	Cumene	1.00E+00	unitless	[5]	1.20E+00	atm·m^3/mol	[2]
98-83-9	Methyl styrene (mixed isomers)	1.00E+00	unitless	[2]	3.01E-03	atm·m^3/mol	[6]
98-86-2	Acetophenone	1.00E+00	unitless	[5]	1.07E-05	atm·m^3/mol	[2]
98-95-3	Nitrobenzene	1.00E+00	unitless	[5]	2.40E-05	atm·m^3/mol	[2]
99-35-4	1,3,5-Trinitrobenzene	9.92E-01	unitless	[5]	3.30E-10	atm·m^3/mol	[2]
99-65-0	1,3-Dinitrobenzene	1.00E+00	unitless	[5]	2.30E-07	atm·m^3/mol	[2]
99-87-6	p-Cymene	1.00E+00	unitless	[2]	1.10E-02	atm·m^3/mol	[3]

Reference	**Reference (source) for Vapor Partitioning Coefficient**
[1]	CCN 097844, "Meeting Minutes: Discuss and Resolve the Outstanding Risk Assessment Issues," dated Sept. 3, 2004
[2]	CCN 129507, Memo, from L.Bostic, to E.Berrios, "Update2: to Vapor Phase Partitioning Coefficients," dated January 6, 2006.

Reference	Reference (source) for Vapor Partitioning Coefficient
[3]	Calculated value per Eq. A-2-1 in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm).
[4]	EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, Final, EPA/530/R-05/006. US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm, calculated value per Eq. A-2-1 and A-2-2).
[5]	EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013).

Reference	Reference (source) for Henry's Law Constant
[1]	EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, Final, EPA/530/R-05/006. US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm, calculated value per Eq. A-2-3).
[2]	EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013).
[3]	EPA. 2012. *Estimation Programs Interface (EPI) Suite*, v 4.11, Copyright © 2000-2012, US Environmental Protection Agency, Office of Polution Prevention Toxics and Syracuse Research Corporation, Washington, DC (http://www.epa.gov/oppt/exposure/docs/episuite.htm, values in database).
[4]	ESFA. 2008. "Opinion of the Scientific Panel on Contaminants in the Food chain on a Request from the European Commission on Mercury as Undesirable Substance in Feed," *The EFSA Journal* (2008) 654, 1-74., European Food Safety Authority, February 2008. (va
[5]	Ecology. *Cleanup Levels and Risk Calculations (CLARC) database* (https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx, accessed May 2014). (units converted to atm-m3/mol)
[6]	ORNL. *The Risk Assessment Information System (RAIS) Database*. Copyright © 2013 Oak Ridge National Laboratory and The University of Tennessee, Oak Ridge, TN (http://rais.ornl.gov, accessed April 2014).
[7]	Syracuse Research Corporation (SRC). *FatePointers Search Module*, Copyright © 2014 SRC, Inc., North Syracuse, NY (http://esc.syrres.com/fatepointer/search.asp).
[8]	Syracuse Research Corporation (SRC). *FatePointers Search Module*, Copyright © 2014 SRC, Inc., North Syracuse, NY (http://esc.syrres.com/fatepointer/search.asp, values reported here are for nitric acid, CAS 7697-37-2).

Table 2-3 provides air and water diffusivity coefficients where available. Air and water diffusivity coefficients are used to calculate the liquid or gas phase transfer of a contaminant into a water body. Blank entries in the table indicate where data are not available.

Table 2-3 Air and Water Diffusivity

CAS Registry Number	Constituent Name	Air Diffusivity (D_a)	Units for Air Diffusivity	Reference	Water Diffusivity (D_w)	Units for Water Diffusivity	Reference
100-02-7	p-Nitrophenol	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
100-21-0	Phthalic acid	4.87E-02	cm^2/s	[3]	9.04E-06	cm^2/s	[3]
100-25-4	1,4-Dinitrobenzene	4.92E-02	cm^2/s	[3]	9.38E-06	cm^2/s	[3]
100-40-3	4-Ethenylcyclohexene	8.37E-02	cm^2/s	[1]	9.69E-06	cm^2/s	[1]
100-41-4	Ethyl benzene	7.50E-02	cm^2/s	[2]	7.80E-06	cm^2/s	[2]
100-42-5	Styrene	7.10E-02	cm^2/s	[2]	8.00E-06	cm^2/s	[2]
100-44-7	Benzyl chloride	7.50E-02	cm^2/s	[2]	7.80E-06	cm^2/s	[2]
100-47-0	Benzonitrile	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
100-51-6	Benzyl alcohol	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
100-52-7	Benzaldehyde	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
10028-15-6	Ozone	1.44E-01	cm^2/s	[1]	1.67E-05	cm^2/s	[1]
10028-17-8	Tritium	2.76E-01	cm^2/s	[1]	1.00E+06	cm^2/s	[8]
10045-97-3	Cesium-137	7.15E-02	cm^2/s	[1]	8.28E-06	cm^2/s	[1]
10061-01-5	cis-1,3-Dichloropropene	7.65E-02	cm^2/s	[3]	1.02E-05	cm^2/s	[3]
10061-02-6	trans-1,3-Dichloropropene	7.63E-02	cm^2/s	[3]	1.01E-05	cm^2/s	[3]
10098-91-6	Yttrium-90	9.47E-02	cm^2/s	[1]	1.10E-05	cm^2/s	[1]
10098-97-2	Strontium-90	9.47E-02	cm^2/s	[1]	1.10E-05	cm^2/s	[1]
101-55-3	4-Bromophenylphenyl ether	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
101-77-9	4,4-Methylenedianiline	5.59E-02	cm^2/s	[3]	6.53E-06	cm^2/s	[3]
10102-44-0	Nitrogen dioxide	1.48E-01	cm^2/s	[1]	1.71E-05	cm^2/s	[1]
10198-40-0	Cobalt-60	1.24E-01	cm^2/s	[1]	1.44E-05	cm^2/s	[1]
103-33-3	Azobenzene	3.59E-02	cm^2/s	[3]	7.47E-06	cm^2/s	[3]
103-65-1	n-Propyl benzene (Isocumene)	6.02E-02	cm^2/s	[3]	7.83E-06	cm^2/s	[3]
104-51-8	n-Butylbenzene	5.28E-02	cm^2/s	[3]	7.33E-06	cm^2/s	[3]
104-76-7	2-Ethyl-1-hexanol	7.40E-02	cm^2/s	[1]	8.56E-06	cm^2/s	[1]
105-67-9	2,4-Dimethylphenol	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
10595-95-6	n-Nitrosomethylethylamine	9.60E-02	cm^2/s	[3]	1.12E-05	cm^2/s	[3]
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	6.26E-02	cm^2/s	[3]	8.66E-06	cm^2/s	[3]
106-44-5	p-Cresol (4-methyl phenol)	7.40E-02	cm^2/s	[2]	1.00E-05	cm^2/s	[2]

Table 2-3 Air and Water Diffusivity

CAS Registry Number	Constituent Name	Air Diffusivity (D_a)	Units for Air Diffusivity	Reference	Water Diffusivity (D_w)	Units for Water Diffusivity	Reference
106-46-7	1,4-Dichlorobenzene	6.90E-02	cm^2/s	[2]	7.90E-06	cm^2/s	[2]
106-47-8	p-Chloroaniline	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
106-49-0	p-Toluidine	7.12E-02	cm^2/s	[3]	8.98E-06	cm^2/s	[3]
106-51-4	Quinone	8.37E-02	cm^2/s	[1]	9.70E-06	cm^2/s	[1]
106-88-7	1,2-Epoxybutane	9.29E-02	cm^2/s	[3]	1.04E-05	cm^2/s	[3]
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	8.60E-02	cm^2/s	[2]	9.80E-06	cm^2/s	[2]
106-93-4	Ethylene dibromide	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
106-99-0	1,3-Butadiene	1.00E-01	cm^2/s	[3]	1.03E-05	cm^2/s	[3]
107-02-8	Acrolein	1.05E-01	cm^2/s	[2]	1.22E-05	cm^2/s	[2]
107-05-1	3-Chloropropene	9.36E-02	cm^2/s	[3]	1.08E-05	cm^2/s	[3]
107-06-2	1,2-Dichloroethane	1.04E-01	cm^2/s	[2]	9.90E-06	cm^2/s	[2]
107-12-0	Propionitrile	1.10E-01	cm^2/s	[3]	1.18E-05	cm^2/s	[3]
107-13-1	Acrylonitrile	1.22E-01	cm^2/s	[2]	1.34E-05	cm^2/s	[2]
107-19-7	Propargyl alcohol	1.17E-01	cm^2/s	[3]	1.31E-05	cm^2/s	[3]
107-21-1	Ethylene glycol (1,2-ethanediol)	1.17E-01	cm^2/s	[3]	1.36E-05	cm^2/s	[3]
107-98-2	Propylene glycol monomethyl ether	8.31E-02	cm^2/s	[3]	9.96E-06	cm^2/s	[3]
108-05-4	Acetic acid vinyl ester	8.50E-02	cm^2/s	[2]	9.20E-06	cm^2/s	[2]
108-10-1	4-Methyl-2-pentanone	7.50E-02	cm^2/s	[2]	7.80E-06	cm^2/s	[2]
108-39-4	m-Cresol	7.40E-02	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
108-60-1	bis (2-Chloroisopropyl)ether	3.99E-02	cm^2/s	[3]	7.36E-06	cm^2/s	[3]
108-67-8	1,3,5-Trimethylbenzene	6.02E-02	cm^2/s	[2]	8.67E-06	cm^2/s	[2]
108-86-1	Bromobenzene (Phenyl bromide)	5.37E-02	cm^2/s	[3]	9.30E-06	cm^2/s	[3]
108-87-2	Methylcyclohexane	7.00E-02	cm^2/s	[3]	8.27E-06	cm^2/s	[3]
108-88-3	Toluene	8.70E-02	cm^2/s	[2]	8.60E-06	cm^2/s	[2]
108-90-7	Chlorobenzene	7.30E-02	cm^2/s	[2]	8.70E-06	cm^2/s	[2]
108-94-1	Cyclohexanone	7.68E-02	cm^2/s	[3]	9.38E-06	cm^2/s	[3]
108-95-2	Phenol	8.20E-02	cm^2/s	[2]	9.10E-06	cm^2/s	[2]
109-74-0	n-Butanenitrile	1.13E-01	cm^2/s	[1]	1.31E-05	cm^2/s	[1]
109-75-1	3-Butenenitrile	1.15E-01	cm^2/s	[1]	1.33E-05	cm^2/s	[1]
109-77-3	Malononitrile	1.15E-01	cm^2/s	[3]	1.36E-05	cm^2/s	[3]

Table 2-3 Air and Water Diffusivity

CAS Registry Number	Constituent Name	Air Diffusivity (D_a)	Units for Air Diffusivity	Reference	Water Diffusivity (D_w)	Units for Water Diffusivity	Reference
109-86-4	2-Methoxyethanol	9.52E-02	cm^2/s	[3]	1.10E-05	cm^2/s	[3]
109-99-9	Tetrahydrofuran	9.80E-02	cm^2/s	[2]	1.05E-05	cm^2/s	[2]
110-00-9	Furan	1.03E-01	cm^2/s	[3]	1.17E-05	cm^2/s	[3]
110-54-3	n-Hexane	7.31E-02	cm^2/s	[3]	8.17E-06	cm^2/s	[3]
110-59-8	Pentanenitrile	9.97E-02	cm^2/s	[1]	1.15E-05	cm^2/s	[1]
110-80-5	2-Ethoxyethanol	8.18E-02	cm^2/s	[3]	9.73E-06	cm^2/s	[3]
110-82-7	Cyclohexane	8.00E-02	cm^2/s	[3]	9.11E-06	cm^2/s	[3]
110-83-8	Cyclohexene	1.01E-01	cm^2/s	[3]	1.17E-05	cm^2/s	[3]
110-86-1	Pyridine	9.10E-02	cm^2/s	[2]	7.60E-06	cm^2/s	[2]
111-15-9	Ethylene glycol monoethyl ether acetate	5.70E-02	cm^2/s	[3]	7.98E-06	cm^2/s	[3]
111-44-4	Bis(2-chloroethyl)ether	4.13E-02	cm^2/s	[2]	9.49E-06	cm^2/s	[2]
111-65-9	n-Octane	8.07E-02	cm^2/s	[1]	9.34E-06	cm^2/s	[1]
111-76-2	2-Butoxyethanol	6.26E-02	cm^2/s	[3]	8.14E-06	cm^2/s	[3]
111-84-2	n-Nonane	5.14E-02	cm^2/s	[3]	6.77E-06	cm^2/s	[3]
111-91-1	Bis(2-chloroethoxy)methane	6.12E-02	cm^2/s	[3]	7.15E-06	cm^2/s	[3]
112-30-1	1-Decanol	6.49E-02	cm^2/s	[3]	7.59E-06	cm^2/s	[3]
112-31-2	Decanal	6.55E-02	cm^2/s	[1]	7.58E-06	cm^2/s	[1]
112-40-3	Dodecane	6.18E-02	cm^2/s	[1]	7.16E-06	cm^2/s	[1]
1120-21-4	Undecane	6.55E-02	cm^2/s	[1]	7.58E-06	cm^2/s	[1]
1120-71-4	1,3-Propane sultone	7.31E-02	cm^2/s	[3]	1.04E-05	cm^2/s	[3]
117-81-7	Bis(2-ethylhexyl) phthalate	3.51E-02	cm^2/s	[2]	3.66E-06	cm^2/s	[2]
117-84-0	Di-n-octylphthalate	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
118-74-1	Hexachlorobenzene	5.42E-02	cm^2/s	[2]	5.91E-06	cm^2/s	[2]
119-90-4	3,3'-Dimethoxybenzidine	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
120-12-7	Anthracene	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
120-82-1	1,2,4-Trichlorobenzene	3.00E-02	cm^2/s	[2]	8.23E-06	cm^2/s	[2]
120-83-2	2,4-Dichlorophenol	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
121-14-2	2,4-Dinitrotoluene	2.03E-01	cm^2/s	[2]	7.06E-06	cm^2/s	[2]
122-39-4	N,N-Diphenylamine	4.17E-02	cm^2/s	[3]	7.63E-06	cm^2/s	[3]
122-66-7	1,2-Diphenylhydrazine	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
123-33-1	Maleic hydrazide	8.17E-02	cm^2/s	[3]	9.55E-06	cm^2/s	[3]
123-38-6	Propionaldehyde	1.10E-01	cm^2/s	[3]	1.22E-05	cm^2/s	[3]

Table 2-3 Air and Water Diffusivity

CAS Registry Number	Constituent Name	Air Diffusivity (D_a)	Units for Air Diffusivity	Reference	Water Diffusivity (D_w)	Units for Water Diffusivity	Reference
123-72-8	Butanal	1.10E-01	cm^2/s	[1]	1.27E-05	cm^2/s	[1]
123-91-1	1,4-Dioxan	2.29E-01	cm^2/s	[2]	1.02E-05	cm^2/s	[2]
124-18-5	Decane	4.51E-02	cm^2/s	[3]	6.40E-06	cm^2/s	[3]
124-38-9	Carbon dioxide	1.52E-01	cm^2/s	[1]	1.76E-05	cm^2/s	[1]
124-48-1	Chlorodibromomethane	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
126-73-8	Tributyl phosphate	2.12E-02	cm^2/s	[3]	5.23E-06	cm^2/s	[3]
126-98-7	2-Methyl-2-propenenitrile	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
127-18-4	1,1,2,2-Tetrachloroethene	7.20E-02	cm^2/s	[2]	8.20E-06	cm^2/s	[2]
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	2.25E-02	cm^2/s	[3]	5.57E-06	cm^2/s	[3]
129-00-0	Pyrene	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
131-11-3	Dimethyl Phthalate	5.68E-02	cm^2/s	[2]	6.29E-06	cm^2/s	[2]
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	4.59E-02	cm^2/s	[3]	5.36E-06	cm^2/s	[3]
132-64-9	Dibenzofuran	4.10E-02	cm^2/s	[3]	7.38E-06	cm^2/s	[3]
133-06-2	Captan	2.62E-02	cm^2/s	[3]	6.90E-06	cm^2/s	[3]
1330-20-7	Xylenes (mixed isomers)	8.47E-02	cm^2/s	[3]	9.90E-06	cm^2/s	[3]
1336-36-3	Polychlorinated biphenyls	4.32E-02	cm^2/s	[3]	5.04E-06	cm^2/s	[3]
134-32-7	alpha-Naphthylamine	5.23E-02	cm^2/s	[3]	7.83E-06	cm^2/s	[3]
135-98-8	sec-Butylbenzene	5.28E-02	cm^2/s	[3]	7.34E-06	cm^2/s	[3]
13966-29-5	Uranium-234	5.00E-02	cm^2/s	[1]	5.79E-06	cm^2/s	[1]
13967-48-1	Ruthenium-106	8.49E-02	cm^2/s	[1]	9.83E-06	cm^2/s	[1]
13967-70-9	Cesium-134	7.26E-02	cm^2/s	[1]	8.41E-06	cm^2/s	[1]
13968-55-3	Uranium-233	5.02E-02	cm^2/s	[1]	5.81E-06	cm^2/s	[1]
13981-15-2	Curium-244	4.87E-02	cm^2/s	[1]	5.63E-06	cm^2/s	[1]
13981-16-3	Plutonium-238	4.95E-02	cm^2/s	[1]	5.73E-06	cm^2/s	[1]
13981-37-8	Nickel-63	1.20E-01	cm^2/s	[1]	1.39E-05	cm^2/s	[1]
13982-10-0	Plutonium-242	4.89E-02	cm^2/s	[1]	5.66E-06	cm^2/s	[1]
13982-63-3	Radium-226	5.12E-02	cm^2/s	[1]	5.93E-06	cm^2/s	[1]
13982-70-2	Uranium-236	4.97E-02	cm^2/s	[1]	5.76E-06	cm^2/s	[1]
13994-20-2	Neptunium-237	4.96E-02	cm^2/s	[1]	5.74E-06	cm^2/s	[1]
141-78-6	Acetic acid ethyl ester	8.23E-02	cm^2/s	[3]	9.70E-06	cm^2/s	[3]
14119-32-5	Plutonium-241	4.91E-02	cm^2/s	[1]	5.68E-06	cm^2/s	[1]
14119-33-6	Plutonium-240	4.92E-02	cm^2/s	[1]	5.70E-06	cm^2/s	[1]

Table 2-3 Air and Water Diffusivity

CAS Registry Number	Constituent Name	Air Diffusivity (D_a)	Units for Air Diffusivity	Reference	Water Diffusivity (D_w)	Units for Water Diffusivity	Reference
14133-76-7	Technetium-99	8.88E-02	cm^2/s	[1]	1.03E-05	cm^2/s	[1]
14158-29-3	Uranium-232	5.03E-02	cm^2/s	[1]	5.83E-06	cm^2/s	[1]
14234-35-6	Antimony-125	7.60E-02	cm^2/s	[1]	8.80E-06	cm^2/s	[1]
14265-44-2	Phosphate	9.13E-02	cm^2/s	[1]	1.06E-05	cm^2/s	[1]
14331-85-2	Protactinium-231	5.05E-02	cm^2/s	[1]	5.84E-06	cm^2/s	[1]
14336-70-0	Nickel-59	1.25E-01	cm^2/s	[1]	1.45E-05	cm^2/s	[1]
14391-16-3	Europium-155	6.59E-02	cm^2/s	[1]	7.63E-06	cm^2/s	[1]
145-73-3	Endothall	3.67E-02	cm^2/s	[3]	8.18E-06	cm^2/s	[3]
14596-10-2	Americium-241	4.91E-02	cm^2/s	[1]	5.68E-06	cm^2/s	[1]
14683-23-9	Europium-152	6.67E-02	cm^2/s	[1]	7.73E-06	cm^2/s	[1]
14762-75-5	Carbon-14	3.29E-01	cm^2/s	[1]	3.81E-05	cm^2/s	[1]
14797-55-8	Nitrate	1.21E-01	cm^2/s	[1]	1.40E-05	cm^2/s	[1]
14797-65-0	Nitrite	1.48E-01	cm^2/s	[1]	1.71E-05	cm^2/s	[1]
14808-79-8	Sulfate	1.19E-01	cm^2/s	[1]	1.37E-05	cm^2/s	[1]
14952-40-0	Actinium-227	5.11E-02	cm^2/s	[1]	5.91E-06	cm^2/s	[1]
14993-75-0	Americium-243	4.88E-02	cm^2/s	[1]	5.65E-06	cm^2/s	[1]
15046-84-1	Iodine-129	7.45E-02	cm^2/s	[1]	8.62E-06	cm^2/s	[1]
15117-48-3	Plutonium-239	4.93E-02	cm^2/s	[1]	5.71E-06	cm^2/s	[1]
15117-96-1	Uranium-235	4.99E-02	cm^2/s	[1]	5.78E-06	cm^2/s	[1]
15262-20-1	Radium-228	5.09E-02	cm^2/s	[1]	5.89E-06	cm^2/s	[1]
15510-73-3	Curium-242	4.89E-02	cm^2/s	[1]	5.66E-06	cm^2/s	[1]
15585-10-1	Europium-154	6.62E-02	cm^2/s	[1]	7.66E-06	cm^2/s	[1]
15594-54-4	Thorium-229	5.08E-02	cm^2/s	[1]	5.88E-06	cm^2/s	[1]
156-59-2	cis-1,2-Dichloroethene	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
156-60-5	1,2-trans-Dichloroethene	7.03E-02	cm^2/s	[2]	1.19E-05	cm^2/s	[2]
15715-94-3	Samarium-151	6.70E-02	cm^2/s	[1]	7.76E-06	cm^2/s	[1]
15751-77-6	Zirconium-93	9.26E-02	cm^2/s	[1]	1.07E-05	cm^2/s	[1]
15757-87-6	Curium-243	4.88E-02	cm^2/s	[1]	5.65E-06	cm^2/s	[1]
15758-45-9	Selenium-79	1.03E-01	cm^2/s	[1]	1.20E-05	cm^2/s	[1]
15832-50-5	Tin-126	7.56E-02	cm^2/s	[1]	8.76E-06	cm^2/s	[1]
1634-04-4	Methyl tert-butyl ether	7.53E-02	cm^2/s	[3]	8.59E-06	cm^2/s	[3]
16887-00-6	Chloride	1.76E-01	cm^2/s	[1]	2.04E-05	cm^2/s	[1]
16984-48-8	Fluoride	2.67E-01	cm^2/s	[1]	3.09E-05	cm^2/s	[1]

Table 2-3 Air and Water Diffusivity

CAS Registry Number	Constituent Name	Air Diffusivity (D_a)	Units for Air Diffusivity	Reference	Water Diffusivity (D_w)	Units for Water Diffusivity	Reference
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1.04E-01	cm^2/s	[2]	5.60E-06	cm^2/s	[2]
18540-29-9	Chromium(VI)	0.00E+00	cm^2/s	[2]	0.00E+00	cm^2/s	[2]
189-55-9	Dibenzo[a,i]pyrene	4.22E-02	cm^2/s	[3]	4.93E-06	cm^2/s	[3]
189-64-0	Dibenzo[a,h]pyrene	4.22E-02	cm^2/s	[3]	4.93E-06	cm^2/s	[3]
191-24-2	Benzo(g,h,i)perylene	4.48E-02	cm^2/s	[3]	5.23E-06	cm^2/s	[3]
191-30-0	Dibenzo(a,l)pyrene	4.22E-02	cm^2/s	[3]	4.93E-06	cm^2/s	[3]
192-65-4	Dibenzo[a,e]pyrene	4.22E-02	cm^2/s	[3]	4.93E-06	cm^2/s	[3]
192-97-2	Benzo(e)pyrene	4.76E-02	cm^2/s	[1]	5.51E-06	cm^2/s	[1]
193-39-5	Indeno(1,2,3-cd)pyrene	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	9.44E-02	cm^2/s	[2]	8.00E-06	cm^2/s	[2]
205-82-3	Benzo[j]fluoranthene	4.76E-02	cm^2/s	[3]	5.56E-06	cm^2/s	[3]
205-99-2	Benzo(b)fluoranthene	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
206-44-0	Fluoranthene	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
207-08-9	Benzo(k)fluoranthene	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
208-96-8	Acenaphthylene	4.50E-02	cm^2/s	[3]	6.98E-06	cm^2/s	[3]
218-01-9	Chrysene	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
224-42-0	Dibenz[a,j]acridine	4.45E-02	cm^2/s	[3]	5.20E-06	cm^2/s	[3]
2245-38-7	2,3,5-Trimethylnaphthalene	6.19E-02	cm^2/s	[1]	7.16E-06	cm^2/s	[1]
226-36-8	Dibenz[a,h]acridine	4.45E-02	cm^2/s	[3]	5.20E-06	cm^2/s	[3]
22967-92-6	Methyl mercury	5.28E-02	cm^2/s	[2]	6.11E-06	cm^2/s	[2]
23950-58-5	Pronamide	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
24959-67-9	Bromide	1.02E-01	cm^2/s	[1]	1.19E-05	cm^2/s	[1]
27154-33-2	Trichlorofluoroethane	8.70E-02	cm^2/s	[7]	9.70E-06	cm^2/s	[7]
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	4.01E-02	cm^2/s	[3]	4.68E-06	cm^2/s	[3]
319-84-6	alpha-BHC	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
319-85-7	beta-BHC	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	4.32E-02	cm^2/s	[3]	5.04E-06	cm^2/s	[3]

Table 2-3 Air and Water Diffusivity

CAS Registry Number	Constituent Name	Air Diffusivity (D_a)	Units for Air Diffusivity	Reference	Water Diffusivity (D_w)	Units for Water Diffusivity	Reference
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	4.01E-02	cm^2/s	[3]	4.68E-06	cm^2/s	[3]
3268-87-9	Octachlorodibenzo(p)dioxin	8.69E-02	cm^2/s	[2]	8.00E-06	cm^2/s	[2]
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	3.75E-02	cm^2/s	[3]	4.38E-06	cm^2/s	[3]
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	9.05E-02	cm^2/s	[2]	8.00E-06	cm^2/s	[2]
3697-24-3	5-Methylchrysene	4.89E-02	cm^2/s	[3]	5.71E-06	cm^2/s	[3]
378253-40-8	Barium-137m	7.15E-02	cm^2/s	[1]	8.28E-06	cm^2/s	[1]
378253-44-2	Cadmium-113m	8.13E-02	cm^2/s	[1]	9.42E-06	cm^2/s	[1]
378782-82-2	Niobium-93m	9.26E-02	cm^2/s	[1]	1.07E-05	cm^2/s	[1]
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	3.75E-02	cm^2/s	[3]	4.38E-06	cm^2/s	[3]
39001-02-0	Octachlorodibenzofuran	1.95E-02	cm^2/s	[2]	8.00E-06	cm^2/s	[2]
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	9.44E-02	cm^2/s	[2]	8.00E-06	cm^2/s	[2]
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	3.53E-02	cm^2/s	[3]	4.12E-06	cm^2/s	[3]
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	9.88E-02	cm^2/s	[2]	8.00E-06	cm^2/s	[2]
4170-30-3	Crotonaldehyde (Propylene aldehyde)	9.60E-02	cm^2/s	[3]	1.08E-05	cm^2/s	[3]
41851-50-7	Chlorocyclopentadiene	8.79E-02	cm^2/s	[3]	1.03E-05	cm^2/s	[3]
460-19-5	Cyanogen (oxalonitrile)	1.24E-01	cm^2/s	[3]	1.38E-05	cm^2/s	[3]
4786-20-3	2-Butenenitrile	1.15E-01	cm^2/s	[1]	1.33E-05	cm^2/s	[1]
50-00-0	Formaldehyde	1.78E-01	cm^2/s	[2]	1.98E-05	cm^2/s	[2]
50-32-8	Benzo(a)pyrene	4.30E-02	cm^2/s	[2]	9.00E-06	cm^2/s	[2]
506-68-3	Cyanogen bromide (bromocyanide)	9.84E-02	cm^2/s	[3]	1.41E-05	cm^2/s	[3]
506-77-4	Cyanogen chloride	1.21E-01	cm^2/s	[3]	1.42E-05	cm^2/s	[3]
51-28-5	2,4-Dinitrophenol	2.73E-02	cm^2/s	[2]	9.06E-06	cm^2/s	[2]

Table 2-3 Air and Water Diffusivity

CAS Registry Number	Constituent Name	Air Diffusivity (D_a)	Units for Air Diffusivity	Reference	Water Diffusivity (D_w)	Units for Water Diffusivity	Reference
51-79-6	Ethyl carbamate (urethane)	8.48E-02	cm^2/s	[3]	1.02E-05	cm^2/s	[3]
510-15-6	Chlorobenzilate	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	2.35E-02	cm^2/s	[2]	6.01E-06	cm^2/s	[2]
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	3.75E-02	cm^2/s	[3]	4.38E-06	cm^2/s	[3]
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	4.47E-02	cm^2/s	[3]	8.25E-06	cm^2/s	[3]
53-70-3	Dibenz[a,h]anthracene	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
532-27-4	2-Chloroacetophenone	5.22E-02	cm^2/s	[3]	8.73E-06	cm^2/s	[3]
534-52-1	4,6-Dinitro-o-cresol	5.59E-02	cm^2/s	[3]	6.53E-06	cm^2/s	[3]
5385-75-1	Dibenzo(a,e)fluoranthene	4.22E-02	cm^2/s	[6]	4.93E-06	cm^2/s	[6]
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	8.79E-02	cm^2/s	[3]	1.12E-05	cm^2/s	[3]
540-73-8	1,2-Dimethylhydrazine	1.06E-01	cm^2/s	[3]	1.16E-05	cm^2/s	[3]
540-84-1	2,2,4-Trimethylpentane	5.74E-02	cm^2/s	[3]	7.06E-06	cm^2/s	[3]
541-73-1	1,3-Dichlorobenzene	6.92E-02	cm^2/s	[2]	7.86E-06	cm^2/s	[2]
542-75-6	1,3-Dichloropropene	6.26E-02	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
542-88-1	Bis(chloromethyl)ether	7.63E-02	cm^2/s	[3]	1.04E-05	cm^2/s	[3]
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	2.03E-02	cm^2/s	[2]	8.00E-06	cm^2/s	[2]
56-23-5	Carbon tetrachloride	7.80E-02	cm^2/s	[2]	8.80E-06	cm^2/s	[2]
56-49-5	3-Methylcholanthrene	2.41E-02	cm^2/s	[3]	6.14E-06	cm^2/s	[3]
56-55-3	Benzo(a)anthracene	5.10E-02	cm^2/s	[2]	9.00E-06	cm^2/s	[2]
57-12-5	Cyanide	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
57-24-9	Strychnine	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
57-74-9	Chlordane	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	2.23E-02	cm^2/s	[2]	8.00E-06	cm^2/s	[2]
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	2.23E-02	cm^2/s	[2]	8.00E-06	cm^2/s	[2]
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	2.12E-02	cm^2/s	[2]	8.00E-06	cm^2/s	[2]
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	4.01E-02	cm^2/s	[3]	4.68E-06	cm^2/s	[3]

Table 2-3 Air and Water Diffusivity

CAS Registry Number	Constituent Name	Air Diffusivity (D_a)	Units for Air Diffusivity	Reference	Water Diffusivity (D_w)	Units for Water Diffusivity	Reference
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	9.44E-02	cm^2/s	[2]	8.00E-06	cm^2/s	[2]
58-89-9	gamma-BHC (Lindane)	4.33E-02	cm^2/s	[3]	5.06E-06	cm^2/s	[3]
58-90-2	2,3,4,6-Tetrachlorophenol	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
581-42-0	2,6-Dimethylnaphthalene	6.55E-02	cm^2/s	[1]	7.58E-06	cm^2/s	[1]
584-84-9	2,4-Toluene diisocyanate	2.03E-01	cm^2/s	[4]	7.06E-06	cm^2/s	[4]
589-38-8	3-Hexanone	8.81E-02	cm^2/s	[1]	1.02E-05	cm^2/s	[1]
59-50-7	4-Chloro-3-methylphenol	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
59-89-2	N-Nitrosomorpholine	7.98E-02	cm^2/s	[3]	9.33E-06	cm^2/s	[3]
591-50-4	Benzene, iodo-	5.48E-02	cm^2/s	[1]	6.35E-06	cm^2/s	[1]
591-78-6	2-Hexanone	7.04E-02	cm^2/s	[3]	8.44E-06	cm^2/s	[3]
593-60-2	Bromoethene (Vinyl bromide)	8.62E-02	cm^2/s	[3]	1.17E-05	cm^2/s	[3]
593-74-8	Dimethyl Mercury	3.89E-02	cm^2/s	[3]	1.16E-05	cm^2/s	[3]
60-11-7	Dimethyl aminoazobenzene	5.13E-02	cm^2/s	[3]	6.00E-06	cm^2/s	[3]
60-29-7	Ethyl ether	8.52E-02	cm^2/s	[3]	9.36E-06	cm^2/s	[3]
60-35-5	Acetamide	1.16E-01	cm^2/s	[3]	1.31E-05	cm^2/s	[3]
602-87-9	5-Nitroacenaphthene	5.57E-02	cm^2/s	[3]	6.51E-06	cm^2/s	[3]
606-20-2	2,6-Dinitrotoluene	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
608-93-5	Pentachlorobenzene	5.70E-02	cm^2/s	[2]	6.30E-06	cm^2/s	[2]
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	2.12E-02	cm^2/s	[2]	8.00E-06	cm^2/s	[2]
61626-71-9	Dichloropentadiene	8.79E-02	cm^2/s	[5]	1.03E-05	cm^2/s	[5]
62-50-0	Ethyl methanesulfonate	7.63E-02	cm^2/s	[2]	8.84E-06	cm^2/s	[2]
62-53-3	Aniline	7.00E-02	cm^2/s	[2]	8.30E-06	cm^2/s	[2]
62-75-9	N-Nitroso-N,N-dimethylamine	9.88E-02	cm^2/s	[3]	1.15E-05	cm^2/s	[3]
621-64-7	N-Nitroso-di-n-propylamine	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
624-83-9	Methyl isocyanate	1.17E-01	cm^2/s	[3]	1.31E-05	cm^2/s	[3]
628-73-9	Hexanenitrile	8.99E-02	cm^2/s	[1]	1.04E-05	cm^2/s	[1]
630-08-0	Carbon monoxide	1.73E-01	cm^2/s	[3]	1.79E-05	cm^2/s	[3]
630-20-6	1,1,1,2-Tetrachloroethane	7.10E-02	cm^2/s	[2]	7.90E-06	cm^2/s	[2]
64-18-6	Formic acid (methanoic acid)	7.90E-02	cm^2/s	[2]	1.37E-06	cm^2/s	[2]

Table 2-3 Air and Water Diffusivity

CAS Registry Number	Constituent Name	Air Diffusivity (D_a)	Units for Air Diffusivity	Reference	Water Diffusivity (D_w)	Units for Water Diffusivity	Reference
65-85-0	Benzoic acid	1.00E-03	cm^2/s	[2]	7.97E-06	cm^2/s	[2]
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	4.01E-02	cm^2/s	[3]	4.68E-06	cm^2/s	[3]
67-56-1	Methyl alcohol	1.50E-01	cm^2/s	[2]	1.64E-05	cm^2/s	[2]
67-63-0	2-Propyl alcohol	1.03E-01	cm^2/s	[3]	1.12E-05	cm^2/s	[3]
67-64-1	2-Propanone (Acetone)	1.24E-01	cm^2/s	[2]	1.14E-05	cm^2/s	[2]
67-66-3	Chloroform	1.04E-01	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
67-72-1	Hexachloroethane	2.50E-03	cm^2/s	[2]	6.80E-06	cm^2/s	[2]
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	2.03E-02	cm^2/s	[2]	8.00E-06	cm^2/s	[2]
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	3.75E-02	cm^2/s	[3]	4.38E-06	cm^2/s	[3]
70-30-4	Hexachlorophene	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	4.32E-02	cm^2/s	[3]	5.04E-06	cm^2/s	[3]
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	2.12E-02	cm^2/s	[2]	8.00E-06	cm^2/s	[2]
71-36-3	n-Butyl alcohol	9.00E-02	cm^2/s	[3]	1.01E-05	cm^2/s	[3]
71-43-2	Benzene	8.80E-02	cm^2/s	[2]	1.02E-05	cm^2/s	[2]
71-55-6	1,1,1-Trichloroethane	7.80E-02	cm^2/s	[2]	8.80E-06	cm^2/s	[2]
72-43-5	Methoxychlor	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
72-55-9	4,4-DDE	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	2.12E-02	cm^2/s	[2]	8.00E-06	cm^2/s	[2]
74-83-9	Bromomethane	7.28E-02	cm^2/s	[2]	1.21E-05	cm^2/s	[2]
74-87-3	Chloromethane	1.26E-01	cm^2/s	[2]	6.50E-06	cm^2/s	[2]
74-88-4	Iodomethane	7.49E-02	cm^2/s	[3]	1.27E-05	cm^2/s	[3]
74-95-3	Methylene bromide	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
74-97-5	Bromochloromethane	7.87E-02	cm^2/s	[3]	1.22E-05	cm^2/s	[3]
7429-90-5	Aluminum	2.11E-01	cm^2/s	[1]	2.45E-05	cm^2/s	[1]
7439-89-6	Iron	1.30E-01	cm^2/s	[1]	1.51E-05	cm^2/s	[1]
7439-92-1	Lead	7.72E-02	cm^2/s	[2]	9.57E-06	cm^2/s	[2]
7439-93-2	Lithium	5.22E-01	cm^2/s	[1]	6.05E-05	cm^2/s	[1]

Table 2-3 Air and Water Diffusivity

CAS Registry Number	Constituent Name	Air Diffusivity (D_a)	Units for Air Diffusivity	Reference	Water Diffusivity (D_w)	Units for Water Diffusivity	Reference
7439-95-4	Magnesium	2.26E-01	cm^2/s	[1]	2.62E-05	cm^2/s	[1]
7439-96-5	Manganese	1.31E-01	cm^2/s	[1]	1.52E-05	cm^2/s	[1]
7439-97-6	Mercury	1.09E-02	cm^2/s	[2]	3.01E-05	cm^2/s	[2]
7439-98-7	Molybdenum	9.07E-02	cm^2/s	[1]	1.05E-05	cm^2/s	[1]
7440-02-0	Nickel	7.72E-02	cm^2/s	[2]	9.57E-06	cm^2/s	[2]
7440-16-6	Rhodium	8.65E-02	cm^2/s	[1]	1.00E-05	cm^2/s	[1]
7440-22-4	Silver	7.72E-02	cm^2/s	[2]	9.57E-06	cm^2/s	[2]
7440-23-5	Sodium	2.35E-01	cm^2/s	[1]	2.72E-05	cm^2/s	[1]
7440-24-6	Strontium (total)	9.63E-02	cm^2/s	[1]	1.12E-05	cm^2/s	[1]
7440-25-7	Tantalum	5.94E-02	cm^2/s	[1]	6.88E-06	cm^2/s	[1]
7440-28-0	Thallium	7.72E-02	cm^2/s	[2]	9.57E-06	cm^2/s	[2]
7440-29-1	Thorium-232	5.03E-02	cm^2/s	[1]	5.83E-06	cm^2/s	[1]
7440-31-5	Tin	7.87E-02	cm^2/s	[1]	9.11E-06	cm^2/s	[1]
7440-33-7	Tungsten	5.88E-02	cm^2/s	[1]	6.80E-06	cm^2/s	[1]
7440-36-0	Antimony	7.72E-02	cm^2/s	[2]	9.57E-06	cm^2/s	[2]
7440-38-2	Arsenic	7.72E-02	cm^2/s	[2]	9.57E-06	cm^2/s	[2]
7440-39-3	Barium	7.72E-02	cm^2/s	[2]	9.57E-06	cm^2/s	[2]
7440-41-7	Beryllium	7.72E-02	cm^2/s	[2]	9.57E-06	cm^2/s	[2]
7440-43-9	Cadmium	7.72E-02	cm^2/s	[2]	9.57E-06	cm^2/s	[2]
7440-47-3	Chromium	1.27E-01	cm^2/s	[2]	1.41E-05	cm^2/s	[2]
7440-48-4	Cobalt	1.25E-01	cm^2/s	[1]	1.45E-05	cm^2/s	[1]
7440-50-8	Copper	1.19E-01	cm^2/s	[1]	1.38E-05	cm^2/s	[1]
7440-61-1	Uranium	4.95E-02	cm^2/s	[1]	5.73E-06	cm^2/s	[1]
7440-61-1R	Uranium-238	4.95E-02	cm^2/s	[1]	5.73E-06	cm^2/s	[1]
7440-62-2	Vanadium	1.38E-01	cm^2/s	[1]	1.60E-05	cm^2/s	[1]
7440-65-5	Yttrium	9.54E-02	cm^2/s	[1]	1.10E-05	cm^2/s	[1]
7440-66-6	Zinc	7.72E-02	cm^2/s	[2]	9.57E-06	cm^2/s	[2]
7440-67-7	Zirconium	9.38E-02	cm^2/s	[1]	1.09E-05	cm^2/s	[1]
7446-09-5	Sulfur dioxide	1.19E-01	cm^2/s	[1]	1.37E-05	cm^2/s	[1]
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	4.01E-02	cm^2/s	[3]	4.68E-06	cm^2/s	[3]
7487-94-7	Mercuric chloride (HgCl2)	4.53E-02	cm^2/s	[2]	5.25E-06	cm^2/s	[2]
75-00-3	Chloroethane	2.71E-01	cm^2/s	[2]	1.15E-05	cm^2/s	[2]

Table 2-3 Air and Water Diffusivity

CAS Registry Number	Constituent Name	Air Diffusivity (D_a)	Units for Air Diffusivity	Reference	Water Diffusivity (D_w)	Units for Water Diffusivity	Reference
75-01-4	1-Chloroethene	1.06E-01	cm^2/s	[2]	1.23E-05	cm^2/s	[2]
75-02-5	Fluoroethene (vinyl fluoride)	1.48E-01	cm^2/s	[1]	1.71E-05	cm^2/s	[1]
75-05-8	Acetonitrile	1.28E-01	cm^2/s	[2]	1.66E-05	cm^2/s	[2]
75-07-0	Acetaldehyde	1.24E-01	cm^2/s	[2]	1.41E-05	cm^2/s	[2]
75-09-2	Dichloromethane (Methylene Chloride)	1.01E-01	cm^2/s	[2]	1.17E-05	cm^2/s	[2]
75-15-0	Carbon disulfide	1.04E-01	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
75-21-8	Ethylene oxide (Oxirane)	1.04E-01	cm^2/s	[2]	1.45E-05	cm^2/s	[2]
75-25-2	Bromoform	1.49E-02	cm^2/s	[2]	1.03E-05	cm^2/s	[2]
75-27-4	Bromodichloromethane	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
75-29-6	2-Chloropropane	8.85E-02	cm^2/s	[3]	1.01E-05	cm^2/s	[3]
75-34-3	1,1-Dichloroethane	7.42E-02	cm^2/s	[2]	1.05E-05	cm^2/s	[2]
75-35-4	1,1-Dichloroethene	9.00E-02	cm^2/s	[2]	1.04E-05	cm^2/s	[2]
75-44-5	Phosgene (hydrogen phosphide)	8.93E-02	cm^2/s	[3]	1.17E-05	cm^2/s	[3]
75-45-6	Chlorodifluoromethane	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
75-50-3	Trimethylamine	1.25E-01	cm^2/s	[1]	1.45E-05	cm^2/s	[1]
75-69-4	Trichlorofluoromethane	8.70E-02	cm^2/s	[2]	9.70E-06	cm^2/s	[2]
75-71-8	Dichlorodifluoromethane	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
76-01-7	Pentachloroethane	3.15E-02	cm^2/s	[3]	8.57E-06	cm^2/s	[3]
76-13-1	1,2,2-Trichlorotrifluoroethane	3.76E-02	cm^2/s	[3]	8.59E-06	cm^2/s	[3]
76-44-8	Heptachlor	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
764-41-0	1,4-Dichloro-2-butene	6.65E-02	cm^2/s	[3]	9.29E-06	cm^2/s	[3]
7647-01-0	Hydrogen chloride	1.73E-01	cm^2/s	[1]	2.00E-05	cm^2/s	[1]
765-34-4	Glycidylaldehyde	1.06E-01	cm^2/s	[3]	1.26E-05	cm^2/s	[3]
7664-39-3	Hydrogen Fluoride	2.58E-01	cm^2/s	[1]	2.99E-05	cm^2/s	[1]
7664-41-7	Ammonia/Ammonium	2.87E-01	cm^2/s	[1]	3.32E-05	cm^2/s	[1]
77-47-4	Hexachlorocyclopentadiene	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
77-78-1	Dimethyl sulfate	6.92E-02	cm^2/s	[3]	9.90E-06	cm^2/s	[3]
7704-34-9	Total Sulfur (thermodynamically stable)	1.88E-01	cm^2/s	[1]	2.18E-05	cm^2/s	[1]
7723-14-0	Phosphorus	1.93E-01	cm^2/s	[1]	2.23E-05	cm^2/s	[1]
7782-41-4	Fluorine gas F2	1.68E-01	cm^2/s	[1]	1.95E-05	cm^2/s	[1]

Table 2-3 Air and Water Diffusivity

CAS Registry Number	Constituent Name	Air Diffusivity (D_a)	Units for Air Diffusivity	Reference	Water Diffusivity (D_w)	Units for Water Diffusivity	Reference
7782-49-2	Selenium	7.72E-02	cm^2/s	[2]	9.57E-06	cm^2/s	[2]
7782-50-5	Chlorine	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
78-83-1	2-Methylpropyl alcohol	8.97E-02	cm^2/s	[3]	1.00E-05	cm^2/s	[3]
78-87-5	1,2-Dichloropropane	7.82E-02	cm^2/s	[2]	8.73E-06	cm^2/s	[2]
78-93-3	2-Butanone	8.08E-02	cm^2/s	[2]	9.80E-06	cm^2/s	[2]
79-00-5	1,1,2-Trichloroethane	7.80E-02	cm^2/s	[2]	8.80E-06	cm^2/s	[2]
79-01-6	1,1,2-Trichloroethylene	7.90E-02	cm^2/s	[2]	9.10E-06	cm^2/s	[2]
79-10-7	2-Propenoic acid	1.03E-01	cm^2/s	[3]	1.20E-05	cm^2/s	[3]
79-34-5	1,1,2,2-Tetrachloroethane	7.10E-02	cm^2/s	[2]	7.90E-06	cm^2/s	[2]
79-46-9	2-Nitropropane	8.47E-02	cm^2/s	[3]	1.02E-05	cm^2/s	[3]
80-62-6	Methyl methacrylate	7.50E-02	cm^2/s	[3]	9.21E-06	cm^2/s	[3]
82-68-8	Pentachloronitrobenzene (PCNB)	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
822-06-0	Hexamethylene-1,5-diisocyanate	4.04E-02	cm^2/s	[3]	7.23E-06	cm^2/s	[3]
823-40-5	Toluene-2,6-diamine	7.72E-02	cm^2/s	[3]	9.02E-06	cm^2/s	[3]
83-32-9	Acenaphthene	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
832-69-9	1-Methylphenanthrene	5.70E-02	cm^2/s	[1]	6.60E-06	cm^2/s	[1]
84-66-2	Diethyl phthalate	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
84-74-2	Di-n-butylphthalate	4.38E-02	cm^2/s	[2]	7.86E-06	cm^2/s	[2]
85-01-8	Phenanthrene	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	7.10E-02	cm^2/s	[2]	8.60E-06	cm^2/s	[2]
85-68-7	Butylbenzylphthalate	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
86-73-7	Fluorene	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
87-61-6	1,2,3-Trichlorobenzene	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
87-68-3	Hexachlorobutadiene	5.61E-02	cm^2/s	[2]	6.16E-06	cm^2/s	[2]
87-86-5	Pentachlorophenol	5.60E-02	cm^2/s	[2]	6.10E-06	cm^2/s	[2]
88-06-2	2,4,6-Trichlorophenol	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
88-74-4	o-Nitroaniline (2-nitroaniline)	7.30E-02	cm^2/s	[2]	8.00E-06	cm^2/s	[2]
88-75-5	2-Nitrophenol	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
90-04-0	o-Anisidine	6.52E-02	cm^2/s	[3]	8.91E-06	cm^2/s	[3]
90-12-0	1-Methylnaphthalene	5.28E-02	cm^2/s	[3]	7.85E-06	cm^2/s	[3]

Table 2-3 Air and Water Diffusivity

CAS Registry Number	Constituent Name	Air Diffusivity (D_a)	Units for Air Diffusivity	Reference	Water Diffusivity (D_w)	Units for Water Diffusivity	Reference
91-20-3	Naphthalene	5.90E-02	cm^2/s	[2]	7.50E-06	cm^2/s	[2]
91-22-5	Quinoline	6.18E-02	cm^2/s	[3]	8.69E-06	cm^2/s	[3]
91-57-6	2-Methylnaphthalene	5.24E-02	cm^2/s	[3]	7.78E-06	cm^2/s	[3]
91-58-7	2-Chloronaphthalene	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
91-94-1	3,3'-Dichlorobenzidine	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
92-52-4	1,1`-Biphenyl	4.71E-02	cm^2/s	[3]	7.56E-06	cm^2/s	[3]
924-16-3	N-Nitroso-di-n-Buetylamine	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
94-75-7	2,4-D	5.20E-02	cm^2/s	[3]	6.07E-06	cm^2/s	[3]
95-48-7	o-Cresol	7.40E-02	cm^2/s	[2]	8.30E-06	cm^2/s	[2]
95-49-8	o-Chlorotoluene	6.29E-02	cm^2/s	[3]	8.72E-06	cm^2/s	[3]
95-50-1	1,2-Dichlorobenzene	6.90E-02	cm^2/s	[2]	7.90E-06	cm^2/s	[2]
95-53-4	o-Toluidine	7.14E-02	cm^2/s	[2]	9.12E-06	cm^2/s	[2]
95-57-8	2-Chlorophenol	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
95-63-6	1,2,4-Trimethyl benzene	6.07E-02	cm^2/s	[3]	7.92E-06	cm^2/s	[3]
95-94-3	1,2,4,5-Tetrachlorobenzene	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
95-95-4	2,4,5-Trichlorophenol	2.91E-02	cm^2/s	[2]	7.03E-06	cm^2/s	[2]
96-12-8	1,2-Dibromo-3-chloropropane	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
96-18-4	1,2,3-Trichloropropane	7.10E-02	cm^2/s	[2]	7.90E-06	cm^2/s	[2]
96-45-7	Ethylene thiourea	8.69E-02	cm^2/s	[3]	1.02E-05	cm^2/s	[3]
97-63-2	Ethyl methacrylate	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
98-01-1	Furfural	8.53E-02	cm^2/s	[3]	1.07E-05	cm^2/s	[3]
98-06-6	tert-Butyl benzene	5.30E-02	cm^2/s	[3]	7.37E-06	cm^2/s	[3]
98-07-7	Benzotrichloride	3.13E-02	cm^2/s	[3]	7.75E-06	cm^2/s	[3]
98-82-8	Cumene	6.50E-02	cm^2/s	[2]	7.10E-06	cm^2/s	[2]
98-83-9	Methyl styrene (mixed isomers)	7.89E-02	cm^2/s	[3]	9.22E-06	cm^2/s	[3]
98-86-2	Acetophenone	6.00E-02	cm^2/s	[2]	8.73E-06	cm^2/s	[2]
98-95-3	Nitrobenzene	7.60E-02	cm^2/s	[2]	8.60E-06	cm^2/s	[2]
99-35-4	1,3,5-Trinitrobenzene	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
99-65-0	1,3-Dinitrobenzene	1.00E-03	cm^2/s	[2]	1.00E-05	cm^2/s	[2]
99-87-6	p-Cymene	5.27E-02	cm^2/s	[3]	7.32E-06	cm^2/s	[3]

Reference	Reference (source) for Air Diffusivity
[1]	Calculated value per Eq. A-2-4 in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm).
[2]	EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013).
[3]	ORNL. *The Risk Assessment Information System (RAIS) Database*. Copyright © 2013 Oak Ridge National Laboratory and The University of Tennessee, Oak Ridge, TN (http://rais.ornl.gov, accessed April 2014).
[4]	Surrogate value from 2,4-Dinitrotoluene.
[5]	Surrogate value from Chlorocyclopentadiene.
[6]	Surrogate value from Dibenzo[a,i]pyrene.
[7]	Surrogate value from Trichlorofluoromethane.

Reference	Reference (source) for Water Diffusivity
[1]	Calculated value per Eq. A-2-5 in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm).
[2]	EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013).
[3]	ORNL. *The Risk Assessment Information System (RAIS) Database*. Copyright © 2013 Oak Ridge National Laboratory and The University of Tennessee, Oak Ridge, TN (http://rais.ornl.gov, accessed April 2014).
[4]	Surrogate value from 2,4-Dinitrotoluene.
[5]	Surrogate value from Chlorocyclopentadiene.
[6]	Surrogate value from Dibenzo[a,i]pyrene.
[7]	Surrogate value from Trichlorofluoromethane.
[8]	Syracuse Research Corporation (SRC). *FatePointers Search Module*, Copyright © 2014 SRC, Inc., North Syracuse, NY (http://esc.syrres.com/fatepointer/search.asp).

Table 2-4 provides data for permeability constants, octanol/water partitioning coefficients, and organic carbon partitioning coefficients where available. The permeability constant is used in quantifying dose to a human receptor through a dermal adsorption exposure route. The octanol-water partitioning coefficient is used to estimate bioconcentration factors, as well as the organic carbon partition coefficient (when it is not available from a study). The organic carbon partition coefficient is used to assess constituent partitioning into exposure media such as soil, water, and sediment. The blank entries in the table indicate where data are not available.

Table 2-4 Permeability Constant, Octanol/Water Partitioning Coefficient, and Organic Carbon Partitioning Coefficient

CAS Registry Number	Constituent Name	Permeability Constant (*Kp*)	Units for Permeability Constant	Reference	Octanol-water Partition Coeff. (K_{ow})	Units for Octanol-water Partition Coeff.	Reference	Organic Carbon Partition Coeff. (K_{oc})	Units for Organic Carbon Partition Coeff.	Reference
100-02-7	p-Nitrophenol	4.83E-03	cm/hr	[3]	8.13E+01	unitless	[2]	7.55E+01	mL/g	[3]
100-21-0	Phthalic acid	3.91E-03	cm/hr	[3]	1.00E+02	unitless	[3]	7.92E+01	mL/g	[6]
100-25-4	1,4-Dinitrobenzene	1.67E-03	cm/hr	[3]	2.88E+01	unitless	[3]	3.52E+02	mL/g	[6]
100-40-3	4-Ethenylcyclohexene	1.58E-01	cm/hr	[2]	8.51E+03	unitless	[3]	1.55E+03	mL/g	[2]
100-41-4	Ethyl benzene	4.93E-02	cm/hr	[3]	1.26E+03	unitless	[2]	2.04E+02	mL/g	[3]
100-42-5	Styrene	3.72E-02	cm/hr	[3]	1.00E+03	unitless	[2]	9.12E+02	mL/g	[3]
100-44-7	Benzyl chloride	1.03E-02	cm/hr	[3]	2.00E+02	unitless	[2]	1.82E+02	mL/g	[3]
100-47-0	Benzonitrile	4.50E-03	cm/hr	[2]	3.63E+01	unitless	[8]	3.42E+01	mL/g	[3]
100-51-6	Benzyl alcohol	2.09E-03	cm/hr	[3]	1.26E+01	unitless	[2]	1.21E+01	mL/g	[3]
100-52-7	Benzaldehyde	3.83E-03	cm/hr	[3]	3.02E+01	unitless	[2]	2.85E+01	mL/g	[3]
10028-15-6	Ozone	1.00E-03	cm/hr	[1]	1.35E-01	unitless	[8]			
10028-17-8	Tritium				4.17E-02	unitless	[8]			
10045-97-3	Cesium-137									
10061-01-5	cis-1,3-Dichloropropene	8.34E-03	cm/hr	[3]	1.15E+02	unitless	[8]	6.61E+01	mL/g	[4]
10061-02-6	trans-1,3-Dichloropropene	8.34E-03	cm/hr	[3]	1.07E+02	unitless	[8]	6.61E+01	mL/g	[4]
10098-91-6	Yttrium-90									
10098-97-2	Strontium-90									
101-55-3	4-Bromophenylphenyl ether	1.20E-01	cm/hr	[3]	1.75E+05	unitless	[2]	1.43E+05	mL/g	[3]
101-77-9	4,4-Methylenedianiline	1.38E-03	cm/hr	[3]	3.89E+01	unitless	[3]	2.13E+03	mL/g	[6]
10102-44-0	Nitrogen dioxide	1.00E-03	cm/hr	[1]	2.63E-01	unitless	[8]			
10198-40-0	Cobalt-60									
103-33-3	Azobenzene	5.14E-02	cm/hr	[3]	6.61E+03	unitless	[3]	2.00E+03	mL/g	[4]
103-65-1	n-Propyl benzene (Isocumene)	9.39E-02	cm/hr	[3]	4.90E+03	unitless	[3]	7.41E+02	mL/g	[4]

Table 2-4 Permeability Constant, Octanol/Water Partitioning Coefficient, and Organic Carbon Partitioning Coefficient

CAS Registry Number	Constituent Name	Permeability Constant (*Kp*)	Units for Permeability Constant	Reference	Octanol-water Partition Coeff. (K_{ow})	Units for Octanol-water Partition Coeff.	Reference	Organic Carbon Partition Coeff. (K_{oc})	Units for Organic Carbon Partition Coeff.	Reference
104-51-8	n-Butylbenzene	2.25E-01	cm/hr	[3]	2.40E+04	unitless	[3]	3.52E+03	mL/g	[2]
104-76-7	2-Ethyl-1-hexanol	1.90E-01	cm/hr	[2]	5.37E+02	unitless	[8]	4.83E+02	mL/g	[1]
105-67-9	2,4-Dimethylphenol	1.09E-02	cm/hr	[3]	2.00E+02	unitless	[2]	1.82E+02	mL/g	[3]
10595-95-6	n-Nitrosomethylethylamine	5.33E-04	cm/hr	[3]	1.10E+00	unitless	[3]	4.35E+01	mL/g	[6]
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	4.98E-02	cm/hr	[3]	2.14E+03	unitless	[3]	3.75E+02	mL/g	[6]
106-44-5	p-Cresol (4-methyl phenol)	7.54E-03	cm/hr	[3]	7.94E+01	unitless	[2]	7.38E+01	mL/g	[3]
106-46-7	1,4-Dichlorobenzene	4.53E-02	cm/hr	[3]	3.16E+03	unitless	[2]	6.16E+02	mL/g	[3]
106-47-8	p-Chloroaniline	4.96E-03	cm/hr	[3]	6.76E+01	unitless	[2]	6.30E+01	mL/g	[3]
106-49-0	p-Toluidine	3.29E-03	cm/hr	[3]	2.45E+01	unitless	[3]	7.94E+01	mL/g	[4]
106-51-4	Quinone	5.26E-04	cm/hr	[2]	1.58E+00	unitless	[3]	1.57E+00	mL/g	[1]
106-88-7	1,2-Epoxybutane	2.31E-03	cm/hr	[3]	7.24E+00	unitless	[4]	9.91E+00	mL/g	[6]
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	9.44E-04	cm/hr	[3]	6.17E-01	unitless	[2]	6.20E-01	mL/g	[3]
106-93-4	Ethylene dibromide	2.78E-03	cm/hr	[3]	1.00E+02	unitless	[2]	9.25E+01	mL/g	[3]
106-99-0	1,3-Butadiene	1.64E-02	cm/hr	[3]	9.77E+01	unitless	[3]	3.96E+01	mL/g	[6]
107-02-8	Acrolein	7.48E-04	cm/hr	[3]	9.77E-01	unitless	[2]	9.80E-01	mL/g	[3]
107-05-1	3-Chloropropene	1.12E-02	cm/hr	[3]	8.51E+01	unitless	[4]	3.96E+01	mL/g	[6]
107-06-2	1,2-Dichloroethane	4.20E-03	cm/hr	[3]	3.16E+01	unitless	[2]	3.80E+01	mL/g	[3]
107-12-0	Propionitrile	9.82E-04	cm/hr	[3]	1.45E+00	unitless	[3]	8.51E+00	mL/g	[6]
107-13-1	Acrylonitrile	1.16E-03	cm/hr	[3]	1.78E+00	unitless	[2]	1.76E+00	mL/g	[3]
107-19-7	Propargyl alcohol	4.24E-04	cm/hr	[3]	4.17E-01	unitless	[3]	1.90E+00	mL/g	[6]
107-21-1	Ethylene glycol (1,2-ethanediol)	8.77E-05	cm/hr	[3]	4.37E-02	unitless	[3]	1.00E+00	mL/g	[6]
107-98-2	Propylene glycol monomethyl ether	3.72E-04	cm/hr	[1]	3.24E-01	unitless	[4]	1.00E+00	mL/g	[6]
108-05-4	Acetic acid vinyl ester	1.57E-03	cm/hr	[3]	5.37E+00	unitless	[2]	5.22E+00	mL/g	[3]
108-10-1	4-Methyl-2-pentanone	3.19E-03	cm/hr	[3]	1.58E+01	unitless	[2]	1.51E+01	mL/g	[3]
108-39-4	m-Cresol	7.77E-03	cm/hr	[3]	9.12E+01	unitless	[2]	8.45E+01	mL/g	[3]
108-60-1	bis (2-Chloroisopropyl)ether	7.64E-03	cm/hr	[3]	3.02E+02	unitless	[3]	4.68E+01	mL/g	[4]
108-67-8	1,3,5-Trimethylbenzene	6.21E-02	cm/hr	[3]	2.63E+03	unitless	[8]	6.12E+02	mL/g	[3]

Table 2-4 Permeability Constant, Octanol/Water Partitioning Coefficient, and Organic Carbon Partitioning Coefficient

CAS Registry Number	Constituent Name	Permeability Constant (*Kp*)	Units for Permeability Constant	Reference	Octanol-water Partition Coeff. (K_{ow})	Units for Octanol-water Partition Coeff.	Reference	Organic Carbon Partition Coeff. (K_{oc})	Units for Organic Carbon Partition Coeff.	Reference
108-86-1	Bromobenzene (Phenyl bromide)	2.00E-02	cm/hr	[3]	9.77E+02	unitless	[3]	3.09E+02	mL/g	[4]
108-87-2	Methylcyclohexane	1.10E-01	cm/hr	[3]	4.07E+03	unitless	[3]	2.34E+02	mL/g	[6]
108-88-3	Toluene	3.11E-02	cm/hr	[3]	5.01E+02	unitless	[2]	1.40E+02	mL/g	[3]
108-90-7	Chlorobenzene	2.82E-02	cm/hr	[3]	6.31E+02	unitless	[2]	2.24E+02	mL/g	[3]
108-94-1	Cyclohexanone	1.52E-03	cm/hr	[3]	6.46E+00	unitless	[3]	1.74E+01	mL/g	[6]
108-95-2	Phenol	4.34E-03	cm/hr	[3]	3.16E+01	unitless	[2]	2.98E+01	mL/g	[3]
109-74-0	n-Butanenitrile	1.44E-03	cm/hr	[2]	3.39E+00	unitless	[3]	3.32E+00	mL/g	[1]
109-75-1	3-Butenenitrile	1.21E-03	cm/hr	[2]	2.51E+00	unitless	[3]	2.47E+00	mL/g	[1]
109-77-3	Malononitrile	2.66E-04	cm/hr	[3]	2.51E-01	unitless	[3]	3.33E+00	mL/g	[6]
109-86-4	2-Methoxyethanol	1.80E-04	cm/hr	[3]	1.70E-01	unitless	[3]	1.00E+00	mL/g	[6]
109-99-9	Tetrahydrofuran	1.20E-03	cm/hr	[1]	2.88E+00	unitless	[2]	2.83E+00	mL/g	[3]
110-00-9	Furan	5.05E-03	cm/hr	[3]	2.19E+01	unitless	[3]	8.00E+01	mL/g	[6]
110-54-3	n-Hexane	2.01E-01	cm/hr	[3]	7.94E+03	unitless	[8]	3.41E+03	mL/g	[5]
110-59-8	Pentanenitrile	2.97E-03	cm/hr	[2]	1.32E+01	unitless	[3]	1.26E+01	mL/g	[1]
110-80-5	2-Ethoxyethanol	3.00E-04	cm/hr	[3]	4.79E-01	unitless	[3]	1.00E+00	mL/g	[6]
110-82-7	Cyclohexane	1.02E-01	cm/hr	[3]	2.75E+03	unitless	[3]	1.46E+02	mL/g	[6]
110-83-8	Cyclohexene	4.31E-02	cm/hr	[3]	7.24E+02	unitless	[3]	1.46E+02	mL/g	[6]
110-86-1	Pyridine	1.52E-03	cm/hr	[3]	4.47E+00	unitless	[2]	4.36E+00	mL/g	[3]
111-15-9	Ethylene glycol monoethyl ether acetate	7.00E-04	cm/hr	[3]	3.89E+00	unitless	[4]	4.54E+00	mL/g	[6]
111-44-4	Bis(2-chloroethyl)ether	1.78E-03	cm/hr	[3]	1.95E+01	unitless	[2]	7.59E+01	mL/g	[3]
111-65-9	n-Octane	9.92E-01	cm/hr	[2]	1.51E+05	unitless	[3]	1.52E+04	mL/g	[2]
111-76-2	2-Butoxyethanol	1.21E-03	cm/hr	[3]	6.76E+00	unitless	[3]	2.82E+00	mL/g	[6]
111-84-2	n-Nonane	1.70E+00	cm/hr	[3]	4.47E+05	unitless	[8]	7.96E+02	mL/g	[6]
111-91-1	Bis(2-chloroethoxy)methane	1.22E-03	cm/hr	[3]	2.00E+01	unitless	[4]	1.44E+01	mL/g	[6]
112-30-1	1-Decanol	7.90E-02	cm/hr	[1]	3.72E+04	unitless	[1]	3.89E+02	mL/g	[4]
112-31-2	Decanal	6.59E-02	cm/hr	[2]	5.75E+03	unitless	[3]	4.97E+03	mL/g	[1]
112-40-3	Dodecane	1.96E+00	cm/hr	[2]	1.26E+06	unitless	[3]	8.11E+04	mL/g	[2]
1120-21-4	Undecane	1.36E+00	cm/hr	[2]	5.50E+05	unitless	[3]	4.21E+04	mL/g	[2]

Table 2-4 Permeability Constant, Octanol/Water Partitioning Coefficient, and Organic Carbon Partitioning Coefficient

CAS Registry Number	Constituent Name	Permeability Constant (*Kp*)	Units for Permeability Constant	Reference	Octanol-water Partition Coeff. (K_{ow})	Units for Octanol-water Partition Coeff.	Reference	Organic Carbon Partition Coeff. (K_{oc})	Units for Organic Carbon Partition Coeff.	Reference
1120-71-4	1,3-Propane sultone	2.11E-04	cm/hr	[3]	5.25E-01	unitless	[8]	9.41E+00	mL/g	[6]
117-81-7	Bis(2-ethylhexyl) phthalate	1.13E+00	cm/hr	[3]	1.26E+05	unitless	[2]	1.11E+05	mL/g	[3]
117-84-0	Di-n-octylphthalate	2.43E+00	cm/hr	[3]	1.26E+08	unitless	[2]	9.17E+07	mL/g	[3]
118-74-1	Hexachlorobenzene	2.54E-01	cm/hr	[3]	2.00E+05	unitless	[2]	8.00E+04	mL/g	[3]
119-90-4	3,3'-Dimethoxybenzidine	1.06E-03	cm/hr	[3]	6.46E+01	unitless	[2]	6.02E+01	mL/g	[3]
120-12-7	Anthracene	1.42E-01	cm/hr	[3]	3.16E+04	unitless	[2]	2.35E+04	mL/g	[3]
120-82-1	1,2,4-Trichlorobenzene	7.05E-02	cm/hr	[3]	1.00E+04	unitless	[2]	1.66E+03	mL/g	[3]
120-83-2	2,4-Dichlorophenol	2.06E-02	cm/hr	[3]	7.94E+02	unitless	[2]	1.47E+02	mL/g	[3]
121-14-2	2,4-Dinitrotoluene	3.08E-03	cm/hr	[3]	9.55E+01	unitless	[2]	8.84E+01	mL/g	[3]
122-39-4	N,N-Diphenylamine	3.73E-02	cm/hr	[3]	3.16E+03	unitless	[3]	6.03E+02	mL/g	[4]
122-66-7	1,2-Diphenylhydrazine	1.30E-02	cm/hr	[3]	7.94E+02	unitless	[2]	7.10E+02	mL/g	[3]
123-33-1	Maleic hydrazide	1.02E-04	cm/hr	[3]	1.45E-01	unitless	[3]	2.82E+00	mL/g	[4]
123-38-6	Propionaldehyde	1.82E-03	cm/hr	[3]	3.89E+00	unitless	[3]	1.00E+00	mL/g	[6]
123-72-8	Butanal	2.37E-03	cm/hr	[2]	7.59E+00	unitless	[3]	7.33E+00	mL/g	[1]
123-91-1	1,4-Dioxan	3.32E-04	cm/hr	[3]	5.37E-01	unitless	[2]	5.40E-01	mL/g	[3]
124-18-5	Decane	5.32E-01	cm/hr	[3]	1.02E+05	unitless	[3]	1.45E+03	mL/g	[6]
124-38-9	Carbon dioxide				6.76E+00	unitless	[3]	5.44E+00	mL/g	[2]
124-48-1	Chlorodibromomethane	2.89E-03	cm/hr	[3]	1.70E+02	unitless	[2]	6.99E+01	mL/g	[3]
126-73-8	Tributyl phosphate	2.28E-02	cm/hr	[3]	1.00E+04	unitless	[3]	2.35E+03	mL/g	[6]
126-98-7	2-Methyl-2-propenenitrile	1.86E-03	cm/hr	[3]	3.47E+00	unitless	[2]	3.40E+00	mL/g	[3]
127-18-4	1,1,2,2-Tetrachloroethene	3.34E-02	cm/hr	[3]	2.51E+03	unitless	[2]	2.65E+02	mL/g	[3]
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	2.23E-01	cm/hr	[3]	1.26E+05	unitless	[8]			
129-00-0	Pyrene	2.01E-01	cm/hr	[3]	7.94E+04	unitless	[2]	6.80E+04	mL/g	[3]
131-11-3	Dimethyl Phthalate	1.47E-03	cm/hr	[3]	3.63E+01	unitless	[2]	3.42E+01	mL/g	[3]
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	2.75E-02	cm/hr	[3]	1.32E+04	unitless	[3]	1.65E+04	mL/g	[6]
132-64-9	Dibenzofuran	9.75E-02	cm/hr	[3]	1.32E+04	unitless	[3]	8.13E+03	mL/g	[4]
133-06-2	Captan	2.34E-03	cm/hr	[3]	6.31E+02	unitless	[3]	2.00E+02	mL/g	[4]
1330-20-7	Xylenes (mixed isomers)	5.00E-02	cm/hr	[3]	1.45E+03	unitless	[3]	1.78E+02	mL/g	[4]

Table 2-4 Permeability Constant, Octanol/Water Partitioning Coefficient, and Organic Carbon Partitioning Coefficient

CAS Registry Number	Constituent Name	Permeability Constant (*Kp*)	Units for Permeability Constant	Reference	Octanol-water Partition Coeff. (K_{ow})	Units for Octanol-water Partition Coeff.	Reference	Organic Carbon Partition Coeff. (K_{oc})	Units for Organic Carbon Partition Coeff.	Reference
1336-36-3	Polychlorinated biphenyls	5.45E-01	cm/hr	[3]	1.95E+06	unitless	[3]	7.81E+04	mL/g	[6]
134-32-7	alpha-Naphthylamine	7.70E-03	cm/hr	[1]	1.78E+02	unitless	[8]			
135-98-8	sec-Butylbenzene	3.01E-01	cm/hr	[3]	3.72E+04	unitless	[3]	1.33E+03	mL/g	[6]
13966-29-5	Uranium-234									
13967-48-1	Ruthenium-106									
13967-70-9	Cesium-134									
13968-55-3	Uranium-233									
13981-15-2	Curium-244									
13981-16-3	Plutonium-238									
13981-37-8	Nickel-63									
13982-10-0	Plutonium-242									
13982-63-3	Radium-226									
13982-70-2	Uranium-236									
13994-20-2	Neptunium-237									
141-78-6	Acetic acid ethyl ester	1.53E-03	cm/hr	[3]	5.37E+00	unitless	[3]	5.58E+00	mL/g	[6]
14119-32-5	Plutonium-241									
14119-33-6	Plutonium-240									
14133-76-7	Technetium-99									
14158-29-3	Uranium-232									
14234-35-6	Antimony-125									
14265-44-2	Phosphate									
14331-85-2	Protactinium-231									
14336-70-0	Nickel-59									
14391-16-3	Europium-155									
145-73-3	Endothall	2.63E-03	cm/hr	[3]	8.13E+01	unitless	[3]	8.51E+01	mL/g	[4]
14596-10-2	Americium-241									
14683-23-9	Europium-152									
14762-75-5	Carbon-14									
14797-55-8	Nitrate	1.00E-03	cm/hr	[1]	1.62E+00	unitless	[10]			
14797-65-0	Nitrite	1.00E-03	cm/hr	[1]						

Table 2-4 Permeability Constant, Octanol/Water Partitioning Coefficient, and Organic Carbon Partitioning Coefficient

CAS Registry Number	Constituent Name	Permeability Constant (*Kp*)	Units for Permeability Constant	Reference	Octanol-water Partition Coeff. (K_{ow})	Units for Octanol-water Partition Coeff.	Reference	Organic Carbon Partition Coeff. (K_{oc})	Units for Organic Carbon Partition Coeff.	Reference
14808-79-8	Sulfate	1.00E-03	cm/hr	[1]						
14952-40-0	Actinium-227									
14993-75-0	Americium-243									
15046-84-1	Iodine-129									
15117-48-3	Plutonium-239									
15117-96-1	Uranium-235									
15262-20-1	Radium-228									
15510-73-3	Curium-242									
15585-10-1	Europium-154									
15594-54-4	Thorium-229									
156-59-2	cis-1,2-Dichloroethene	1.10E-02	cm/hr	[3]	7.94E+01	unitless	[2]	3.83E+01	mL/g	[3]
156-60-5	1,2-trans-Dichloroethene	1.10E-02	cm/hr	[3]	1.26E+02	unitless	[2]	3.80E+01	mL/g	[3]
15715-94-3	Samarium-151									
15751-77-6	Zirconium-93									
15757-87-6	Curium-243									
15758-45-9	Selenium-79									
15832-50-5	Tin-126									
1634-04-4	Methyl tert-butyl ether	2.11E-03	cm/hr	[3]	8.71E+00	unitless	[3]	1.10E+01	mL/g	[11]
16887-00-6	Chloride	1.00E-03	cm/hr	[1]	3.47E+00	unitless	[8]			
16984-48-8	Fluoride	1.00E-03	cm/hr	[1]						
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	8.08E-01	cm/hr	[3]	6.31E+06	unitless	[2]	3.89E+06	mL/g	[3]
18540-29-9	Chromium(VI)	2.00E-03	cm/hr	[1]	1.00E+00	unitless	[2]			
189-55-9	Dibenzo[a,i]pyrene	2.19E+00	cm/hr	[3]	1.91E+07	unitless	[8]	6.35E+06	mL/g	[6]
189-64-0	Dibenzo[a,h]pyrene	2.19E+00	cm/hr	[3]	1.91E+07	unitless	[8]	6.35E+06	mL/g	[6]
191-24-2	Benzo(g,h,i)perylene	1.12E+00	cm/hr	[3]	4.27E+06	unitless	[3]	1.95E+06	mL/g	[6]
191-30-0	Dibenzo(a,l)pyrene	4.19E+00	cm/hr	[3]	5.13E+07	unitless	[8]	6.48E+06	mL/g	[6]
192-65-4	Dibenzo[a,e]pyrene	4.19E+00	cm/hr	[3]	1.91E+07	unitless	[8]	6.48E+06	mL/g	[6]
192-97-2	Benzo(e)pyrene	1.15E+00	cm/hr	[2]	2.75E+06	unitless	[3]	2.14E+06	mL/g	[1]

Table 2-4 Permeability Constant, Octanol/Water Partitioning Coefficient, and Organic Carbon Partitioning Coefficient

CAS Registry Number	Constituent Name	Permeability Constant (*Kp*)	Units for Permeability Constant	Reference	Octanol-water Partition Coeff. (K_{ow})	Units for Octanol-water Partition Coeff.	Reference	Organic Carbon Partition Coeff. (K_{oc})	Units for Organic Carbon Partition Coeff.	Reference
193-39-5	Indeno(1,2,3-cd)pyrene	1.04E+00	cm/hr	[1]	3.98E+06	unitless	[2]	3.08E+06	mL/g	[3]
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	2.86E+00	cm/hr	[3]	2.00E+07	unitless	[2]	1.23E+07	mL/g	[3]
205-82-3	Benzo[j]fluoranthene	6.90E-01	cm/hr	[3]	1.29E+06	unitless	[8]	5.99E+05	mL/g	[6]
205-99-2	Benzo(b)fluoranthene	4.17E-01	cm/hr	[3]	1.33E+06	unitless	[2]	1.05E+06	mL/g	[3]
206-44-0	Fluoranthene	3.08E-01	cm/hr	[3]	1.00E+05	unitless	[2]	4.91E+04	mL/g	[3]
207-08-9	Benzo(k)fluoranthene	6.91E-01	cm/hr	[3]	1.26E+06	unitless	[2]	9.92E+05	mL/g	[3]
208-96-8	Acenaphthylene	9.11E-02	cm/hr	[3]	8.71E+03	unitless	[3]	5.62E+03	mL/g	[4]
218-01-9	Chrysene	5.96E-01	cm/hr	[3]	5.01E+05	unitless	[2]	4.01E+05	mL/g	[3]
224-42-0	Dibenz[a,j]acridine	2.73E-01	cm/hr	[3]	4.27E+05	unitless	[8]	1.91E+06	mL/g	[6]
2245-38-7	2,3,5-Trimethylnaphthalene	2.73E-01	cm/hr	[2]	6.46E+04	unitless	[3]	5.35E+04	mL/g	[1]
226-36-8	Dibenz[a,h]acridine	2.73E-01	cm/hr	[3]	5.37E+05	unitless	[3]	1.91E+06	mL/g	[6]
22967-92-6	Methyl mercury	1.00E-03	cm/hr	[1]						
23950-58-5	Pronamide	1.09E-02	cm/hr	[3]	2.69E+03	unitless	[8]	2.35E+03	mL/g	[3]
24959-67-9	Bromide	1.46E-03	cm/hr	[2]	4.27E+00	unitless	[8]			
27154-33-2	Trichlorofluoroethane	1.27E-02	cm/hr	[7]	3.16E+02	unitless	[7]	1.14E+02	mL/g	[10]
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	1.24E+00	cm/hr	[3]	1.32E+07	unitless	[3]	1.28E+05	mL/g	[6]
319-84-6	alpha-BHC	2.06E-02	cm/hr	[3]	6.31E+03	unitless	[2]	1.76E+03	mL/g	[3]
319-85-7	beta-BHC	2.06E-02	cm/hr	[3]	6.31E+03	unitless	[2]	2.14E+03	mL/g	[3]
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	9.17E-01	cm/hr	[3]	4.27E+06	unitless	[3]	7.81E+04	mL/g	[6]
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	7.51E-01	cm/hr	[3]	6.17E+06	unitless	[3]	1.31E+05	mL/g	[6]
3268-87-9	Octachlorodibenzo(p)dioxin	1.16E+00	cm/hr	[3]	1.58E+08	unitless	[2]	9.77E+07	mL/g	[3]
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	1.24E+00	cm/hr	[3]	2.57E+07	unitless	[8]	2.09E+05	mL/g	[6]
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	1.33E+00	cm/hr	[2]	1.00E+08	unitless	[2]	6.17E+07	mL/g	[3]

Table 2-4 Permeability Constant, Octanol/Water Partitioning Coefficient, and Organic Carbon Partitioning Coefficient

CAS Registry Number	Constituent Name	Permeability Constant (*Kp*)	Units for Permeability Constant	Reference	Octanol-water Partition Coeff. (K_{ow})	Units for Octanol-water Partition Coeff.	Reference	Organic Carbon Partition Coeff. (K_{oc})	Units for Organic Carbon Partition Coeff.	Reference
3697-24-3	5-Methylchrysene	7.38E-01	cm/hr	[3]	1.17E+06	unitless	[8]	2.95E+05	mL/g	[6]
378253-40-8	Barium-137m									
378253-44-2	Cadmium-113m									
378782-82-2	Niobium-93m									
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	1.66E+00	cm/hr	[3]	3.98E+07	unitless	[3]	2.14E+05	mL/g	[6]
39001-02-0	Octachlorodibenzofuran	2.63E+00	cm/hr	[3]	1.00E+08	unitless	[2]	6.17E+07	mL/g	[3]
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	1.53E+00	cm/hr	[3]	6.31E+07	unitless	[2]	3.89E+07	mL/g	[3]
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	2.96E+00	cm/hr	[3]	1.86E+08	unitless	[8]	3.50E+05	mL/g	[6]
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	4.05E-01	cm/hr	[3]	4.37E+06	unitless	[2]	2.69E+06	mL/g	[3]
4170-30-3	Crotonaldehyde (Propylene aldehyde)	1.59E-03	cm/hr	[3]	3.98E+00	unitless	[8]	1.79E+00	mL/g	[6]
41851-50-7	Chlorocyclopentadiene	1.77E-02	cm/hr	[3]	2.69E+02	unitless	[4]	1.28E+02	mL/g	[6]
460-19-5	Cyanogen (oxalonitrile)	1.00E-03	cm/hr	[1]	1.17E+00	unitless	[3]	1.17E+00	mL/g	[1]
4786-20-3	2-Butenenitrile	1.70E-03	cm/hr	[2]	4.17E+00	unitless	[3]	4.07E+00	mL/g	[1]
50-00-0	Formaldehyde	1.82E-03	cm/hr	[3]	2.24E+00	unitless	[2]	2.21E+00	mL/g	[3]
50-32-8	Benzo(a)pyrene	7.13E-01	cm/hr	[3]	1.00E+06	unitless	[2]	9.69E+05	mL/g	[3]
506-68-3	Cyanogen bromide (bromocyanide)	1.00E-03	cm/hr	[1]	5.13E-01	unitless	[8]	5.19E-01	mL/g	[1]
506-77-4	Cyanogen chloride	1.00E-03	cm/hr	[1]	4.17E-01	unitless	[8]	5.99E-01	mL/g	[2]
51-28-5	2,4-Dinitrophenol	1.87E-03	cm/hr	[3]	3.47E+01	unitless	[2]	1.00E-02	mL/g	[3]
51-79-6	Ethyl carbamate (urethane)	3.94E-04	cm/hr	[1]	7.08E-01	unitless	[1]	1.21E+01	mL/g	[6]
510-15-6	Chlorobenzilate	3.31E-02	cm/hr	[3]	2.29E+04	unitless	[2]	1.93E+04	mL/g	[3]
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	6.57E-01	cm/hr	[3]	1.26E+06	unitless	[2]	7.76E+05	mL/g	[3]

Table 2-4 Permeability Constant, Octanol/Water Partitioning Coefficient, and Organic Carbon Partitioning Coefficient

CAS Registry Number	Constituent Name	Permeability Constant (*Kp*)	Units for Permeability Constant	Reference	Octanol-water Partition Coeff. (K_{ow})	Units for Octanol-water Partition Coeff.	Reference	Organic Carbon Partition Coeff. (K_{oc})	Units for Organic Carbon Partition Coeff.	Reference
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	1.43E+00	cm/hr	[3]	3.16E+07	unitless	[3]	2.09E+05	mL/g	[6]
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	2.37E-03	cm/hr	[3]	4.90E+01	unitless	[3]	3.59E+02	mL/g	[6]
53-70-3	Dibenz[a,h]anthracene	9.53E-01	cm/hr	[3]	3.16E+06	unitless	[2]	1.79E+06	mL/g	[3]
532-27-4	2-Chloroacetophenone	4.06E-03	cm/hr	[3]	8.51E+01	unitless	[4]	9.89E+01	mL/g	[6]
534-52-1	4,6-Dinitro-o-cresol	3.15E-03	cm/hr	[3]	1.35E+02	unitless	[3]	2.57E+02	mL/g	[4]
5385-75-1	Dibenzo(a,e)fluoranthene	2.19E+00	cm/hr	[6]	1.91E+07	unitless	[8]	6.35E+06	mL/g	[9]
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	1.10E-02	cm/hr	[3]	1.00E+02	unitless	[3]	3.80E+01	mL/g	[11]
540-73-8	1,2-Dimethylhydrazine	3.17E-04	cm/hr	[3]	2.88E-01	unitless	[4]	1.49E+01	mL/g	[6]
540-84-1	2,2,4-Trimethylpentane	1.86E-01	cm/hr	[3]	1.23E+04	unitless	[8]	2.40E+02	mL/g	[6]
541-73-1	1,3-Dichlorobenzene	5.20E-02	cm/hr	[3]	3.98E+03	unitless	[2]	8.50E+02	mL/g	[3]
542-75-6	1,3-Dichloropropene	8.34E-03	cm/hr	[3]	3.98E+01	unitless	[2]	2.71E+01	mL/g	[3]
542-88-1	Bis(chloromethyl)ether	8.55E-04	cm/hr	[3]	3.72E+00	unitless	[4]	9.70E+00	mL/g	[6]
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	1.45E+00	cm/hr	[3]	2.51E+07	unitless	[2]	1.55E+07	mL/g	[3]
56-23-5	Carbon tetrachloride	1.63E-02	cm/hr	[3]	6.31E+02	unitless	[2]	1.52E+02	mL/g	[3]
56-49-5	3-Methylcholanthrene	9.03E-01	cm/hr	[3]	2.63E+06	unitless	[3]	2.05E+06	mL/g	[1]
56-55-3	Benzo(a)anthracene	5.52E-01	cm/hr	[3]	5.01E+05	unitless	[2]	3.58E+05	mL/g	[3]
57-12-5	Cyanide	1.00E-03	cm/hr	[1]	2.04E-01	unitless	[2]	3.40E-01	mL/g	[3]
57-24-9	Strychnine	3.99E-04	cm/hr	[3]	8.51E+01	unitless	[2]	7.90E+01	mL/g	[3]
57-74-9	Chlordane	4.08E-01	cm/hr	[3]	1.45E+06	unitless	[8]	5.13E+04	mL/g	[3]
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	6.27E-01	cm/hr	[3]	3.16E+06	unitless	[2]	1.95E+06	mL/g	[3]
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	6.27E-01	cm/hr	[3]	6.17E+06	unitless	[2]	3.80E+06	mL/g	[3]
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	2.25E+00	cm/hr	[3]	1.00E+07	unitless	[2]	6.17E+06	mL/g	[3]
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	1.00E+00	cm/hr	[3]	1.32E+07	unitless	[5]	1.28E+05	mL/g	[6]

Table 2-4 Permeability Constant, Octanol/Water Partitioning Coefficient, and Organic Carbon Partitioning Coefficient

CAS Registry Number	Constituent Name	Permeability Constant (*Kp*)	Units for Permeability Constant	Reference	Octanol-water Partition Coeff. (K_{ow})	Units for Octanol-water Partition Coeff.	Reference	Organic Carbon Partition Coeff. (K_{oc})	Units for Organic Carbon Partition Coeff.	Reference
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	2.86E+00	cm/hr	[3]	2.00E+07	unitless	[2]	1.23E+07	mL/g	[3]
58-89-9	gamma-BHC (Lindane)	2.06E-02	cm/hr	[3]	1.38E+04	unitless	[3]	1.35E+03	mL/g	[11]
58-90-2	2,3,4,6-Tetrachlorophenol	7.10E-02	cm/hr	[3]	2.82E+04	unitless	[2]	2.80E+02	mL/g	[3]
581-42-0	2,6-Dimethylnaphthalene	1.52E-01	cm/hr	[2]	2.04E+04	unitless	[3]	1.73E+04	mL/g	[1]
584-84-9	2,4-Toluene diisocyanate	3.08E-03	cm/hr	[4]	5.50E+03	unitless	[8]	8.84E+01	mL/g	[7]
589-38-8	3-Hexanone	2.86E-03	cm/hr	[2]	1.74E+01	unitless	[8]	1.66E+01	mL/g	[1]
59-50-7	4-Chloro-3-methylphenol	2.85E-02	cm/hr	[3]	1.26E+03	unitless	[8]	1.12E+03	mL/g	[3]
59-89-2	N-Nitrosomorpholine	1.78E-04	cm/hr	[1]	3.63E-01	unitless	[1]	2.25E+01	mL/g	[6]
591-50-4	Benzene, iodo-	1.62E-02	cm/hr	[2]	1.78E+03	unitless	[3]	1.57E+03	mL/g	[1]
591-78-6	2-Hexanone	3.55E-03	cm/hr	[3]	2.40E+01	unitless	[3]	1.50E+01	mL/g	[6]
593-60-2	Bromoethene (Vinyl bromide)	4.35E-03	cm/hr	[3]	3.72E+01	unitless	[3]	2.17E+01	mL/g	[6]
593-74-8	Dimethyl Mercury	4.19E-03	cm/hr	[3]	3.89E+02	unitless	[3]	2.17E+01	mL/g	[6]
60-11-7	Dimethyl aminoazobenzene	9.46E-02	cm/hr	[1]	3.80E+04	unitless	[8]	2.03E+03	mL/g	[6]
60-29-7	Ethyl ether	2.35E-03	cm/hr	[3]	7.76E+00	unitless	[3]	9.70E+00	mL/g	[6]
60-35-5	Acetamide	1.06E-04	cm/hr	[1]	5.50E-02	unitless	[1]	2.99E+00	mL/g	[6]
602-87-9	5-Nitroacenaphthene	4.32E-02	cm/hr	[3]	7.08E+03	unitless	[8]	7.97E+03	mL/g	[6]
606-20-2	2,6-Dinitrotoluene	3.70E-03	cm/hr	[3]	5.25E+01	unitless	[2]	4.91E+01	mL/g	[3]
608-93-5	Pentachlorobenzene	1.68E-01	cm/hr	[3]	1.48E+05	unitless	[2]	1.21E+05	mL/g	[3]
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	2.25E+00	cm/hr	[3]	1.00E+07	unitless	[2]	6.17E+06	mL/g	[3]
61626-71-9	Dichloropentadiene	1.77E-02	cm/hr	[5]	2.69E+02	unitless	[6]	1.28E+02	mL/g	[8]
62-50-0	Ethyl methanesulfonate	2.44E-04	cm/hr	[3]	1.12E+00	unitless	[2]	1.12E+00	mL/g	[3]
62-53-3	Aniline	1.86E-03	cm/hr	[3]	7.94E+00	unitless	[2]	7.67E+00	mL/g	[3]
62-75-9	N-Nitroso-N,N-dimethylamine	2.51E-04	cm/hr	[3]	2.69E-01	unitless	[8]	2.28E+01	mL/g	[6]
621-64-7	N-Nitroso-di-n-propylamine	2.33E-03	cm/hr	[3]	2.29E+01	unitless	[2]	2.17E+01	mL/g	[3]
624-83-9	Methyl isocyanate	2.50E-03	cm/hr	[3]	6.17E+00	unitless	[8]	3.96E+01	mL/g	[6]
628-73-9	Hexanenitrile	5.66E-03	cm/hr	[2]	4.57E+01	unitless	[3]	4.29E+01	mL/g	[1]
630-08-0	Carbon monoxide	2.02E-03	cm/hr	[3]	6.03E+01	unitless	[9]	1.32E+01	mL/g	[6]

Table 2-4 Permeability Constant, Octanol/Water Partitioning Coefficient, and Organic Carbon Partitioning Coefficient

CAS Registry Number	Constituent Name	Permeability Constant (*Kp*)	Units for Permeability Constant	Reference	Octanol-water Partition Coeff. (K_{ow})	Units for Octanol-water Partition Coeff.	Reference	Organic Carbon Partition Coeff. (K_{oc})	Units for Organic Carbon Partition Coeff.	Reference
630-20-6	1,1,1,2-Tetrachloroethane	1.59E-02	cm/hr	[3]	1.07E+03	unitless	[2]	3.01E+02	mL/g	[3]
64-18-6	Formic acid (methanoic acid)	3.78E-04	cm/hr	[3]	2.88E-01	unitless	[2]	2.90E-01	mL/g	[3]
65-85-0	Benzoic acid	5.65E-03	cm/hr	[3]	7.41E+01	unitless	[2]	6.00E-01	mL/g	[3]
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	1.00E+00	cm/hr	[3]	1.32E+07	unitless	[5]	1.31E+05	mL/g	[6]
67-56-1	Methyl alcohol	3.19E-04	cm/hr	[3]	1.70E-01	unitless	[2]	1.80E-01	mL/g	[3]
67-63-0	2-Propyl alcohol	7.78E-04	cm/hr	[3]	1.12E+00	unitless	[3]	1.53E+00	mL/g	[6]
67-64-1	2-Propanone (Acetone)	5.12E-04	cm/hr	[3]	5.75E-01	unitless	[2]	5.80E-01	mL/g	[3]
67-66-3	Chloroform	6.83E-03	cm/hr	[3]	1.00E+02	unitless	[2]	5.25E+01	mL/g	[3]
67-72-1	Hexachloroethane	4.15E-02	cm/hr	[3]	8.51E+03	unitless	[2]	1.55E+03	mL/g	[3]
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	1.45E+00	cm/hr	[3]	2.51E+07	unitless	[2]	1.55E+07	mL/g	[3]
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	1.66E+00	cm/hr	[3]	3.98E+07	unitless	[3]	2.14E+05	mL/g	[6]
70-30-4	Hexachlorophene	8.36E-01	cm/hr	[3]	3.47E+07	unitless	[2]	2.58E+07	mL/g	[3]
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	5.84E-01	cm/hr	[3]	1.32E+07	unitless	[5]	7.81E+04	mL/g	[6]
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	2.25E+00	cm/hr	[3]	1.00E+07	unitless	[2]	6.17E+06	mL/g	[3]
71-36-3	n-Butyl alcohol	2.31E-03	cm/hr	[3]	7.59E+00	unitless	[3]	3.16E+00	mL/g	[4]
71-43-2	Benzene	1.49E-02	cm/hr	[3]	1.26E+02	unitless	[2]	6.17E+01	mL/g	[3]
71-55-6	1,1,1-Trichloroethane	1.26E-02	cm/hr	[3]	3.16E+02	unitless	[2]	1.35E+02	mL/g	[3]
72-43-5	Methoxychlor	4.28E-02	cm/hr	[3]	6.31E+04	unitless	[2]	8.00E+04	mL/g	[3]
72-55-9	4,4-DDE	5.45E-01	cm/hr	[3]	5.01E+05	unitless	[2]	8.64E+04	mL/g	[3]
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	1.35E+00	cm/hr	[3]	1.00E+07	unitless	[2]	6.17E+06	mL/g	[3]
74-83-9	Bromomethane	2.84E-03	cm/hr	[3]	1.55E+01	unitless	[2]	9.00E+00	mL/g	[3]
74-87-3	Chloromethane	3.28E-03	cm/hr	[3]	8.13E+00	unitless	[2]	6.30E+00	mL/g	[3]
74-88-4	Iodomethane	2.52E-03	cm/hr	[1]	3.24E+01	unitless	[1]	1.32E+01	mL/g	[6]

Table 2-4 Permeability Constant, Octanol/Water Partitioning Coefficient, and Organic Carbon Partitioning Coefficient

CAS Registry Number	Constituent Name	Permeability Constant (*Kp*)	Units for Permeability Constant	Reference	Octanol-water Partition Coeff. (K_{ow})	Units for Octanol-water Partition Coeff.	Reference	Organic Carbon Partition Coeff. (K_{oc})	Units for Organic Carbon Partition Coeff.	Reference
74-95-3	Methylene bromide	2.23E-03	cm/hr	[3]	3.38E+01	unitless	[2]	3.19E+01	mL/g	[3]
74-97-5	Bromochloromethane	2.55E-03	cm/hr	[3]	2.57E+01	unitless	[3]	2.17E+01	mL/g	[6]
7429-90-5	Aluminum	1.00E-03	cm/hr	[1]						
7439-89-6	Iron	1.00E-03	cm/hr	[1]						
7439-92-1	Lead	1.00E-04	cm/hr	[1]	5.37E+00	unitless	[2]	4.53E+00	mL/g	[2]
7439-93-2	Lithium	1.00E-03	cm/hr	[1]						
7439-95-4	Magnesium	1.00E-03	cm/hr	[1]						
7439-96-5	Manganese	1.00E-03	cm/hr	[1]						
7439-97-6	Mercury	1.00E-03	cm/hr	[1]	4.17E+00	unitless	[2]			
7439-98-7	Molybdenum	1.00E-03	cm/hr	[1]						
7440-02-0	Nickel	2.00E-04	cm/hr	[1]	2.69E-01	unitless	[2]			
7440-16-6	Rhodium									
7440-22-4	Silver	6.00E-04	cm/hr	[1]	1.70E+00	unitless	[2]			
7440-23-5	Sodium	1.00E-03	cm/hr	[1]						
7440-24-6	Strontium (total)	1.00E-03	cm/hr	[1]	1.70E+00	unitless	[8]			
7440-25-7	Tantalum									
7440-28-0	Thallium	1.00E-03	cm/hr	[1]	1.70E+00	unitless	[2]			
7440-29-1	Thorium-232	1.00E-03	cm/hr	[1]						
7440-31-5	Tin	1.00E-03	cm/hr	[1]						
7440-33-7	Tungsten	1.00E-03	cm/hr	[1]						
7440-36-0	Antimony	1.00E-03	cm/hr	[1]	5.37E+00	unitless	[2]			
7440-38-2	Arsenic	1.00E-03	cm/hr	[1]	4.79E+00	unitless	[2]			
7440-39-3	Barium	1.00E-03	cm/hr	[1]	1.70E+00	unitless	[2]			
7440-41-7	Beryllium	1.00E-03	cm/hr	[1]	2.69E-01	unitless	[2]			
7440-43-9	Cadmium	1.00E-03	cm/hr	[1]	8.51E-01	unitless	[2]			
7440-47-3	Chromium	1.00E-03	cm/hr	[1]	1.70E+00	unitless	[2]			
7440-48-4	Cobalt	4.00E-04	cm/hr	[1]						
7440-50-8	Copper	1.00E-03	cm/hr	[1]						
7440-61-1	Uranium	1.00E-03	cm/hr	[1]						
7440-61-1R	Uranium-238									

Table 2-4 Permeability Constant, Octanol/Water Partitioning Coefficient, and Organic Carbon Partitioning Coefficient

CAS Registry Number	Constituent Name	Permeability Constant (*Kp*)	Units for Permeability Constant	Reference	Octanol-water Partition Coeff. (K_{ow})	Units for Octanol-water Partition Coeff.	Reference	Organic Carbon Partition Coeff. (K_{oc})	Units for Organic Carbon Partition Coeff.	Reference
7440-62-2	Vanadium	1.00E-03	cm/hr	[1]						
7440-65-5	Yttrium	1.00E-03	cm/hr	[1]						
7440-66-6	Zinc	6.00E-04	cm/hr	[1]	3.39E-01	unitless	[8]			
7440-67-7	Zirconium	1.00E-03	cm/hr	[1]						
7446-09-5	Sulfur dioxide	1.00E-03	cm/hr	[1]	6.31E-03	unitless	[8]			
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	1.00E+00	cm/hr	[3]	9.55E+06	unitless	[8]	1.31E+05	mL/g	[6]
7487-94-7	Mercuric chloride (HgCl2)	1.00E-03	cm/hr	[1]	6.10E-01	unitless	[2]			
75-00-3	Chloroethane	6.07E-03	cm/hr	[3]	2.51E+01	unitless	[2]	1.54E+01	mL/g	[3]
75-01-4	1-Chloroethene	8.38E-03	cm/hr	[3]	2.51E+01	unitless	[2]	1.54E+01	mL/g	[3]
75-02-5	Fluoroethene (vinyl fluoride)	5.30E-03	cm/hr	[2]	1.55E+01	unitless	[8]	1.05E+01	mL/g	[2]
75-05-8	Acetonitrile	5.48E-04	cm/hr	[3]	4.57E-01	unitless	[2]	4.60E-01	mL/g	[3]
75-07-0	Acetaldehyde	5.27E-04	cm/hr	[3]	6.03E-01	unitless	[2]	6.10E-01	mL/g	[3]
75-09-2	Dichloromethane (Methylene Chloride)	3.54E-03	cm/hr	[3]	2.00E+01	unitless	[2]	1.00E+01	mL/g	[3]
75-15-0	Carbon disulfide	1.14E-02	cm/hr	[3]	1.58E+02	unitless	[2]	6.62E+01	mL/g	[3]
75-21-8	Ethylene oxide (Oxirane)	5.60E-04	cm/hr	[3]	5.01E-01	unitless	[2]	5.10E-01	mL/g	[3]
75-25-2	Bromoform	2.35E-03	cm/hr	[3]	2.34E+02	unitless	[2]	1.26E+02	mL/g	[3]
75-27-4	Bromodichloromethane	4.02E-03	cm/hr	[3]	1.26E+02	unitless	[2]	5.51E+01	mL/g	[3]
75-29-6	2-Chloropropane	1.04E-02	cm/hr	[3]	7.94E+01	unitless	[3]	3.18E+01	mL/g	[6]
75-34-3	1,1-Dichloroethane	6.75E-03	cm/hr	[3]	6.31E+01	unitless	[2]	5.34E+01	mL/g	[3]
75-35-4	1,1-Dichloroethene	1.17E-02	cm/hr	[3]	1.26E+02	unitless	[2]	6.50E+01	mL/g	[3]
75-44-5	Phosgene (hydrogen phosphide)	1.47E-04	cm/hr	[3]	1.95E-01	unitless	[8]	1.00E+00	mL/g	[6]
75-45-6	Chlorodifluoromethane	2.68E-03	cm/hr	[3]	1.20E+01	unitless	[8]	8.58E+00	mL/g	[3]
75-50-3	Trimethylamine	9.32E-04	cm/hr	[2]	1.45E+00	unitless	[8]			
75-69-4	Trichlorofluoromethane	1.27E-02	cm/hr	[3]	3.16E+02	unitless	[2]	1.14E+02	mL/g	[3]
75-71-8	Dichlorodifluoromethane	8.95E-03	cm/hr	[3]	1.45E+02	unitless	[2]	6.15E+01	mL/g	[3]
76-01-7	Pentachloroethane	1.58E-02	cm/hr	[3]	1.66E+03	unitless	[3]	1.36E+02	mL/g	[6]

Table 2-4 Permeability Constant, Octanol/Water Partitioning Coefficient, and Organic Carbon Partitioning Coefficient

CAS Registry Number	Constituent Name	Permeability Constant (*Kp*)	Units for Permeability Constant	Reference	Octanol-water Partition Coeff. (K_{ow})	Units for Octanol-water Partition Coeff.	Reference	Organic Carbon Partition Coeff. (K_{oc})	Units for Organic Carbon Partition Coeff.	Reference
76-13-1	1,2,2-Trichlorotrifluoroethane	1.75E-02	cm/hr	[3]	1.45E+03	unitless	[3]	1.97E+02	mL/g	[6]
76-44-8	Heptachlor	1.43E-01	cm/hr	[3]	2.00E+04	unitless	[2]	9.53E+03	mL/g	[3]
764-41-0	1,4-Dichloro-2-butene	1.66E-02	cm/hr	[3]	3.98E+02	unitless	[4]	1.32E+02	mL/g	[6]
7647-01-0	Hydrogen chloride	1.00E-03	cm/hr	[1]						
765-34-4	Glycidylaldehyde	5.16E-04	cm/hr	[3]	7.59E-01	unitless	[4]	1.00E+00	mL/g	[6]
7664-39-3	Hydrogen Fluoride	1.00E-03	cm/hr	[1]	1.70E+00	unitless	[8]			
7664-41-7	Ammonia/Ammonium	1.00E-03	cm/hr	[1]	1.70E+00	unitless	[8]			
77-47-4	Hexachlorocyclopentadiene	1.03E-01	cm/hr	[3]	1.10E+05	unitless	[2]	1.17E+04	mL/g	[3]
77-78-1	Dimethyl sulfate	3.92E-04	cm/hr	[3]	1.45E+01	unitless	[4]	8.49E+00	mL/g	[6]
7704-34-9	Total Sulfur (thermodynamically stable)	1.00E-03	cm/hr	[1]	4.17E-02	unitless	[3]			
7723-14-0	Phosphorus	1.00E-03	cm/hr	[1]	5.37E-01	unitless	[8]			
7782-41-4	Fluorine gas F2	1.00E-03	cm/hr	[1]	1.66E+00	unitless	[8]	1.79E+00	mL/g	[2]
7782-49-2	Selenium	1.00E-03	cm/hr	[1]	1.74E+00	unitless	[2]			
7782-50-5	Chlorine	1.00E-03	cm/hr	[1]	7.08E+00	unitless	[8]			
78-83-1	2-Methylpropyl alcohol	1.92E-03	cm/hr	[3]	5.75E+00	unitless	[3]	2.92E+00	mL/g	[6]
78-87-5	1,2-Dichloropropane	7.53E-03	cm/hr	[3]	1.00E+02	unitless	[2]	4.70E+01	mL/g	[3]
78-93-3	2-Butanone	9.62E-04	cm/hr	[3]	1.95E+00	unitless	[2]	1.93E+00	mL/g	[3]
79-00-5	1,1,2-Trichloroethane	5.04E-03	cm/hr	[3]	1.00E+02	unitless	[2]	7.50E+01	mL/g	[3]
79-01-6	1,1,2-Trichloroethylene	1.16E-02	cm/hr	[3]	2.51E+02	unitless	[2]	9.43E+01	mL/g	[3]
79-10-7	2-Propenoic acid	1.05E-03	cm/hr	[3]	2.24E+00	unitless	[3]	1.44E+00	mL/g	[6]
79-34-5	1,1,2,2-Tetrachloroethane	6.94E-03	cm/hr	[3]	2.51E+02	unitless	[2]	7.90E+01	mL/g	[3]
79-46-9	2-Nitropropane	2.06E-03	cm/hr	[3]	8.51E+00	unitless	[3]	3.08E+01	mL/g	[6]
80-62-6	Methyl methacrylate	3.55E-03	cm/hr	[3]	2.40E+01	unitless	[3]	9.14E+00	mL/g	[6]
82-68-8	Pentachloronitrobenzene (PCNB)	4.18E-02	cm/hr	[3]	4.37E+04	unitless	[2]	3.64E+04	mL/g	[3]
822-06-0	Hexamethylene-1,5-diisocyanate	2.37E-02	cm/hr	[3]	1.58E+03	unitless	[4]	4.82E+03	mL/g	[6]
823-40-5	Toluene-2,6-diamine	4.10E-04	cm/hr	[3]	1.45E+00	unitless	[4]	5.65E+01	mL/g	[6]
83-32-9	Acenaphthene	8.60E-02	cm/hr	[3]	7.94E+03	unitless	[2]	4.90E+03	mL/g	[3]

Table 2-4 Permeability Constant, Octanol/Water Partitioning Coefficient, and Organic Carbon Partitioning Coefficient

CAS Registry Number	Constituent Name	Permeability Constant (*Kp*)	Units for Permeability Constant	Reference	Octanol-water Partition Coeff. (K_{ow})	Units for Octanol-water Partition Coeff.	Reference	Organic Carbon Partition Coeff. (K_{oc})	Units for Organic Carbon Partition Coeff.	Reference
832-69-9	1-Methylphenanthrene	3.11E-01	cm/hr	[2]	1.20E+05	unitless	[3]	9.86E+04	mL/g	[1]
84-66-2	Diethyl phthalate	3.60E-03	cm/hr	[3]	3.16E+02	unitless	[2]	8.22E+01	mL/g	[3]
84-74-2	Di-n-butylphthalate	4.20E-02	cm/hr	[3]	5.01E+04	unitless	[2]	1.57E+03	mL/g	[3]
85-01-8	Phenanthrene	1.44E-01	cm/hr	[3]	3.16E+04	unitless	[2]	2.65E+04	mL/g	[3]
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	2.67E-03	cm/hr	[3]	2.40E-01	unitless	[2]	2.50E-01	mL/g	[3]
85-68-7	Butylbenzylphthalate	3.85E-02	cm/hr	[3]	7.94E+04	unitless	[2]	1.37E+04	mL/g	[3]
86-73-7	Fluorene	1.10E-01	cm/hr	[3]	1.58E+04	unitless	[2]	7.71E+03	mL/g	[3]
87-61-6	1,2,3-Trichlorobenzene	7.38E-02	cm/hr	[3]	1.12E+04	unitless	[2]	1.93E+03	mL/g	[3]
87-68-3	Hexachlorobutadiene	8.10E-02	cm/hr	[3]	6.31E+04	unitless	[2]	7.58E+03	mL/g	[3]
87-86-5	Pentachlorophenol	1.27E-01	cm/hr	[3]	1.26E+05	unitless	[2]	5.92E+02	mL/g	[3]
88-06-2	2,4,6-Trichlorophenol	3.46E-02	cm/hr	[3]	5.01E+03	unitless	[2]	3.81E+02	mL/g	[3]
88-74-4	o-Nitroaniline (2-nitroaniline)	4.46E-03	cm/hr	[3]	7.08E+01	unitless	[2]	6.59E+01	mL/g	[3]
88-75-5	2-Nitrophenol	4.02E-03	cm/hr	[1]	6.17E+01	unitless	[2]	5.75E+01	mL/g	[3]
90-04-0	o-Anisidine	1.46E-03	cm/hr	[1]	1.51E+01	unitless	[1]	4.59E+01	mL/g	[6]
90-12-0	1-Methylnaphthalene	9.31E-02	cm/hr	[3]	7.41E+03	unitless	[3]	2.29E+03	mL/g	[4]
91-20-3	Naphthalene	4.66E-02	cm/hr	[3]	2.00E+03	unitless	[2]	1.19E+03	mL/g	[3]
91-22-5	Quinoline	6.59E-03	cm/hr	[3]	1.07E+02	unitless	[3]	1.26E+03	mL/g	[4]
91-57-6	2-Methylnaphthalene	9.17E-02	cm/hr	[3]	7.24E+03	unitless	[3]	3.98E+03	mL/g	[4]
91-58-7	2-Chloronaphthalene	7.49E-02	cm/hr	[3]	2.40E+03	unitless	[2]	2.10E+03	mL/g	[3]
91-94-1	3,3'-Dichlorobenzidine	1.28E-02	cm/hr	[3]	3.24E+03	unitless	[2]	7.21E+02	mL/g	[3]
92-52-4	1,1`-Biphenyl	9.43E-02	cm/hr	[3]	1.02E+04	unitless	[3]	1.86E+03	mL/g	[4]
924-16-3	N-Nitroso-di-n-Buetylamine	1.13E-02	cm/hr	[3]	8.32E+01	unitless	[2]	7.72E+01	mL/g	[3]
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	1.13E-02	cm/hr	[1]	4.57E+02	unitless	[2]	4.12E+02	mL/g	[3]
94-75-7	2,4-D	6.64E-03	cm/hr	[3]	6.46E+02	unitless	[3]	4.57E+01	mL/g	[4]
95-48-7	o-Cresol	7.66E-03	cm/hr	[3]	8.91E+01	unitless	[2]	8.26E+01	mL/g	[3]
95-49-8	o-Chlorotoluene	5.72E-02	cm/hr	[3]	2.63E+03	unitless	[3]	3.83E+02	mL/g	[6]
95-50-1	1,2-Dichlorobenzene	4.46E-02	cm/hr	[3]	2.40E+03	unitless	[2]	3.79E+02	mL/g	[3]

Table 2-4 Permeability Constant, Octanol/Water Partitioning Coefficient, and Organic Carbon Partitioning Coefficient

CAS Registry Number	Constituent Name	Permeability Constant (*Kp*)	Units for Permeability Constant	Reference	Octanol-water Partition Coeff. (K_{ow})	Units for Octanol-water Partition Coeff.	Reference	Organic Carbon Partition Coeff. (K_{oc})	Units for Organic Carbon Partition Coeff.	Reference
95-53-4	o-Toluidine	2.96E-03	cm/hr	[3]	2.09E+01	unitless	[2]	1.99E+01	mL/g	[3]
95-57-8	2-Chlorophenol	7.99E-03	cm/hr	[3]	1.41E+02	unitless	[2]	3.88E+02	mL/g	[3]
95-63-6	1,2,4-Trimethyl benzene	8.57E-02	cm/hr	[3]	4.27E+03	unitless	[3]	6.14E+02	mL/g	[6]
95-94-3	1,2,4,5-Tetrachlorobenzene	1.17E-01	cm/hr	[3]	6.31E+04	unitless	[2]	7.58E+03	mL/g	[3]
95-95-4	2,4,5-Trichlorophenol	3.62E-02	cm/hr	[3]	5.25E+03	unitless	[2]	1.60E+03	mL/g	[3]
96-12-8	1,2-Dibromo-3-chloropropane	6.85E-03	cm/hr	[3]	2.00E+02	unitless	[2]	1.82E+02	mL/g	[3]
96-18-4	1,2,3-Trichloropropane	7.52E-03	cm/hr	[3]	1.00E+02	unitless	[2]	4.59E+01	mL/g	[3]
96-45-7	Ethylene thiourea	1.52E-04	cm/hr	[3]	2.19E-01	unitless	[3]	1.30E+01	mL/g	[6]
97-63-2	Ethyl methacrylate	6.98E-03	cm/hr	[3]	8.71E+01	unitless	[2]	8.08E+01	mL/g	[3]
98-01-1	Furfural	8.48E-04	cm/hr	[3]	2.57E+00	unitless	[3]	6.08E+00	mL/g	[6]
98-06-6	tert-Butyl benzene	1.49E-01	cm/hr	[3]	1.29E+04	unitless	[3]	1.00E+03	mL/g	[6]
98-07-7	Benzotrichloride	4.87E-02	cm/hr	[3]	7.94E+03	unitless	[4]	1.00E+03	mL/g	[6]
98-82-8	Cumene	8.97E-02	cm/hr	[3]	5.01E+03	unitless	[2]	1.02E+03	mL/g	[3]
98-83-9	Methyl styrene (mixed isomers)	6.60E-02	cm/hr	[3]	3.02E+03	unitless	[3]	7.16E+02	mL/g	[6]
98-86-2	Acetophenone	3.72E-03	cm/hr	[3]	3.80E+01	unitless	[2]	3.58E+01	mL/g	[3]
98-95-3	Nitrobenzene	5.41E-03	cm/hr	[3]	7.08E+01	unitless	[2]	1.19E+02	mL/g	[3]
99-35-4	1,3,5-Trinitrobenzene	6.07E-04	cm/hr	[3]	1.58E+01	unitless	[2]	1.51E+01	mL/g	[3]
99-65-0	1,3-Dinitrobenzene	1.74E-03	cm/hr	[3]	3.16E+01	unitless	[2]	2.98E+01	mL/g	[3]
99-87-6	p-Cymene	1.47E-01	cm/hr	[3]	1.26E+04	unitless	[3]	1.12E+03	mL/g	[6]

Reference **Reference (source) for Permeability Constant**

[1] EPA. 2004. *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), Final*, EPA/540/R/99/005, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/oswer/riskassessment/ragse/pdf/2004_1101_part_e.pdf).

[2] EPA. 2012. *Estimation Programs Interface (EPI) Suite*, v 4.11, Copyright © 2000-2012, US Environmental Protection Agency, Office of Polution Prevention Toxics and Syracuse Research Corporation, Washington, DC [Dermwin v. 2.02 estimate] (http://www.epa.gov/oppt/exposure/docs/episuite.htm).

[3] ORNL. *The Risk Assessment Information System (RAIS) Database*. Copyright © 2013 Oak Ridge National Laboratory and The University of Tennessee, Oak Ridge, TN (http://rais.ornl.gov, accessed April 2014).

[4] Surrogate value from 2,4-Dinitrotoluene.

Reference	Reference (source) for Permeability Constant
[5]	Surrogate value from Chlorocyclopentadiene.
[6]	Surrogate value from Dibenzo[a,i]pyrene.
[7]	Surrogate value from Trichlorofluoromethane.

Reference	Reference (source) for Octanol-water Partition Coeff.
[1]	EPA. 2004. *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), Final*, EPA/540/R/99/005, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/oswer/riskassessment/ragse/pdf/2004_1101_part_e.pdf).
[2]	EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013).
[3]	EPA. 2012. *Estimation Programs Interface (EPI) Suite*, v 4.11, Copyright © 2000-2012, US Environmental Protection Agency, Office of Polution Prevention Toxics and Syracuse Research Corporation, Washington, DC (http://www.epa.gov/oppt/exposure/docs/episuite.htm, values in database).
[4]	ORNL. *The Risk Assessment Information System (RAIS) Database*. Copyright © 2013 Oak Ridge National Laboratory and The University of Tennessee, Oak Ridge, TN (http://rais.ornl.gov, accessed April 2014).
[5]	Surrogate value from 2,3',4,4',5-Pentachlorobiphenyl (PCB 118).
[6]	Surrogate value from Chlorocyclopentadiene.
[7]	Surrogate value from Trichlorofluoromethane.
[8]	Syracuse Research Corporation (SRC). *FatePointers Search Module*, Copyright © 2014 SRC, Inc., North Syracuse, NY (http://esc.syrres.com/fatepointer/search.asp).
[9]	Syracuse Research Corporation (SRC). *FatePointers Search Module*, Copyright © 2014 SRC, Inc., North Syracuse, NY (http://esc.syrres.com/fatepointer/search.asp, value reported as <25 deg C).
[10]	Syracuse Research Corporation (SRC). *FatePointers Search Module*, Copyright © 2014 SRC, Inc., North Syracuse, NY (http://esc.syrres.com/fatepointer/search.asp, values reported here are for nitric acid, CAS 7697-37-2).

Reference	Reference (source) for Organic Carbon Partition Coeff.
[1]	Calculated value per Eq. A-2-7 in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm).
[2]	Calculated value per Eq. A-2-8 in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm).
[3]	EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013).
[4]	EPA. 2012. *Estimation Programs Interface (EPI) Suite*, v 4.11, Copyright © 2000-2012, US Environmental Protection Agency, Office of Polution Prevention Toxics and Syracuse Research Corporation, Washington, DC (http://www.epa.gov/oppt/exposure/docs/episuite.htm, values in database). (converted from log value to mL/g)
[5]	Ecology. *Cleanup Levels and Risk Calculations (CLARC) database* (https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx, accessed May 2014).
[6]	ORNL. *The Risk Assessment Information System (RAIS) Database*. Copyright © 2013 Oak Ridge National Laboratory and The University of Tennessee, Oak Ridge, TN (http://rais.ornl.gov, accessed April 2014).

Reference	Reference (source) for Organic Carbon Partition Coeff.
[7]	Surrogate value from 2,4-Dinitrotoluene.
[8]	Surrogate value from Chlorocyclopentadiene.
[9]	Surrogate value from Dibenzo[a,i]pyrene.
[10]	Surrogate value from Trichlorofluoromethane.
[11]	WAC 173-340-900. *Tables*, Washington Administrative Code, effective 15 August 2001.

Table 2-5 provides data for soil/water, suspended sediment/surface water, and bed sediment/sediment pore water partitioning coefficients where available. These values are related to the organic carbon partition coefficient and are used to assess constituent partitioning into exposure media such as soil, water, and sediment. The blank entries in the table indicate where data are not available.

Table 2-5 Soil/Water Partitioning Constant, Suspended Sediment/Surface Water Partitioning Coefficient, and Bed Sediment/Sediment Pore Water Partitioning Coefficient

CAS Registry Number	Constituent Name	Soil-water Partition Coeff. (Kd_s)	Units for Soil-Water Partition Coeff.	Reference	Suspended Sediment-Surface Water Partition Coeff. (Kd_{sw})	Units for Suspended Sediment-Surface Water Partition Coeff.	Reference	Bed Sediment-Sediment Pore Water Partition Coeff. (Kd_{bs})	Units for Sediment-Sediment Pore Water Partition Coeff.	Reference
100-02-7	p-Nitrophenol	3.35E-01	cm^3/g or L/kg	[2]	5.66E+00	cm^3/g or L/kg	[3]	3.02E+00	cm^3/g or L/kg	[3]
100-21-0	Phthalic acid	3.52E-01	cm^3/g or L/kg	[2]	5.94E+00	cm^3/g or L/kg	[2]	3.17E+00	cm^3/g or L/kg	[2]
100-25-4	1,4-Dinitrobenzene	1.56E+00	cm^3/g or L/kg	[2]	2.64E+01	cm^3/g or L/kg	[2]	1.41E+01	cm^3/g or L/kg	[2]
100-40-3	4-Ethenylcyclohexene	6.89E+00	cm^3/g or L/kg	[2]	1.16E+02	cm^3/g or L/kg	[2]	6.20E+01	cm^3/g or L/kg	[2]
100-41-4	Ethyl benzene	7.30E-01	cm^3/g or L/kg	[3]	1.53E+01	cm^3/g or L/kg	[3]	8.16E+00	cm^3/g or L/kg	[3]
100-42-5	Styrene	1.20E+02	cm^3/g or L/kg	[3]	6.84E+01	cm^3/g or L/kg	[3]	3.65E+01	cm^3/g or L/kg	[3]
100-44-7	Benzyl chloride	8.10E-01	cm^3/g or L/kg	[2]	1.37E+01	cm^3/g or L/kg	[3]	7.30E+00	cm^3/g or L/kg	[3]
100-47-0	Benzonitrile	1.52E-01	cm^3/g or L/kg	[2]	2.56E+00	cm^3/g or L/kg	[3]	1.37E+00	cm^3/g or L/kg	[3]
100-51-6	Benzyl alcohol	5.36E-02	cm^3/g or L/kg	[2]	9.00E-01	cm^3/g or L/kg	[3]	4.80E-01	cm^3/g or L/kg	[3]
100-52-7	Benzaldehyde	1.27E-01	cm^3/g or L/kg	[2]	2.14E+00	cm^3/g or L/kg	[3]	1.14E+00	cm^3/g or L/kg	[3]
10028-15-6	Ozone									
10028-17-8	Tritium	0.00E+00	cm^3/g or L/kg	[6]						
10045-97-3	Cesium-137	1.00E+03	cm^3/g or L/kg	[1]	1.00E+03	cm^3/g or L/kg	[1]	1.00E+03	cm^3/g or L/kg	[1]
10061-01-5	cis-1,3-Dichloropropene	7.10E-02	cm^3/g or L/kg	[14]	2.87E+00	cm^3/g or L/kg	[12]	1.53E+00	cm^3/g or L/kg	[12]
10061-02-6	trans-1,3-Dichloropropene	2.93E-01	cm^3/g or L/kg	[2]	4.96E+00	cm^3/g or L/kg	[2]	2.64E+00	cm^3/g or L/kg	[2]

Table 2-5 Soil/Water Partitioning Constant, Suspended Sediment/Surface Water Partitioning Coefficient, and Bed Sediment/Sediment Pore Water Partitioning Coefficient

CAS Registry Number	Constituent Name	Soil-water Partition Coeff. (Kd_s)	Units for Soil-Water Partition Coeff.	Reference	Suspended Sediment-Surface Water Partition Coeff. (Kd_{sw})	Units for Suspended Sediment-Surface Water Partition Coeff.	Reference	Bed Sediment-Sediment Pore Water Partition Coeff. (Kd_{bs})	Units for Sediment-Sediment Pore Water Partition Coeff.	Reference
10098-91-6	Yttrium-90	5.00E+02	cm^3/g or L/kg	[1]	5.00E+02	cm^3/g or L/kg	[1]	5.00E+02	cm^3/g or L/kg	[1]
10098-97-2	Strontium-90	3.50E+01	cm^3/g or L/kg	[1]	3.50E+01	cm^3/g or L/kg	[1]	3.50E+01	cm^3/g or L/kg	[1]
101-55-3	4-Bromophenylphenyl ether	6.33E+02	cm^3/g or L/kg	[2]	1.07E+04	cm^3/g or L/kg	[3]	5.70E+03	cm^3/g or L/kg	[3]
101-77-9	4,4-Methylenedianiline	9.46E+00	cm^3/g or L/kg	[2]	1.60E+02	cm^3/g or L/kg	[2]	8.52E+01	cm^3/g or L/kg	[2]
10102-44-0	Nitrogen dioxide									
10198-40-0	Cobalt-60	4.50E+01	cm^3/g or L/kg	[1]	4.50E+01	cm^3/g or L/kg	[1]	4.50E+01	cm^3/g or L/kg	[1]
103-33-3	Azobenzene	8.86E+00	cm^3/g or L/kg	[2]	1.50E+02	cm^3/g or L/kg	[2]	7.98E+01	cm^3/g or L/kg	[2]
103-65-1	n-Propyl benzene (Isocumene)	3.29E+00	cm^3/g or L/kg	[2]	5.56E+01	cm^3/g or L/kg	[2]	2.97E+01	cm^3/g or L/kg	[2]
104-51-8	n-Butylbenzene	1.56E+01	cm^3/g or L/kg	[2]	2.64E+02	cm^3/g or L/kg	[2]	1.41E+02	cm^3/g or L/kg	[2]
104-76-7	2-Ethyl-1-hexanol	2.14E+00	cm^3/g or L/kg	[2]	3.62E+01	cm^3/g or L/kg	[2]	1.93E+01	cm^3/g or L/kg	[2]
105-67-9	2,4-Dimethylphenol	3.20E+01	cm^3/g or L/kg	[3]	1.37E+01	cm^3/g or L/kg	[3]	7.30E+00	cm^3/g or L/kg	[3]
10595-95-6	n-Nitrosomethylethylamine	1.93E-01	cm^3/g or L/kg	[2]	3.26E+00	cm^3/g or L/kg	[2]	1.74E+00	cm^3/g or L/kg	[2]
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	1.67E+00	cm^3/g or L/kg	[2]	2.81E+01	cm^3/g or L/kg	[2]	1.50E+01	cm^3/g or L/kg	[2]
106-44-5	p-Cresol (4-methyl phenol)	1.20E+01	cm^3/g or L/kg	[3]	5.53E+00	cm^3/g or L/kg	[3]	2.95E+00	cm^3/g or L/kg	[3]
106-46-7	1,4-Dichlorobenzene	1.20E+00	cm^3/g or L/kg	[3]	4.62E+01	cm^3/g or L/kg	[3]	2.46E+01	cm^3/g or L/kg	[3]
106-47-8	p-Chloroaniline	2.80E-01	cm^3/g or L/kg	[2]	4.72E+00	cm^3/g or L/kg	[3]	2.52E+00	cm^3/g or L/kg	[3]

Table 2-5 Soil/Water Partitioning Constant, Suspended Sediment/Surface Water Partitioning Coefficient, and Bed Sediment/Sediment Pore Water Partitioning Coefficient

CAS Registry Number	Constituent Name	Soil-water Partition Coeff. (Kd_s)	Units for Soil-Water Partition Coeff.	Reference	Suspended Sediment-Surface Water Partition Coeff. (Kd_{sw})	Units for Suspended Sediment-Surface Water Partition Coeff.	Reference	Bed Sediment-Sediment Pore Water Partition Coeff. (Kd_{bs})	Units for Sediment-Sediment Pore Water Partition Coeff.	Reference
106-49-0	p-Toluidine	3.53E-01	cm^3/g or L/kg	[2]	5.96E+00	cm^3/g or L/kg	[2]	3.18E+00	cm^3/g or L/kg	[2]
106-51-4	Quinone	6.99E-03	cm^3/g or L/kg	[2]	1.18E-01	cm^3/g or L/kg	[2]	6.29E-02	cm^3/g or L/kg	[2]
106-88-7	1,2-Epoxybutane	4.40E-02	cm^3/g or L/kg	[2]	7.43E-01	cm^3/g or L/kg	[2]	3.96E-01	cm^3/g or L/kg	[2]
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	2.75E-03	cm^3/g or L/kg	[2]	5.00E-02	cm^3/g or L/kg	[3]	2.00E-02	cm^3/g or L/kg	[3]
106-93-4	Ethylene dibromide	8.50E-02	cm^3/g or L/kg	[3]	6.94E+00	cm^3/g or L/kg	[3]	3.70E+00	cm^3/g or L/kg	[3]
106-99-0	1,3-Butadiene	1.76E-01	cm^3/g or L/kg	[2]	2.97E+00	cm^3/g or L/kg	[2]	1.58E+00	cm^3/g or L/kg	[2]
107-02-8	Acrolein	1.50E-01	cm^3/g or L/kg	[3]	7.00E-02	cm^3/g or L/kg	[3]	4.00E-02	cm^3/g or L/kg	[3]
107-05-1	3-Chloropropene	1.76E-01	cm^3/g or L/kg	[2]	2.97E+00	cm^3/g or L/kg	[2]	1.58E+00	cm^3/g or L/kg	[2]
107-06-2	1,2-Dichloroethane	3.50E-02	cm^3/g or L/kg	[3]	2.85E+00	cm^3/g or L/kg	[3]	1.52E+00	cm^3/g or L/kg	[3]
107-12-0	Propionitrile	3.78E-02	cm^3/g or L/kg	[2]	6.38E-01	cm^3/g or L/kg	[2]	3.40E-01	cm^3/g or L/kg	[2]
107-13-1	Acrylonitrile	7.81E-03	cm^3/g or L/kg	[2]	1.30E-01	cm^3/g or L/kg	[3]	7.00E-02	cm^3/g or L/kg	[3]
107-19-7	Propargyl alcohol	8.44E-03	cm^3/g or L/kg	[2]	1.43E-01	cm^3/g or L/kg	[2]	7.60E-02	cm^3/g or L/kg	[2]
107-21-1	Ethylene glycol (1,2-ethanediol)	4.44E-03	cm^3/g or L/kg	[2]	7.50E-02	cm^3/g or L/kg	[2]	4.00E-02	cm^3/g or L/kg	[2]
107-98-2	Propylene glycol monomethyl ether	4.44E-03	cm^3/g or L/kg	[2]	7.50E-02	cm^3/g or L/kg	[2]	4.00E-02	cm^3/g or L/kg	[2]
108-05-4	Acetic acid vinyl ester	7.90E-01	cm^3/g or L/kg	[3]	3.90E-01	cm^3/g or L/kg	[3]	2.10E-01	cm^3/g or L/kg	[3]
108-10-1	4-Methyl-2-pentanone	2.20E+00	cm^3/g or L/kg	[3]	1.13E+00	cm^3/g or L/kg	[3]	6.10E-01	cm^3/g or L/kg	[3]

Table 2-5 Soil/Water Partitioning Constant, Suspended Sediment/Surface Water Partitioning Coefficient, and Bed Sediment/Sediment Pore Water Partitioning Coefficient

CAS Registry Number	Constituent Name	Soil-water Partition Coeff. (Kd_s)	Units for Soil-Water Partition Coeff.	Reference	Suspended Sediment-Surface Water Partition Coeff. (Kd_{sw})	Units for Suspended Sediment-Surface Water Partition Coeff.	Reference	Bed Sediment-Sediment Pore Water Partition Coeff. (Kd_{bs})	Units for Sediment-Sediment Pore Water Partition Coeff.	Reference
108-39-4	m-Cresol	3.75E-01	cm^3/g or L/kg	[2]	6.34E+00	cm^3/g or L/kg	[3]	3.38E+00	cm^3/g or L/kg	[3]
108-60-1	bis (2-Chloroisopropyl)ether	2.08E-01	cm^3/g or L/kg	[2]	3.51E+00	cm^3/g or L/kg	[2]	1.87E+00	cm^3/g or L/kg	[2]
108-67-8	1,3,5-Trimethylbenzene	2.72E+00	cm^3/g or L/kg	[2]	4.59E+01	cm^3/g or L/kg	[3]	2.45E+01	cm^3/g or L/kg	[3]
108-86-1	Bromobenzene (Phenyl bromide)	1.37E+00	cm^3/g or L/kg	[2]	2.32E+01	cm^3/g or L/kg	[2]	1.24E+01	cm^3/g or L/kg	[2]
108-87-2	Methylcyclohexane	1.04E+00	cm^3/g or L/kg	[2]	1.76E+01	cm^3/g or L/kg	[2]	9.36E+00	cm^3/g or L/kg	[2]
108-88-3	Toluene	3.60E-01	cm^3/g or L/kg	[3]	1.05E+01	cm^3/g or L/kg	[3]	5.60E+00	cm^3/g or L/kg	[3]
108-90-7	Chlorobenzene	4.40E-01	cm^3/g or L/kg	[3]	1.68E+01	cm^3/g or L/kg	[3]	8.96E+00	cm^3/g or L/kg	[3]
108-94-1	Cyclohexanone	7.73E-02	cm^3/g or L/kg	[2]	1.31E+00	cm^3/g or L/kg	[2]	6.96E-01	cm^3/g or L/kg	[2]
108-95-2	Phenol	4.40E+00	cm^3/g or L/kg	[3]	2.24E+00	cm^3/g or L/kg	[3]	1.20E+00	cm^3/g or L/kg	[3]
109-74-0	n-Butanenitrile	1.47E-02	cm^3/g or L/kg	[2]	2.49E-01	cm^3/g or L/kg	[2]	1.33E-01	cm^3/g or L/kg	[2]
109-75-1	3-Butenenitrile	1.10E-02	cm^3/g or L/kg	[2]	1.86E-01	cm^3/g or L/kg	[2]	9.90E-02	cm^3/g or L/kg	[2]
109-77-3	Malononitrile	1.48E-02	cm^3/g or L/kg	[2]	2.50E-01	cm^3/g or L/kg	[2]	1.33E-01	cm^3/g or L/kg	[2]
109-86-4	2-Methoxyethanol	4.44E-03	cm^3/g or L/kg	[2]	7.50E-02	cm^3/g or L/kg	[2]	4.00E-02	cm^3/g or L/kg	[2]
109-99-9	Tetrahydrofuran	1.26E-02	cm^3/g or L/kg	[2]	2.10E-01	cm^3/g or L/kg	[3]	1.10E-01	cm^3/g or L/kg	[3]
110-00-9	Furan	3.55E-01	cm^3/g or L/kg	[2]	6.00E+00	cm^3/g or L/kg	[2]	3.20E+00	cm^3/g or L/kg	[2]
110-54-3	n-Hexane	1.51E+01	cm^3/g or L/kg	[2]	2.56E+02	cm^3/g or L/kg	[2]	1.36E+02	cm^3/g or L/kg	[2]

Table 2-5 Soil/Water Partitioning Constant, Suspended Sediment/Surface Water Partitioning Coefficient, and Bed Sediment/Sediment Pore Water Partitioning Coefficient

CAS Registry Number	Constituent Name	Soil-water Partition Coeff. (Kd_s)	Units for Soil-Water Partition Coeff.	Reference	Suspended Sediment-Surface Water Partition Coeff. (Kd_{sw})	Units for Suspended Sediment-Surface Water Partition Coeff.	Reference	Bed Sediment-Sediment Pore Water Partition Coeff. (Kd_{bs})	Units for Sediment-Sediment Pore Water Partition Coeff.	Reference
110-59-8	Pentanenitrile	5.61E-02	cm^3/g or L/kg	[2]	9.47E-01	cm^3/g or L/kg	[2]	5.05E-01	cm^3/g or L/kg	[2]
110-80-5	2-Ethoxyethanol	4.44E-03	cm^3/g or L/kg	[2]	7.50E-02	cm^3/g or L/kg	[2]	4.00E-02	cm^3/g or L/kg	[2]
110-82-7	Cyclohexane	6.48E-01	cm^3/g or L/kg	[2]	1.10E+01	cm^3/g or L/kg	[2]	5.84E+00	cm^3/g or L/kg	[2]
110-83-8	Cyclohexene	6.48E-01	cm^3/g or L/kg	[2]	1.10E+01	cm^3/g or L/kg	[2]	5.84E+00	cm^3/g or L/kg	[2]
110-86-1	Pyridine	1.94E-02	cm^3/g or L/kg	[2]	3.30E-01	cm^3/g or L/kg	[3]	1.70E-01	cm^3/g or L/kg	[3]
111-15-9	Ethylene glycol monoethyl ether acetate	2.02E-02	cm^3/g or L/kg	[2]	3.41E-01	cm^3/g or L/kg	[2]	1.82E-01	cm^3/g or L/kg	[2]
111-44-4	Bis(2-chloroethyl)ether	3.37E-01	cm^3/g or L/kg	[2]	5.69E+00	cm^3/g or L/kg	[3]	3.04E+00	cm^3/g or L/kg	[3]
111-65-9	n-Octane	6.73E+01	cm^3/g or L/kg	[2]	1.14E+03	cm^3/g or L/kg	[2]	6.06E+02	cm^3/g or L/kg	[2]
111-76-2	2-Butoxyethanol	1.25E-02	cm^3/g or L/kg	[2]	2.12E-01	cm^3/g or L/kg	[2]	1.13E-01	cm^3/g or L/kg	[2]
111-84-2	n-Nonane	3.53E+00	cm^3/g or L/kg	[2]	5.97E+01	cm^3/g or L/kg	[2]	3.18E+01	cm^3/g or L/kg	[2]
111-91-1	Bis(2-chloroethoxy)methane	6.39E-02	cm^3/g or L/kg	[2]	1.08E+00	cm^3/g or L/kg	[2]	5.76E-01	cm^3/g or L/kg	[2]
112-30-1	1-Decanol	1.73E+00	cm^3/g or L/kg	[2]	2.92E+01	cm^3/g or L/kg	[2]	1.56E+01	cm^3/g or L/kg	[2]
112-31-2	Decanal	2.21E+01	cm^3/g or L/kg	[2]	3.73E+02	cm^3/g or L/kg	[2]	1.99E+02	cm^3/g or L/kg	[2]
112-40-3	Dodecane	3.60E+02	cm^3/g or L/kg	[2]	6.08E+03	cm^3/g or L/kg	[2]	3.24E+03	cm^3/g or L/kg	[2]
1120-21-4	Undecane	1.87E+02	cm^3/g or L/kg	[2]	3.15E+03	cm^3/g or L/kg	[2]	1.68E+03	cm^3/g or L/kg	[2]
1120-71-4	1,3-Propane sultone	4.18E-02	cm^3/g or L/kg	[2]	7.06E-01	cm^3/g or L/kg	[2]	3.76E-01	cm^3/g or L/kg	[2]

Table 2-5 Soil/Water Partitioning Constant, Suspended Sediment/Surface Water Partitioning Coefficient, and Bed Sediment/Sediment Pore Water Partitioning Coefficient

CAS Registry Number	Constituent Name	Soil-water Partition Coeff. (Kd_s)	Units for Soil-Water Partition Coeff.	Reference	Suspended Sediment-Surface Water Partition Coeff. (Kd_{sw})	Units for Suspended Sediment-Surface Water Partition Coeff.	Reference	Bed Sediment-Sediment Pore Water Partition Coeff. (Kd_{bs})	Units for Sediment-Sediment Pore Water Partition Coeff.	Reference
117-81-7	Bis(2-ethylhexyl) phthalate	2.30E+06	cm^3/g or L/kg	[3]	8.33E+03	cm^3/g or L/kg	[3]	4.44E+03	cm^3/g or L/kg	[3]
117-84-0	Di-n-octylphthalate	1.30E+07	cm^3/g or L/kg	[3]	6.88E+06	cm^3/g or L/kg	[3]	3.67E+06	cm^3/g or L/kg	[3]
118-74-1	Hexachlorobenzene	1.10E+02	cm^3/g or L/kg	[3]	6.00E+03	cm^3/g or L/kg	[3]	3.20E+03	cm^3/g or L/kg	[3]
119-90-4	3,3'-Dimethoxybenzidine	2.67E-01	cm^3/g or L/kg	[2]	4.51E+00	cm^3/g or L/kg	[3]	2.40E+00	cm^3/g or L/kg	[3]
120-12-7	Anthracene	4.50E+03	cm^3/g or L/kg	[3]	1.76E+03	cm^3/g or L/kg	[3]	9.40E+02	cm^3/g or L/kg	[3]
120-82-1	1,2,4-Trichlorobenzene	3.60E+00	cm^3/g or L/kg	[3]	1.25E+02	cm^3/g or L/kg	[3]	6.64E+01	cm^3/g or L/kg	[3]
120-83-2	2,4-Dichlorophenol	2.90E-01	cm^3/g or L/kg	[3]	1.10E+01	cm^3/g or L/kg	[3]	5.88E+00	cm^3/g or L/kg	[3]
121-14-2	2,4-Dinitrotoluene	3.93E-01	cm^3/g or L/kg	[2]	6.63E+00	cm^3/g or L/kg	[3]	3.54E+00	cm^3/g or L/kg	[3]
122-39-4	N,N-Diphenylamine	2.68E+00	cm^3/g or L/kg	[2]	4.52E+01	cm^3/g or L/kg	[2]	2.41E+01	cm^3/g or L/kg	[2]
122-66-7	1,2-Diphenylhydrazine	1.20E+02	cm^3/g or L/kg	[3]	5.32E+01	cm^3/g or L/kg	[3]	2.84E+01	cm^3/g or L/kg	[3]
123-33-1	Maleic hydrazide	1.25E-02	cm^3/g or L/kg	[2]	2.11E-01	cm^3/g or L/kg	[2]	1.13E-01	cm^3/g or L/kg	[2]
123-38-6	Propionaldehyde	4.44E-03	cm^3/g or L/kg	[2]	7.50E-02	cm^3/g or L/kg	[2]	4.00E-02	cm^3/g or L/kg	[2]
123-72-8	Butanal	3.26E-02	cm^3/g or L/kg	[2]	5.50E-01	cm^3/g or L/kg	[2]	2.93E-01	cm^3/g or L/kg	[2]
123-91-1	1,4-Dioxan	2.40E-03	cm^3/g or L/kg	[2]	4.00E-02	cm^3/g or L/kg	[3]	2.00E-02	cm^3/g or L/kg	[3]
124-18-5	Decane	6.44E+00	cm^3/g or L/kg	[2]	1.09E+02	cm^3/g or L/kg	[2]	5.80E+01	cm^3/g or L/kg	[2]
124-38-9	Carbon dioxide	2.42E-02	cm^3/g or L/kg	[2]	4.08E-01	cm^3/g or L/kg	[2]	2.18E-01	cm^3/g or L/kg	[2]
124-48-1	Chlorodibromomethane	3.10E-01	cm^3/g or L/kg	[2]	5.24E+00	cm^3/g or L/kg	[3]	2.80E+00	cm^3/g or L/kg	[3]

Table 2-5 Soil/Water Partitioning Constant, Suspended Sediment/Surface Water Partitioning Coefficient, and Bed Sediment/Sediment Pore Water Partitioning Coefficient

CAS Registry Number	Constituent Name	Soil-water Partition Coeff. (Kd_s)	Units for Soil-Water Partition Coeff.	Reference	Suspended Sediment-Surface Water Partition Coeff. (Kd_{sw})	Units for Suspended Sediment-Surface Water Partition Coeff.	Reference	Bed Sediment-Sediment Pore Water Partition Coeff. (Kd_{bs})	Units for Sediment-Sediment Pore Water Partition Coeff.	Reference
126-73-8	Tributyl phosphate	1.04E+01	cm^3/g or L/kg	[2]	1.76E+02	cm^3/g or L/kg	[2]	9.40E+01	cm^3/g or L/kg	[2]
126-98-7	2-Methyl-2-propenenitrile	1.51E-02	cm^3/g or L/kg	[2]	2.50E-01	cm^3/g or L/kg	[3]	1.40E-01	cm^3/g or L/kg	[3]
127-18-4	1,1,2,2-Tetrachloroethene	3.10E-01	cm^3/g or L/kg	[3]	1.99E+01	cm^3/g or L/kg	[3]	1.06E+01	cm^3/g or L/kg	[3]
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol									
129-00-0	Pyrene	9.50E+03	cm^3/g or L/kg	[3]	5.10E+03	cm^3/g or L/kg	[3]	2.72E+03	cm^3/g or L/kg	[3]
131-11-3	Dimethyl Phthalate	1.52E-01	cm^3/g or L/kg	[2]	2.56E+00	cm^3/g or L/kg	[3]	1.37E+00	cm^3/g or L/kg	[3]
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	7.33E+01	cm^3/g or L/kg	[2]	1.24E+03	cm^3/g or L/kg	[2]	6.60E+02	cm^3/g or L/kg	[2]
132-64-9	Dibenzofuran	3.61E+01	cm^3/g or L/kg	[2]	6.10E+02	cm^3/g or L/kg	[2]	3.25E+02	cm^3/g or L/kg	[2]
133-06-2	Captan	8.86E-01	cm^3/g or L/kg	[2]	1.50E+01	cm^3/g or L/kg	[2]	7.98E+00	cm^3/g or L/kg	[2]
1330-20-7	Xylenes (mixed isomers)	7.90E-01	cm^3/g or L/kg	[2]	1.33E+01	cm^3/g or L/kg	[2]	7.11E+00	cm^3/g or L/kg	[2]
1336-36-3	Polychlorinated biphenyls	3.47E+02	cm^3/g or L/kg	[2]	5.86E+03	cm^3/g or L/kg	[2]	3.12E+03	cm^3/g or L/kg	[2]
134-32-7	alpha-Naphthylamine									
135-98-8	sec-Butylbenzene	5.91E+00	cm^3/g or L/kg	[2]	9.98E+01	cm^3/g or L/kg	[2]	5.32E+01	cm^3/g or L/kg	[2]
13966-29-5	Uranium-234	4.50E+02	cm^3/g or L/kg	[1]	4.50E+02	cm^3/g or L/kg	[1]	4.50E+02	cm^3/g or L/kg	[1]
13967-48-1	Ruthenium-106	3.50E+02	cm^3/g or L/kg	[1]	3.50E+02	cm^3/g or L/kg	[1]	3.50E+02	cm^3/g or L/kg	[1]
13967-70-9	Cesium-134	1.00E+03	cm^3/g or L/kg	[1]	1.00E+03	cm^3/g or L/kg	[1]	1.00E+03	cm^3/g or L/kg	[1]
13968-55-3	Uranium-233	4.50E+02	cm^3/g or L/kg	[1]	4.50E+02	cm^3/g or L/kg	[1]	4.50E+02	cm^3/g or L/kg	[1]

Table 2-5 Soil/Water Partitioning Constant, Suspended Sediment/Surface Water Partitioning Coefficient, and Bed Sediment/Sediment Pore Water Partitioning Coefficient

CAS Registry Number	Constituent Name	Soil-water Partition Coeff. (Kd_s)	Units for Soil-Water Partition Coeff.	Reference	Suspended Sediment-Surface Water Partition Coeff. (Kd_{sw})	Units for Suspended Sediment-Surface Water Partition Coeff.	Reference	Bed Sediment-Sediment Pore Water Partition Coeff. (Kd_{bs})	Units for Sediment-Sediment Pore Water Partition Coeff.	Reference
13981-15-2	Curium-244	2.00E+03	cm^3/g or L/kg	[1]	2.00E+03	cm^3/g or L/kg	[1]	2.00E+03	cm^3/g or L/kg	[1]
13981-16-3	Plutonium-238	4.50E+03	cm^3/g or L/kg	[1]	4.50E+03	cm^3/g or L/kg	[1]	4.50E+03	cm^3/g or L/kg	[1]
13981-37-8	Nickel-63	1.50E+02	cm^3/g or L/kg	[1]	1.50E+02	cm^3/g or L/kg	[1]	1.50E+02	cm^3/g or L/kg	[1]
13982-10-0	Plutonium-242	4.50E+03	cm^3/g or L/kg	[1]	4.50E+03	cm^3/g or L/kg	[1]	4.50E+03	cm^3/g or L/kg	[1]
13982-63-3	Radium-226	4.50E+02	cm^3/g or L/kg	[1]	4.50E+02	cm^3/g or L/kg	[1]	4.50E+02	cm^3/g or L/kg	[1]
13982-70-2	Uranium-236	4.50E+02	cm^3/g or L/kg	[1]	4.50E+02	cm^3/g or L/kg	[1]	4.50E+02	cm^3/g or L/kg	[1]
13994-20-2	Neptunium-237	3.00E+01	cm^3/g or L/kg	[1]	3.00E+01	cm^3/g or L/kg	[1]	3.00E+01	cm^3/g or L/kg	[1]
141-78-6	Acetic acid ethyl ester	2.48E-02	cm^3/g or L/kg	[2]	4.19E-01	cm^3/g or L/kg	[2]	2.23E-01	cm^3/g or L/kg	[2]
14119-32-5	Plutonium-241	4.50E+03	cm^3/g or L/kg	[1]	4.50E+03	cm^3/g or L/kg	[1]	4.50E+03	cm^3/g or L/kg	[1]
14119-33-6	Plutonium-240	4.50E+03	cm^3/g or L/kg	[1]	4.50E+03	cm^3/g or L/kg	[1]	4.50E+03	cm^3/g or L/kg	[1]
14133-76-7	Technetium-99	1.50E+00	cm^3/g or L/kg	[1]	1.50E+00	cm^3/g or L/kg	[1]	1.50E+00	cm^3/g or L/kg	[1]
14158-29-3	Uranium-232	4.50E+02	cm^3/g or L/kg	[1]	4.50E+02	cm^3/g or L/kg	[1]	4.50E+02	cm^3/g or L/kg	[1]
14234-35-6	Antimony-125	4.50E+01	cm^3/g or L/kg	[1]	4.50E+01	cm^3/g or L/kg	[1]	4.50E+01	cm^3/g or L/kg	[1]
14265-44-2	Phosphate									
14331-85-2	Protactinium-231	2.50E+03	cm^3/g or L/kg	[1]	2.50E+03	cm^3/g or L/kg	[1]	2.50E+03	cm^3/g or L/kg	[1]
14336-70-0	Nickel-59	1.50E+02	cm^3/g or L/kg	[1]	1.50E+02	cm^3/g or L/kg	[1]	1.50E+02	cm^3/g or L/kg	[1]
14391-16-3	Europium-155	6.50E+02	cm^3/g or L/kg	[1]	6.50E+02	cm^3/g or L/kg	[1]	6.50E+02	cm^3/g or L/kg	[1]

Table 2-5 Soil/Water Partitioning Constant, Suspended Sediment/Surface Water Partitioning Coefficient, and Bed Sediment/Sediment Pore Water Partitioning Coefficient

CAS Registry Number	Constituent Name	Soil-water Partition Coeff. (Kd_s)	Units for Soil-Water Partition Coeff.	Reference	Suspended Sediment-Surface Water Partition Coeff. (Kd_{sw})	Units for Suspended Sediment-Surface Water Partition Coeff.	Reference	Bed Sediment-Sediment Pore Water Partition Coeff. (Kd_{bs})	Units for Sediment-Sediment Pore Water Partition Coeff.	Reference
145-73-3	Endothall	3.78E-01	cm^3/g or L/kg	[2]	6.38E+00	cm^3/g or L/kg	[2]	3.40E+00	cm^3/g or L/kg	[2]
14596-10-2	Americium-241	7.00E+02	cm^3/g or L/kg	[1]	7.00E+02	cm^3/g or L/kg	[1]	7.00E+02	cm^3/g or L/kg	[1]
14683-23-9	Europium-152	6.50E+02	cm^3/g or L/kg	[1]	6.50E+02	cm^3/g or L/kg	[1]	6.50E+02	cm^3/g or L/kg	[1]
14762-75-5	Carbon-14	6.70E+00	cm^3/g or L/kg	[4]	6.70E+00	cm^3/g or L/kg	[4]	6.70E+00	cm^3/g or L/kg	[4]
14797-55-8	Nitrate									
14797-65-0	Nitrite									
14808-79-8	Sulfate									
14952-40-0	Actinium-227	1.50E+03	cm^3/g or L/kg	[1]	1.50E+03	cm^3/g or L/kg	[1]	1.50E+03	cm^3/g or L/kg	[1]
14993-75-0	Americium-243	7.00E+02	cm^3/g or L/kg	[1]	7.00E+02	cm^3/g or L/kg	[1]	7.00E+02	cm^3/g or L/kg	[1]
15046-84-1	Iodine-129	6.00E+01	cm^3/g or L/kg	[1]	6.00E+01	cm^3/g or L/kg	[1]	6.00E+01	cm^3/g or L/kg	[1]
15117-48-3	Plutonium-239	4.50E+03	cm^3/g or L/kg	[1]	4.50E+03	cm^3/g or L/kg	[1]	4.50E+03	cm^3/g or L/kg	[1]
15117-96-1	Uranium-235	4.50E+02	cm^3/g or L/kg	[1]	4.50E+02	cm^3/g or L/kg	[1]	4.50E+02	cm^3/g or L/kg	[1]
15262-20-1	Radium-228	4.50E+02	cm^3/g or L/kg	[1]	4.50E+02	cm^3/g or L/kg	[1]	4.50E+02	cm^3/g or L/kg	[1]
15510-73-3	Curium-242	2.00E+03	cm^3/g or L/kg	[1]	2.00E+03	cm^3/g or L/kg	[1]	2.00E+03	cm^3/g or L/kg	[1]
15585-10-1	Europium-154	6.50E+02	cm^3/g or L/kg	[1]	6.50E+02	cm^3/g or L/kg	[1]	6.50E+02	cm^3/g or L/kg	[1]
15594-54-4	Thorium-229	1.50E+05	cm^3/g or L/kg	[1]	1.50E+05	cm^3/g or L/kg	[1]	1.50E+05	cm^3/g or L/kg	[1]
156-59-2	cis-1,2-Dichloroethene	7.10E-02	cm^3/g or L/kg	[3]	2.87E+00	cm^3/g or L/kg	[3]	1.53E+00	cm^3/g or L/kg	[3]
156-60-5	1,2-trans-Dichloroethene	1.00E-01	cm^3/g or L/kg	[3]	2.85E+00	cm^3/g or L/kg	[3]	1.52E+00	cm^3/g or L/kg	[3]

Table 2-5 Soil/Water Partitioning Constant, Suspended Sediment/Surface Water Partitioning Coefficient, and Bed Sediment/Sediment Pore Water Partitioning Coefficient

CAS Registry Number	Constituent Name	Soil-water Partition Coeff. (Kd_s)	Units for Soil-Water Partition Coeff.	Reference	Suspended Sediment-Surface Water Partition Coeff. (Kd_{sw})	Units for Suspended Sediment-Surface Water Partition Coeff.	Reference	Bed Sediment-Sediment Pore Water Partition Coeff. (Kd_{bs})	Units for Sediment-Sediment Pore Water Partition Coeff.	Reference
15715-94-3	Samarium-151	6.50E+02	cm^3/g or L/kg	[1]	6.50E+02	cm^3/g or L/kg	[1]	6.50E+02	cm^3/g or L/kg	[1]
15751-77-6	Zirconium-93	3.00E+03	cm^3/g or L/kg	[1]	3.00E+03	cm^3/g or L/kg	[1]	3.00E+03	cm^3/g or L/kg	[1]
15757-87-6	Curium-243	2.00E+03	cm^3/g or L/kg	[1]	2.00E+03	cm^3/g or L/kg	[1]	2.00E+03	cm^3/g or L/kg	[1]
15758-45-9	Selenium-79	3.00E+02	cm^3/g or L/kg	[1]	3.00E+02	cm^3/g or L/kg	[1]	3.00E+02	cm^3/g or L/kg	[1]
15832-50-5	Tin-126	2.50E+02	cm^3/g or L/kg	[1]	2.50E+02	cm^3/g or L/kg	[1]	2.50E+02	cm^3/g or L/kg	[1]
1634-04-4	Methyl tert-butyl ether	4.88E-02	cm^3/g or L/kg	[2]	8.25E-01	cm^3/g or L/kg	[2]	4.40E-01	cm^3/g or L/kg	[2]
16887-00-6	Chloride									
16984-48-8	Fluoride	1.50E+02	cm^3/g or L/kg	[5]						
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1.73E+04	cm^3/g or L/kg	[2]	2.92E+05	cm^3/g or L/kg	[3]	1.56E+05	cm^3/g or L/kg	[3]
18540-29-9	Chromium(VI)	1.90E+01	cm^3/g or L/kg	[3]	1.90E+01	cm^3/g or L/kg	[3]	1.90E+01	cm^3/g or L/kg	[3]
189-55-9	Dibenzo[a,i]pyrene	1.60E+05	cm^3/g or L/kg	[10]	7.27E+04	cm^3/g or L/kg	[8]	3.88E+04	cm^3/g or L/kg	[8]
189-64-0	Dibenzo[a,h]pyrene	2.82E+04	cm^3/g or L/kg	[2]	4.76E+05	cm^3/g or L/kg	[2]	2.54E+05	cm^3/g or L/kg	[2]
191-24-2	Benzo(g,h,i)perylene	8.66E+03	cm^3/g or L/kg	[2]	1.46E+05	cm^3/g or L/kg	[2]	7.80E+04	cm^3/g or L/kg	[2]
191-30-0	Dibenzo(a,l)pyrene	2.88E+04	cm^3/g or L/kg	[2]	4.86E+05	cm^3/g or L/kg	[2]	2.59E+05	cm^3/g or L/kg	[2]
192-65-4	Dibenzo[a,e]pyrene	2.88E+04	cm^3/g or L/kg	[2]	4.86E+05	cm^3/g or L/kg	[2]	2.59E+05	cm^3/g or L/kg	[2]
192-97-2	Benzo(e)pyrene	9.51E+03	cm^3/g or L/kg	[2]	1.61E+05	cm^3/g or L/kg	[2]	8.57E+04	cm^3/g or L/kg	[2]
193-39-5	Indeno(1,2,3-cd)pyrene	5.30E+05	cm^3/g or L/kg	[3]	2.31E+05	cm^3/g or L/kg	[3]	1.23E+05	cm^3/g or L/kg	[3]

Table 2-5 Soil/Water Partitioning Constant, Suspended Sediment/Surface Water Partitioning Coefficient, and Bed Sediment/Sediment Pore Water Partitioning Coefficient

CAS Registry Number	Constituent Name	Soil-water Partition Coeff. (Kd_s)	Units for Soil-Water Partition Coeff.	Reference	Suspended Sediment-Surface Water Partition Coeff. (Kd_{sw})	Units for Suspended Sediment-Surface Water Partition Coeff.	Reference	Bed Sediment-Sediment Pore Water Partition Coeff. (Kd_{bs})	Units for Sediment-Sediment Pore Water Partition Coeff.	Reference
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	5.46E+04	cm^3/g or L/kg	[2]	9.23E+05	cm^3/g or L/kg	[3]	4.92E+05	cm^3/g or L/kg	[3]
205-82-3	Benzo[j]fluoranthene	2.66E+03	cm^3/g or L/kg	[2]	4.49E+04	cm^3/g or L/kg	[2]	2.40E+04	cm^3/g or L/kg	[2]
205-99-2	Benzo(b)fluoranthene	4.65E+03	cm^3/g or L/kg	[2]	7.86E+04	cm^3/g or L/kg	[3]	4.19E+04	cm^3/g or L/kg	[3]
206-44-0	Fluoranthene	1.10E+04	cm^3/g or L/kg	[3]	3.68E+03	cm^3/g or L/kg	[3]	1.96E+03	cm^3/g or L/kg	[3]
207-08-9	Benzo(k)fluoranthene	1.90E+05	cm^3/g or L/kg	[3]	7.44E+04	cm^3/g or L/kg	[3]	3.97E+04	cm^3/g or L/kg	[3]
208-96-8	Acenaphthylene	2.50E+01	cm^3/g or L/kg	[2]	4.22E+02	cm^3/g or L/kg	[2]	2.25E+02	cm^3/g or L/kg	[2]
218-01-9	Chrysene	6.00E+04	cm^3/g or L/kg	[3]	3.01E+04	cm^3/g or L/kg	[3]	1.60E+04	cm^3/g or L/kg	[3]
224-42-0	Dibenz[a,j]acridine	5.80E+05	cm^3/g or L/kg	[12]	1.34E+05	cm^3/g or L/kg	[10]	7.16E+04	cm^3/g or L/kg	[10]
2245-38-7	2,3,5-Trimethylnaphthalene	2.38E+02	cm^3/g or L/kg	[2]	4.01E+03	cm^3/g or L/kg	[2]	2.14E+03	cm^3/g or L/kg	[2]
226-36-8	Dibenz[a,h]acridine	5.80E+05	cm^3/g or L/kg	[12]	1.34E+05	cm^3/g or L/kg	[10]	7.16E+04	cm^3/g or L/kg	[10]
22967-92-6	Methyl mercury	7.00E+03	cm^3/g or L/kg	[3]	1.00E+05	cm^3/g or L/kg	[3]	3.00E+03	cm^3/g or L/kg	[3]
23950-58-5	Pronamide	1.05E+01	cm^3/g or L/kg	[2]	1.77E+02	cm^3/g or L/kg	[3]	9.42E+01	cm^3/g or L/kg	[3]
24959-67-9	Bromide									
27154-33-2	Trichlorofluoroethane	2.40E-01	cm^3/g or L/kg	[13]	8.57E+00	cm^3/g or L/kg	[11]	4.57E+00	cm^3/g or L/kg	[11]
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	5.68E+02	cm^3/g or L/kg	[2]	9.60E+03	cm^3/g or L/kg	[2]	5.12E+03	cm^3/g or L/kg	[2]
319-84-6	alpha-BHC	2.50E+00	cm^3/g or L/kg	[3]	1.32E+02	cm^3/g or L/kg	[3]	7.04E+01	cm^3/g or L/kg	[3]

Table 2-5 Soil/Water Partitioning Constant, Suspended Sediment/Surface Water Partitioning Coefficient, and Bed Sediment/Sediment Pore Water Partitioning Coefficient

CAS Registry Number	Constituent Name	Soil-water Partition Coeff. (Kd_s)	Units for Soil-Water Partition Coeff.	Reference	Suspended Sediment-Surface Water Partition Coeff. (Kd_{sw})	Units for Suspended Sediment-Surface Water Partition Coeff.	Reference	Bed Sediment-Sediment Pore Water Partition Coeff. (Kd_{bs})	Units for Sediment-Sediment Pore Water Partition Coeff.	Reference
319-85-7	beta-BHC	2.50E+00	cm^3/g or L/kg	[3]	1.61E+02	cm^3/g or L/kg	[3]	8.56E+01	cm^3/g or L/kg	[3]
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	3.47E+02	cm^3/g or L/kg	[2]	5.86E+03	cm^3/g or L/kg	[2]	3.12E+03	cm^3/g or L/kg	[2]
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	5.82E+02	cm^3/g or L/kg	[2]	9.83E+03	cm^3/g or L/kg	[2]	5.24E+03	cm^3/g or L/kg	[2]
3268-87-9	Octachlorodibenzo(p)dioxin	4.34E+05	cm^3/g or L/kg	[2]	7.33E+06	cm^3/g or L/kg	[3]	3.91E+06	cm^3/g or L/kg	[3]
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	9.28E+02	cm^3/g or L/kg	[2]	1.57E+04	cm^3/g or L/kg	[2]	8.36E+03	cm^3/g or L/kg	[2]
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	2.74E+05	cm^3/g or L/kg	[2]	4.62E+06	cm^3/g or L/kg	[3]	2.47E+06	cm^3/g or L/kg	[3]
3697-24-3	5-Methylchrysene	6.00E+04	cm^3/g or L/kg	[11]	3.01E+04	cm^3/g or L/kg	[9]	1.60E+04	cm^3/g or L/kg	[9]
378253-40-8	Barium-137m	6.00E+01	cm^3/g or L/kg	[1]	6.00E+01	cm^3/g or L/kg	[1]	6.00E+01	cm^3/g or L/kg	[1]
378253-44-2	Cadmium-113m	6.50E+00	cm^3/g or L/kg	[1]	6.50E+00	cm^3/g or L/kg	[1]	6.50E+00	cm^3/g or L/kg	[1]
378782-82-2	Niobium-93m	3.50E+02	cm^3/g or L/kg	[1]	3.50E+02	cm^3/g or L/kg	[1]	3.50E+02	cm^3/g or L/kg	[1]
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	9.50E+02	cm^3/g or L/kg	[2]	1.61E+04	cm^3/g or L/kg	[2]	8.56E+03	cm^3/g or L/kg	[2]
39001-02-0	Octachlorodibenzofuran	2.74E+05	cm^3/g or L/kg	[2]	4.62E+06	cm^3/g or L/kg	[3]	2.47E+06	cm^3/g or L/kg	[3]
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	1.73E+05	cm^3/g or L/kg	[2]	2.92E+06	cm^3/g or L/kg	[3]	1.56E+06	cm^3/g or L/kg	[3]
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	1.55E+03	cm^3/g or L/kg	[2]	2.63E+04	cm^3/g or L/kg	[2]	1.40E+04	cm^3/g or L/kg	[2]

Table 2-5 Soil/Water Partitioning Constant, Suspended Sediment/Surface Water Partitioning Coefficient, and Bed Sediment/Sediment Pore Water Partitioning Coefficient

CAS Registry Number	Constituent Name	Soil-water Partition Coeff. (Kd_s)	Units for Soil-Water Partition Coeff.	Reference	Suspended Sediment-Surface Water Partition Coeff. (Kd_{sw})	Units for Suspended Sediment-Surface Water Partition Coeff.	Reference	Bed Sediment-Sediment Pore Water Partition Coeff. (Kd_{bs})	Units for Sediment-Sediment Pore Water Partition Coeff.	Reference
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	1.20E+04	cm^3/g or L/kg	[2]	2.02E+05	cm^3/g or L/kg	[3]	1.08E+05	cm^3/g or L/kg	[3]
4170-30-3	Crotonaldehyde (Propylene aldehyde)	7.95E-03	cm^3/g or L/kg	[2]	1.34E-01	cm^3/g or L/kg	[2]	7.16E-02	cm^3/g or L/kg	[2]
41851-50-7	Chlorocyclopentadiene	5.68E-01	cm^3/g or L/kg	[2]	9.60E+00	cm^3/g or L/kg	[2]	5.12E+00	cm^3/g or L/kg	[2]
460-19-5	Cyanogen (oxalonitrile)	5.21E-03	cm^3/g or L/kg	[2]	8.79E-02	cm^3/g or L/kg	[2]	4.69E-02	cm^3/g or L/kg	[2]
4786-20-3	2-Butenenitrile	1.81E-02	cm^3/g or L/kg	[2]	3.05E-01	cm^3/g or L/kg	[2]	1.63E-01	cm^3/g or L/kg	[2]
50-00-0	Formaldehyde	9.81E-03	cm^3/g or L/kg	[2]	1.70E-01	cm^3/g or L/kg	[3]	9.00E-02	cm^3/g or L/kg	[3]
50-32-8	Benzo(a)pyrene	1.60E+05	cm^3/g or L/kg	[3]	7.27E+04	cm^3/g or L/kg	[3]	3.88E+04	cm^3/g or L/kg	[3]
506-68-3	Cyanogen bromide (bromocyanide)	2.30E-03	cm^3/g or L/kg	[2]	3.89E-02	cm^3/g or L/kg	[2]	2.08E-02	cm^3/g or L/kg	[2]
506-77-4	Cyanogen chloride	2.66E-03	cm^3/g or L/kg	[2]	4.49E-02	cm^3/g or L/kg	[2]	2.40E-02	cm^3/g or L/kg	[2]
51-28-5	2,4-Dinitrophenol	4.44E-05	cm^3/g or L/kg	[2]	8.00E-04	cm^3/g or L/kg	[3]	4.00E-04	cm^3/g or L/kg	[3]
51-79-6	Ethyl carbamate (urethane)	5.37E-02	cm^3/g or L/kg	[2]	9.08E-01	cm^3/g or L/kg	[2]	4.84E-01	cm^3/g or L/kg	[2]
510-15-6	Chlorobenzilate	8.58E+01	cm^3/g or L/kg	[2]	1.45E+03	cm^3/g or L/kg	[3]	7.73E+02	cm^3/g or L/kg	[3]
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	3.45E+03	cm^3/g or L/kg	[2]	5.82E+04	cm^3/g or L/kg	[3]	3.10E+04	cm^3/g or L/kg	[3]
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	9.28E+02	cm^3/g or L/kg	[2]	1.57E+04	cm^3/g or L/kg	[2]	8.36E+03	cm^3/g or L/kg	[2]
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	1.59E+00	cm^3/g or L/kg	[2]	2.69E+01	cm^3/g or L/kg	[2]	1.44E+01	cm^3/g or L/kg	[2]

Table 2-5 Soil/Water Partitioning Constant, Suspended Sediment/Surface Water Partitioning Coefficient, and Bed Sediment/Sediment Pore Water Partitioning Coefficient

CAS Registry Number	Constituent Name	Soil-water Partition Coeff. (Kd_s)	Units for Soil-Water Partition Coeff.	Reference	Suspended Sediment-Surface Water Partition Coeff. (Kd_{sw})	Units for Suspended Sediment-Surface Water Partition Coeff.	Reference	Bed Sediment-Sediment Pore Water Partition Coeff. (Kd_{bs})	Units for Sediment-Sediment Pore Water Partition Coeff.	Reference
53-70-3	Dibenz[a,h]anthracene	5.80E+05	cm^3/g or L/kg	[3]	1.34E+05	cm^3/g or L/kg	[3]	7.16E+04	cm^3/g or L/kg	[3]
532-27-4	2-Chloroacetophenone	4.39E-01	cm^3/g or L/kg	[2]	7.42E+00	cm^3/g or L/kg	[2]	3.96E+00	cm^3/g or L/kg	[2]
534-52-1	4,6-Dinitro-o-cresol	1.14E+00	cm^3/g or L/kg	[2]	1.93E+01	cm^3/g or L/kg	[2]	1.03E+01	cm^3/g or L/kg	[2]
5385-75-1	Dibenzo(a,e)fluoranthene	2.82E+04	cm^3/g or L/kg	[2]	4.76E+05	cm^3/g or L/kg	[2]	2.54E+05	cm^3/g or L/kg	[2]
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	1.69E-01	cm^3/g or L/kg	[2]	2.85E+00	cm^3/g or L/kg	[2]	1.52E+00	cm^3/g or L/kg	[2]
540-73-8	1,2-Dimethylhydrazine	6.62E-02	cm^3/g or L/kg	[2]	1.12E+00	cm^3/g or L/kg	[2]	5.96E-01	cm^3/g or L/kg	[2]
540-84-1	2,2,4-Trimethylpentane	1.07E+00	cm^3/g or L/kg	[2]	1.80E+01	cm^3/g or L/kg	[2]	9.60E+00	cm^3/g or L/kg	[2]
541-73-1	1,3-Dichlorobenzene	3.77E+00	cm^3/g or L/kg	[2]	6.37E+01	cm^3/g or L/kg	[3]	3.40E+01	cm^3/g or L/kg	[3]
542-75-6	1,3-Dichloropropene	9.10E-02	cm^3/g or L/kg	[3]	2.03E+00	cm^3/g or L/kg	[3]	1.08E+00	cm^3/g or L/kg	[3]
542-88-1	Bis(chloromethyl)ether	4.31E-02	cm^3/g or L/kg	[2]	7.28E-01	cm^3/g or L/kg	[2]	3.88E-01	cm^3/g or L/kg	[2]
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	6.88E+04	cm^3/g or L/kg	[2]	1.16E+06	cm^3/g or L/kg	[3]	6.20E+05	cm^3/g or L/kg	[3]
56-23-5	Carbon tetrachloride	3.50E-01	cm^3/g or L/kg	[3]	1.14E+01	cm^3/g or L/kg	[3]	6.08E+00	cm^3/g or L/kg	[3]
56-49-5	3-Methylcholanthrene	9.09E+03	cm^3/g or L/kg	[2]	1.54E+05	cm^3/g or L/kg	[2]	8.19E+04	cm^3/g or L/kg	[2]
56-55-3	Benzo(a)anthracene	6.00E+04	cm^3/g or L/kg	[3]	2.69E+04	cm^3/g or L/kg	[3]	1.43E+04	cm^3/g or L/kg	[3]
57-12-5	Cyanide	9.90E+00	cm^3/g or L/kg	[3]	3.00E-02	cm^3/g or L/kg	[3]	1.40E-02	cm^3/g or L/kg	[3]
57-24-9	Strychnine	3.51E-01	cm^3/g or L/kg	[2]	5.92E+00	cm^3/g or L/kg	[3]	3.16E+00	cm^3/g or L/kg	[3]

Table 2-5 Soil/Water Partitioning Constant, Suspended Sediment/Surface Water Partitioning Coefficient, and Bed Sediment/Sediment Pore Water Partitioning Coefficient

CAS Registry Number	Constituent Name	Soil-water Partition Coeff. (Kd_s)	Units for Soil-Water Partition Coeff.	Reference	Suspended Sediment-Surface Water Partition Coeff. (Kd_{sw})	Units for Suspended Sediment-Surface Water Partition Coeff.	Reference	Bed Sediment-Sediment Pore Water Partition Coeff. (Kd_{bs})	Units for Sediment-Sediment Pore Water Partition Coeff.	Reference
57-74-9	Chlordane	2.40E+02	cm^3/g or L/kg	[3]	3.85E+03	cm^3/g or L/kg	[3]	2.05E+03	cm^3/g or L/kg	[3]
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	8.66E+03	cm^3/g or L/kg	[2]	1.46E+05	cm^3/g or L/kg	[3]	7.80E+04	cm^3/g or L/kg	[3]
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	1.69E+04	cm^3/g or L/kg	[2]	2.85E+05	cm^3/g or L/kg	[3]	1.52E+05	cm^3/g or L/kg	[3]
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	2.74E+04	cm^3/g or L/kg	[2]	4.62E+05	cm^3/g or L/kg	[3]	2.47E+05	cm^3/g or L/kg	[3]
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	5.68E+02	cm^3/g or L/kg	[2]	9.60E+03	cm^3/g or L/kg	[2]	5.12E+03	cm^3/g or L/kg	[2]
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	5.46E+04	cm^3/g or L/kg	[2]	9.23E+05	cm^3/g or L/kg	[3]	4.92E+05	cm^3/g or L/kg	[3]
58-89-9	gamma-BHC (Lindane)	6.00E+00	cm^3/g or L/kg	[2]	1.01E+02	cm^3/g or L/kg	[2]	5.41E+01	cm^3/g or L/kg	[2]
58-90-2	2,3,4,6-Tetrachlorophenol	1.24E+00	cm^3/g or L/kg	[2]	2.10E+01	cm^3/g or L/kg	[3]	1.12E+01	cm^3/g or L/kg	[3]
581-42-0	2,6-Dimethylnaphthalene	7.66E+01	cm^3/g or L/kg	[2]	1.29E+03	cm^3/g or L/kg	[2]	6.90E+02	cm^3/g or L/kg	[2]
584-84-9	2,4-Toluene diisocyanate	8.80E-01	cm^3/g or L/kg	[7]	6.63E+00	cm^3/g or L/kg	[5]	3.54E+00	cm^3/g or L/kg	[5]
589-38-8	3-Hexanone	7.36E-02	cm^3/g or L/kg	[2]	1.24E+00	cm^3/g or L/kg	[2]	6.63E-01	cm^3/g or L/kg	[2]
59-50-7	4-Chloro-3-methylphenol	4.95E+00	cm^3/g or L/kg	[2]	8.37E+01	cm^3/g or L/kg	[3]	4.46E+01	cm^3/g or L/kg	[3]
59-89-2	N-Nitrosomorpholine	9.99E-02	cm^3/g or L/kg	[2]	1.69E+00	cm^3/g or L/kg	[2]	9.00E-01	cm^3/g or L/kg	[2]
591-50-4	Benzene, iodo-	6.96E+00	cm^3/g or L/kg	[2]	1.18E+02	cm^3/g or L/kg	[2]	6.27E+01	cm^3/g or L/kg	[2]
591-78-6	2-Hexanone	6.66E-02	cm^3/g or L/kg	[2]	1.13E+00	cm^3/g or L/kg	[2]	6.00E-01	cm^3/g or L/kg	[2]

Table 2-5 Soil/Water Partitioning Constant, Suspended Sediment/Surface Water Partitioning Coefficient, and Bed Sediment/Sediment Pore Water Partitioning Coefficient

CAS Registry Number	Constituent Name	Soil-water Partition Coeff. (Kd_s)	Units for Soil-Water Partition Coeff.	Reference	Suspended Sediment-Surface Water Partition Coeff. (Kd_{sw})	Units for Suspended Sediment-Surface Water Partition Coeff.	Reference	Bed Sediment-Sediment Pore Water Partition Coeff. (Kd_{bs})	Units for Sediment-Sediment Pore Water Partition Coeff.	Reference
593-60-2	Bromoethene (Vinyl bromide)	9.63E-02	cm^3/g or L/kg	[2]	1.63E+00	cm^3/g or L/kg	[2]	8.68E-01	cm^3/g or L/kg	[2]
593-74-8	Dimethyl Mercury									
60-11-7	Dimethyl aminoazobenzene	9.01E+00	cm^3/g or L/kg	[2]	1.52E+02	cm^3/g or L/kg	[2]	8.12E+01	cm^3/g or L/kg	[2]
60-29-7	Ethyl ether	4.31E-02	cm^3/g or L/kg	[2]	7.28E-01	cm^3/g or L/kg	[2]	3.88E-01	cm^3/g or L/kg	[2]
60-35-5	Acetamide	1.33E-02	cm^3/g or L/kg	[2]	2.24E-01	cm^3/g or L/kg	[2]	1.20E-01	cm^3/g or L/kg	[2]
602-87-9	5-Nitroacenaphthene	1.10E+03	cm^3/g or L/kg	[8]	3.68E+02	cm^3/g or L/kg	[6]	1.96E+02	cm^3/g or L/kg	[6]
606-20-2	2,6-Dinitrotoluene	2.18E-01	cm^3/g or L/kg	[2]	3.68E+00	cm^3/g or L/kg	[3]	1.96E+00	cm^3/g or L/kg	[3]
608-93-5	Pentachlorobenzene	5.37E+02	cm^3/g or L/kg	[2]	9.07E+03	cm^3/g or L/kg	[3]	4.84E+03	cm^3/g or L/kg	[3]
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	2.74E+04	cm^3/g or L/kg	[2]	4.62E+05	cm^3/g or L/kg	[3]	2.47E+05	cm^3/g or L/kg	[3]
61626-71-9	Dichloropentadiene	5.68E-01	cm^3/g or L/kg	[2]	9.60E+00	cm^3/g or L/kg	[2]	5.12E+00	cm^3/g or L/kg	[2]
62-50-0	Ethyl methanesulfonate	4.97E-03	cm^3/g or L/kg	[2]	8.00E-02	cm^3/g or L/kg	[3]	4.00E-02	cm^3/g or L/kg	[3]
62-53-3	Aniline	1.20E+00	cm^3/g or L/kg	[3]	5.80E-01	cm^3/g or L/kg	[3]	3.10E-01	cm^3/g or L/kg	[3]
62-75-9	N-Nitroso-N,N-dimethylamine	1.01E-01	cm^3/g or L/kg	[2]	1.71E+00	cm^3/g or L/kg	[2]	9.12E-01	cm^3/g or L/kg	[2]
621-64-7	N-Nitroso-di-n-propylamine	9.65E-02	cm^3/g or L/kg	[2]	1.63E+00	cm^3/g or L/kg	[3]	8.70E-01	cm^3/g or L/kg	[3]
624-83-9	Methyl isocyanate	2.00E-02	cm^3/g or L/kg	[9]	1.30E-01	cm^3/g or L/kg	[7]	7.00E-02	cm^3/g or L/kg	[7]
628-73-9	Hexanenitrile	1.90E-01	cm^3/g or L/kg	[2]	3.21E+00	cm^3/g or L/kg	[2]	1.71E+00	cm^3/g or L/kg	[2]
630-08-0	Carbon monoxide									

Table 2-5 Soil/Water Partitioning Constant, Suspended Sediment/Surface Water Partitioning Coefficient, and Bed Sediment/Sediment Pore Water Partitioning Coefficient

CAS Registry Number	Constituent Name	Soil-water Partition Coeff. (Kd_s)	Units for Soil-Water Partition Coeff.	Reference	Suspended Sediment-Surface Water Partition Coeff. (Kd_{sw})	Units for Suspended Sediment-Surface Water Partition Coeff.	Reference	Bed Sediment-Sediment Pore Water Partition Coeff. (Kd_{bs})	Units for Sediment-Sediment Pore Water Partition Coeff.	Reference
630-20-6	1,1,1,2-Tetrachloroethane	1.33E+00	cm^3/g or L/kg	[2]	2.25E+01	cm^3/g or L/kg	[3]	1.20E+01	cm^3/g or L/kg	[3]
64-18-6	Formic acid (methanoic acid)	1.29E-03	cm^3/g or L/kg	[2]	2.00E-02	cm^3/g or L/kg	[3]	1.00E-02	cm^3/g or L/kg	[3]
65-85-0	Benzoic acid	2.66E-03	cm^3/g or L/kg	[2]	5.00E-02	cm^3/g or L/kg	[3]	2.40E-02	cm^3/g or L/kg	[3]
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	5.82E+02	cm^3/g or L/kg	[2]	9.83E+03	cm^3/g or L/kg	[2]	5.24E+03	cm^3/g or L/kg	[2]
67-56-1	Methyl alcohol	7.99E-04	cm^3/g or L/kg	[2]	1.00E-02	cm^3/g or L/kg	[3]	7.00E-03	cm^3/g or L/kg	[3]
67-63-0	2-Propyl alcohol	6.79E-03	cm^3/g or L/kg	[2]	1.15E-01	cm^3/g or L/kg	[2]	6.12E-02	cm^3/g or L/kg	[2]
67-64-1	2-Propanone (Acetone)	8.70E-02	cm^3/g or L/kg	[3]	4.00E-02	cm^3/g or L/kg	[3]	2.00E-02	cm^3/g or L/kg	[3]
67-66-3	Chloroform	8.00E-02	cm^3/g or L/kg	[3]	3.94E+00	cm^3/g or L/kg	[3]	2.10E+00	cm^3/g or L/kg	[3]
67-72-1	Hexachloroethane	6.89E+00	cm^3/g or L/kg	[2]	1.16E+02	cm^3/g or L/kg	[3]	6.20E+01	cm^3/g or L/kg	[3]
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	6.88E+04	cm^3/g or L/kg	[2]	1.16E+06	cm^3/g or L/kg	[3]	6.20E+05	cm^3/g or L/kg	[3]
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	9.50E+02	cm^3/g or L/kg	[2]	1.61E+04	cm^3/g or L/kg	[2]	8.56E+03	cm^3/g or L/kg	[2]
70-30-4	Hexachlorophene	1.15E+05	cm^3/g or L/kg	[2]	1.94E+06	cm^3/g or L/kg	[3]	1.03E+06	cm^3/g or L/kg	[3]
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	3.47E+02	cm^3/g or L/kg	[2]	5.86E+03	cm^3/g or L/kg	[2]	3.12E+03	cm^3/g or L/kg	[2]
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	2.74E+04	cm^3/g or L/kg	[2]	4.62E+05	cm^3/g or L/kg	[3]	2.47E+05	cm^3/g or L/kg	[3]
71-36-3	n-Butyl alcohol	1.40E-02	cm^3/g or L/kg	[2]	2.37E-01	cm^3/g or L/kg	[2]	1.26E-01	cm^3/g or L/kg	[2]

Table 2-5 Soil/Water Partitioning Constant, Suspended Sediment/Surface Water Partitioning Coefficient, and Bed Sediment/Sediment Pore Water Partitioning Coefficient

CAS Registry Number	Constituent Name	Soil-water Partition Coeff. (Kd_s)	Units for Soil-Water Partition Coeff.	Reference	Suspended Sediment-Surface Water Partition Coeff. (Kd_{sw})	Units for Suspended Sediment-Surface Water Partition Coeff.	Reference	Bed Sediment-Sediment Pore Water Partition Coeff. (Kd_{bs})	Units for Sediment-Sediment Pore Water Partition Coeff.	Reference
71-43-2	Benzene	1.20E-01	cm^3/g or L/kg	[3]	4.63E+00	cm^3/g or L/kg	[3]	2.47E+00	cm^3/g or L/kg	[3]
71-55-6	1,1,1-Trichloroethane	2.20E-01	cm^3/g or L/kg	[3]	1.01E+01	cm^3/g or L/kg	[3]	5.40E+00	cm^3/g or L/kg	[3]
72-43-5	Methoxychlor	1.50E+04	cm^3/g or L/kg	[3]	6.00E+03	cm^3/g or L/kg	[3]	3.20E+03	cm^3/g or L/kg	[3]
72-55-9	4,4-DDE	6.80E+05	cm^3/g or L/kg	[3]	6.48E+03	cm^3/g or L/kg	[3]	3.46E+03	cm^3/g or L/kg	[3]
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	2.74E+04	cm^3/g or L/kg	[2]	4.62E+05	cm^3/g or L/kg	[3]	2.47E+05	cm^3/g or L/kg	[3]
74-83-9	Bromomethane	4.00E-02	cm^3/g or L/kg	[2]	6.75E-01	cm^3/g or L/kg	[3]	3.60E-01	cm^3/g or L/kg	[3]
74-87-3	Chloromethane	2.80E-02	cm^3/g or L/kg	[2]	4.70E-01	cm^3/g or L/kg	[3]	2.50E-01	cm^3/g or L/kg	[3]
74-88-4	Iodomethane	5.86E-02	cm^3/g or L/kg	[2]	9.90E-01	cm^3/g or L/kg	[2]	5.28E-01	cm^3/g or L/kg	[2]
74-95-3	Methylene bromide	1.41E-01	cm^3/g or L/kg	[2]	2.39E+00	cm^3/g or L/kg	[3]	1.27E+00	cm^3/g or L/kg	[3]
74-97-5	Bromochloromethane	9.63E-02	cm^3/g or L/kg	[2]	1.63E+00	cm^3/g or L/kg	[2]	8.68E-01	cm^3/g or L/kg	[2]
7429-90-5	Aluminum	1.50E+03	cm^3/g or L/kg	[5]	1.50E+03	cm^3/g or L/kg	[1]	1.50E+03	cm^3/g or L/kg	[1]
7439-89-6	Iron	2.50E+01	cm^3/g or L/kg	[5]	2.50E+01	cm^3/g or L/kg	[1]	2.50E+01	cm^3/g or L/kg	[1]
7439-92-1	Lead	9.00E+02	cm^3/g or L/kg	[3]	9.00E+02	cm^3/g or L/kg	[3]	9.00E+02	cm^3/g or L/kg	[3]
7439-93-2	Lithium	3.00E+02	cm^3/g or L/kg	[5]	3.00E+02	cm^3/g or L/kg	[1]	3.00E+02	cm^3/g or L/kg	[1]
7439-95-4	Magnesium	4.50E+00	cm^3/g or L/kg	[5]	4.50E+00	cm^3/g or L/kg	[1]	4.50E+00	cm^3/g or L/kg	[1]
7439-96-5	Manganese	6.50E+01	cm^3/g or L/kg	[5]	6.50E+01	cm^3/g or L/kg	[1]	6.50E+01	cm^3/g or L/kg	[1]

Table 2-5 Soil/Water Partitioning Constant, Suspended Sediment/Surface Water Partitioning Coefficient, and Bed Sediment/Sediment Pore Water Partitioning Coefficient

CAS Registry Number	Constituent Name	Soil-water Partition Coeff. (Kd_s)	Units for Soil-Water Partition Coeff.	Reference	Suspended Sediment-Surface Water Partition Coeff. (Kd_{sw})	Units for Suspended Sediment-Surface Water Partition Coeff.	Reference	Bed Sediment-Sediment Pore Water Partition Coeff. (Kd_{bs})	Units for Sediment-Sediment Pore Water Partition Coeff.	Reference
7439-97-6	Mercury	1.00E+03	cm^3/g or L/kg	[3]	1.00E+03	cm^3/g or L/kg	[3]	3.00E+03	cm^3/g or L/kg	[3]
7439-98-7	Molybdenum	2.00E+01	cm^3/g or L/kg	[5]	2.00E+01	cm^3/g or L/kg	[1]	2.00E+01	cm^3/g or L/kg	[1]
7440-02-0	Nickel	6.50E+01	cm^3/g or L/kg	[3]	6.50E+01	cm^3/g or L/kg	[3]	6.50E+01	cm^3/g or L/kg	[3]
7440-16-6	Rhodium	6.00E+01	cm^3/g or L/kg	[1]	6.00E+01	cm^3/g or L/kg	[1]	6.00E+01	cm^3/g or L/kg	[1]
7440-22-4	Silver	8.30E+00	cm^3/g or L/kg	[3]	8.30E+00	cm^3/g or L/kg	[3]	8.30E+00	cm^3/g or L/kg	[3]
7440-23-5	Sodium	1.00E+02	cm^3/g or L/kg	[5]	1.00E+02	cm^3/g or L/kg	[1]	1.00E+02	cm^3/g or L/kg	[1]
7440-24-6	Strontium (total)	3.50E+01	cm^3/g or L/kg	[5]	3.50E+01	cm^3/g or L/kg	[1]	3.50E+01	cm^3/g or L/kg	[1]
7440-25-7	Tantalum	6.50E+02	cm^3/g or L/kg	[1]	6.50E+02	cm^3/g or L/kg	[1]	6.50E+02	cm^3/g or L/kg	[1]
7440-28-0	Thallium	7.10E+01	cm^3/g or L/kg	[3]	7.10E+01	cm^3/g or L/kg	[3]	7.10E+01	cm^3/g or L/kg	[3]
7440-29-1	Thorium-232	2.00E+01	cm^3/g or L/kg	[6]	1.50E+05	cm^3/g or L/kg	[1]	1.50E+05	cm^3/g or L/kg	[1]
7440-31-5	Tin	2.50E+02	cm^3/g or L/kg	[5]	2.50E+02	cm^3/g or L/kg	[1]	2.50E+02	cm^3/g or L/kg	[1]
7440-33-7	Tungsten	1.50E+02	cm^3/g or L/kg	[1]	1.50E+02	cm^3/g or L/kg	[1]	1.50E+02	cm^3/g or L/kg	[1]
7440-36-0	Antimony	4.50E+01	cm^3/g or L/kg	[3]	4.50E+01	cm^3/g or L/kg	[3]	4.50E+01	cm^3/g or L/kg	[3]
7440-38-2	Arsenic	2.90E+01	cm^3/g or L/kg	[3]	2.90E+01	cm^3/g or L/kg	[3]	2.90E+01	cm^3/g or L/kg	[3]
7440-39-3	Barium	4.10E+01	cm^3/g or L/kg	[3]	4.10E+01	cm^3/g or L/kg	[3]	4.10E+01	cm^3/g or L/kg	[3]
7440-41-7	Beryllium	7.90E+02	cm^3/g or L/kg	[3]	7.90E+02	cm^3/g or L/kg	[3]	7.90E+02	cm^3/g or L/kg	[3]
7440-43-9	Cadmium	7.50E+01	cm^3/g or L/kg	[3]	7.50E+01	cm^3/g or L/kg	[3]	7.50E+01	cm^3/g or L/kg	[3]

Table 2-5 Soil/Water Partitioning Constant, Suspended Sediment/Surface Water Partitioning Coefficient, and Bed Sediment/Sediment Pore Water Partitioning Coefficient

CAS Registry Number	Constituent Name	Soil-water Partition Coeff. (Kd_s)	Units for Soil-Water Partition Coeff.	Reference	Suspended Sediment-Surface Water Partition Coeff. (Kd_{sw})	Units for Suspended Sediment-Surface Water Partition Coeff.	Reference	Bed Sediment-Sediment Pore Water Partition Coeff. (Kd_{bs})	Units for Sediment-Sediment Pore Water Partition Coeff.	Reference
7440-47-3	Chromium	1.90E+01	cm^3/g or L/kg	[3]	1.90E+01	cm^3/g or L/kg	[3]	1.90E+01	cm^3/g or L/kg	[3]
7440-48-4	Cobalt	4.50E+01	cm^3/g or L/kg	[5]	4.50E+01	cm^3/g or L/kg	[1]	4.50E+01	cm^3/g or L/kg	[1]
7440-50-8	Copper	3.50E+01	cm^3/g or L/kg	[5]	3.50E+01	cm^3/g or L/kg	[1]	3.50E+01	cm^3/g or L/kg	[1]
7440-61-1	Uranium	4.50E+02	cm^3/g or L/kg	[5]	4.50E+02	cm^3/g or L/kg	[1]	4.50E+02	cm^3/g or L/kg	[1]
7440-61-1R	Uranium-238	4.50E+02	cm^3/g or L/kg	[1]	4.50E+02	cm^3/g or L/kg	[1]	4.50E+02	cm^3/g or L/kg	[1]
7440-62-2	Vanadium	1.00E+03	cm^3/g or L/kg	[5]	1.00E+03	cm^3/g or L/kg	[1]	1.00E+03	cm^3/g or L/kg	[1]
7440-65-5	Yttrium	5.00E+02	cm^3/g or L/kg	[1]	5.00E+02	cm^3/g or L/kg	[1]	5.00E+02	cm^3/g or L/kg	[1]
7440-66-6	Zinc	6.20E+01	cm^3/g or L/kg	[3]	6.20E+01	cm^3/g or L/kg	[3]	6.20E+01	cm^3/g or L/kg	[3]
7440-67-7	Zirconium	3.00E+03	cm^3/g or L/kg	[5]	3.00E+03	cm^3/g or L/kg	[1]	3.00E+03	cm^3/g or L/kg	[1]
7446-09-5	Sulfur dioxide									
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	5.82E+02	cm^3/g or L/kg	[2]	9.83E+03	cm^3/g or L/kg	[2]	5.24E+03	cm^3/g or L/kg	[2]
7487-94-7	Mercuric chloride (HgCl2)	5.80E+04	cm^3/g or L/kg	[3]	1.00E+05	cm^3/g or L/kg	[3]	5.00E+04	cm^3/g or L/kg	[3]
75-00-3	Chloroethane	3.20E-02	cm^3/g or L/kg	[3]	1.15E+00	cm^3/g or L/kg	[3]	6.20E-01	cm^3/g or L/kg	[3]
75-01-4	1-Chloroethene	3.70E-02	cm^3/g or L/kg	[3]	1.15E+00	cm^3/g or L/kg	[3]	6.20E-01	cm^3/g or L/kg	[3]
75-02-5	Fluoroethene (vinyl fluoride)	4.66E-02	cm^3/g or L/kg	[2]	7.87E-01	cm^3/g or L/kg	[2]	4.20E-01	cm^3/g or L/kg	[2]
75-05-8	Acetonitrile	2.04E-03	cm^3/g or L/kg	[2]	3.00E-02	cm^3/g or L/kg	[3]	2.00E-02	cm^3/g or L/kg	[3]
75-07-0	Acetaldehyde	2.71E-03	cm^3/g or L/kg	[2]	5.00E-02	cm^3/g or L/kg	[3]	2.00E-02	cm^3/g or L/kg	[3]

Table 2-5 Soil/Water Partitioning Constant, Suspended Sediment/Surface Water Partitioning Coefficient, and Bed Sediment/Sediment Pore Water Partitioning Coefficient

CAS Registry Number	Constituent Name	Soil-water Partition Coeff. (Kd_s)	Units for Soil-Water Partition Coeff.	Reference	Suspended Sediment-Surface Water Partition Coeff. (Kd_{sw})	Units for Suspended Sediment-Surface Water Partition Coeff.	Reference	Bed Sediment-Sediment Pore Water Partition Coeff. (Kd_{bs})	Units for Sediment-Sediment Pore Water Partition Coeff.	Reference
75-09-2	Dichloromethane (Methylene Chloride)	2.40E-02	cm^3/g or L/kg	[3]	7.50E-01	cm^3/g or L/kg	[3]	4.00E-01	cm^3/g or L/kg	[3]
75-15-0	Carbon disulfide	9.10E-02	cm^3/g or L/kg	[3]	4.96E+00	cm^3/g or L/kg	[3]	2.65E+00	cm^3/g or L/kg	[3]
75-21-8	Ethylene oxide (Oxirane)	2.26E-03	cm^3/g or L/kg	[2]	4.00E-02	cm^3/g or L/kg	[3]	2.00E-02	cm^3/g or L/kg	[3]
75-25-2	Bromoform	5.59E-01	cm^3/g or L/kg	[2]	9.45E+00	cm^3/g or L/kg	[3]	5.04E+00	cm^3/g or L/kg	[3]
75-27-4	Bromodichloromethane	1.10E-01	cm^3/g or L/kg	[3]	4.13E+00	cm^3/g or L/kg	[3]	2.21E+00	cm^3/g or L/kg	[3]
75-29-6	2-Chloropropane	1.41E-01	cm^3/g or L/kg	[2]	2.39E+00	cm^3/g or L/kg	[2]	1.27E+00	cm^3/g or L/kg	[2]
75-34-3	1,1-Dichloroethane	6.00E-02	cm^3/g or L/kg	[3]	4.01E+00	cm^3/g or L/kg	[3]	2.14E+00	cm^3/g or L/kg	[3]
75-35-4	1,1-Dichloroethene	1.20E-01	cm^3/g or L/kg	[3]	4.88E+00	cm^3/g or L/kg	[3]	2.60E+00	cm^3/g or L/kg	[3]
75-44-5	Phosgene (hydrogen phosphide)	7.10E-02	cm^3/g or L/kg	[14]	2.87E+00	cm^3/g or L/kg	[12]	1.53E+00	cm^3/g or L/kg	[12]
75-45-6	Chlorodifluoromethane	3.81E-02	cm^3/g or L/kg	[2]	6.40E-01	cm^3/g or L/kg	[3]	3.40E-01	cm^3/g or L/kg	[3]
75-50-3	Trimethylamine									
75-69-4	Trichlorofluoromethane	2.40E-01	cm^3/g or L/kg	[3]	8.57E+00	cm^3/g or L/kg	[3]	4.57E+00	cm^3/g or L/kg	[3]
75-71-8	Dichlorodifluoromethane	2.73E-01	cm^3/g or L/kg	[2]	4.61E+00	cm^3/g or L/kg	[3]	2.46E+00	cm^3/g or L/kg	[3]
76-01-7	Pentachloroethane	6.04E-01	cm^3/g or L/kg	[2]	1.02E+01	cm^3/g or L/kg	[2]	5.44E+00	cm^3/g or L/kg	[2]
76-13-1	1,2,2-Trichlorotrifluoroethane	8.75E-01	cm^3/g or L/kg	[2]	1.48E+01	cm^3/g or L/kg	[2]	7.88E+00	cm^3/g or L/kg	[2]
76-44-8	Heptachlor	2.10E+05	cm^3/g or L/kg	[3]	7.15E+02	cm^3/g or L/kg	[3]	3.81E+02	cm^3/g or L/kg	[3]

Table 2-5 Soil/Water Partitioning Constant, Suspended Sediment/Surface Water Partitioning Coefficient, and Bed Sediment/Sediment Pore Water Partitioning Coefficient

CAS Registry Number	Constituent Name	Soil-water Partition Coeff. (Kd_s)	Units for Soil-Water Partition Coeff.	Reference	Suspended Sediment-Surface Water Partition Coeff. (Kd_{sw})	Units for Suspended Sediment-Surface Water Partition Coeff.	Reference	Bed Sediment-Sediment Pore Water Partition Coeff. (Kd_{bs})	Units for Sediment-Sediment Pore Water Partition Coeff.	Reference
764-41-0	1,4-Dichloro-2-butene	5.86E-01	cm^3/g or L/kg	[2]	9.90E+00	cm^3/g or L/kg	[2]	5.28E+00	cm^3/g or L/kg	[2]
7647-01-0	Hydrogen chloride									
765-34-4	Glycidylaldehyde	4.44E-03	cm^3/g or L/kg	[2]	7.50E-02	cm^3/g or L/kg	[2]	4.00E-02	cm^3/g or L/kg	[2]
7664-39-3	Hydrogen Fluoride									
7664-41-7	Ammonia/Ammonium									
77-47-4	Hexachlorocyclopentadiene	5.21E+01	cm^3/g or L/kg	[2]	8.80E+02	cm^3/g or L/kg	[3]	4.70E+02	cm^3/g or L/kg	[3]
77-78-1	Dimethyl sulfate	3.77E-02	cm^3/g or L/kg	[2]	6.37E-01	cm^3/g or L/kg	[2]	3.40E-01	cm^3/g or L/kg	[2]
7704-34-9	Total Sulfur (thermodynamically stable)									
7723-14-0	Phosphorus	3.50E+00	cm^3/g or L/kg	[5]	3.50E+00	cm^3/g or L/kg	[1]	3.50E+00	cm^3/g or L/kg	[1]
7782-41-4	Fluorine gas F2	1.50E+02	cm^3/g or L/kg	[5]						
7782-49-2	Selenium	5.00E+00	cm^3/g or L/kg	[3]	5.00E+00	cm^3/g or L/kg	[3]	5.00E+00	cm^3/g or L/kg	[3]
7782-50-5	Chlorine	2.50E-01	cm^3/g or L/kg	[5]						
78-83-1	2-Methylpropyl alcohol	1.30E-02	cm^3/g or L/kg	[2]	2.19E-01	cm^3/g or L/kg	[2]	1.17E-01	cm^3/g or L/kg	[2]
78-87-5	1,2-Dichloropropane	9.00E-02	cm^3/g or L/kg	[3]	3.53E+00	cm^3/g or L/kg	[3]	1.88E+00	cm^3/g or L/kg	[3]
78-93-3	2-Butanone	2.90E-01	cm^3/g or L/kg	[3]	1.40E-01	cm^3/g or L/kg	[3]	8.00E-02	cm^3/g or L/kg	[3]
79-00-5	1,1,2-Trichloroethane	1.00E-01	cm^3/g or L/kg	[3]	5.63E+00	cm^3/g or L/kg	[3]	3.00E+00	cm^3/g or L/kg	[3]
79-01-6	1,1,2-Trichloroethylene	3.30E-01	cm^3/g or L/kg	[3]	7.07E+00	cm^3/g or L/kg	[3]	3.77E+00	cm^3/g or L/kg	[3]

Table 2-5 Soil/Water Partitioning Constant, Suspended Sediment/Surface Water Partitioning Coefficient, and Bed Sediment/Sediment Pore Water Partitioning Coefficient

CAS Registry Number	Constituent Name	Soil-water Partition Coeff. (Kd_s)	Units for Soil-Water Partition Coeff.	Reference	Suspended Sediment-Surface Water Partition Coeff. (Kd_{sw})	Units for Suspended Sediment-Surface Water Partition Coeff.	Reference	Bed Sediment-Sediment Pore Water Partition Coeff. (Kd_{bs})	Units for Sediment-Sediment Pore Water Partition Coeff.	Reference
79-10-7	2-Propenoic acid	6.39E-03	cm^3/g or L/kg	[2]	1.08E-01	cm^3/g or L/kg	[2]	5.76E-02	cm^3/g or L/kg	[2]
79-34-5	1,1,2,2-Tetrachloroethane	1.90E-01	cm^3/g or L/kg	[3]	5.93E+00	cm^3/g or L/kg	[3]	3.16E+00	cm^3/g or L/kg	[3]
79-46-9	2-Nitropropane	1.37E-01	cm^3/g or L/kg	[2]	2.31E+00	cm^3/g or L/kg	[2]	1.23E+00	cm^3/g or L/kg	[2]
80-62-6	Methyl methacrylate	4.06E-02	cm^3/g or L/kg	[2]	6.86E-01	cm^3/g or L/kg	[2]	3.66E-01	cm^3/g or L/kg	[2]
82-68-8	Pentachloronitrobenzene (PCNB)	1.62E+02	cm^3/g or L/kg	[2]	2.73E+03	cm^3/g or L/kg	[3]	1.46E+03	cm^3/g or L/kg	[3]
822-06-0	Hexamethylene-1,5-diisocyanate	2.14E+01	cm^3/g or L/kg	[2]	3.62E+02	cm^3/g or L/kg	[2]	1.93E+02	cm^3/g or L/kg	[2]
823-40-5	Toluene-2,6-diamine	2.51E-01	cm^3/g or L/kg	[2]	4.24E+00	cm^3/g or L/kg	[2]	2.26E+00	cm^3/g or L/kg	[2]
83-32-9	Acenaphthene	1.10E+03	cm^3/g or L/kg	[3]	3.68E+02	cm^3/g or L/kg	[3]	1.96E+02	cm^3/g or L/kg	[3]
832-69-9	1-Methylphenanthrene	4.38E+02	cm^3/g or L/kg	[2]	7.40E+03	cm^3/g or L/kg	[2]	3.94E+03	cm^3/g or L/kg	[2]
84-66-2	Diethyl phthalate	4.40E+01	cm^3/g or L/kg	[3]	6.17E+00	cm^3/g or L/kg	[3]	3.29E+00	cm^3/g or L/kg	[3]
84-74-2	Di-n-butylphthalate	5.20E+03	cm^3/g or L/kg	[3]	1.18E+02	cm^3/g or L/kg	[3]	6.28E+01	cm^3/g or L/kg	[3]
85-01-8	Phenanthrene	3.70E+03	cm^3/g or L/kg	[3]	1.99E+03	cm^3/g or L/kg	[3]	1.06E+03	cm^3/g or L/kg	[3]
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	1.11E-03	cm^3/g or L/kg	[2]	2.00E-02	cm^3/g or L/kg	[3]	1.00E-02	cm^3/g or L/kg	[3]
85-68-7	Butylbenzylphthalate	8.70E+03	cm^3/g or L/kg	[3]	1.03E+03	cm^3/g or L/kg	[3]	5.48E+02	cm^3/g or L/kg	[3]
86-73-7	Fluorene	2.10E+03	cm^3/g or L/kg	[3]	5.78E+02	cm^3/g or L/kg	[3]	3.08E+02	cm^3/g or L/kg	[3]
87-61-6	1,2,3-Trichlorobenzene	8.57E+00	cm^3/g or L/kg	[2]	1.45E+02	cm^3/g or L/kg	[3]	7.72E+01	cm^3/g or L/kg	[3]

Table 2-5 Soil/Water Partitioning Constant, Suspended Sediment/Surface Water Partitioning Coefficient, and Bed Sediment/Sediment Pore Water Partitioning Coefficient

CAS Registry Number	Constituent Name	Soil-water Partition Coeff. (Kd_s)	Units for Soil-Water Partition Coeff.	Reference	Suspended Sediment-Surface Water Partition Coeff. (Kd_{sw})	Units for Suspended Sediment-Surface Water Partition Coeff.	Reference	Bed Sediment-Sediment Pore Water Partition Coeff. (Kd_{bs})	Units for Sediment-Sediment Pore Water Partition Coeff.	Reference
87-68-3	Hexachlorobutadiene	7.60E+03	cm^3/g or L/kg	[3]	5.68E+02	cm^3/g or L/kg	[3]	3.03E+02	cm^3/g or L/kg	[3]
87-86-5	Pentachlorophenol	1.20E+00	cm^3/g or L/kg	[3]	4.44E+01	cm^3/g or L/kg	[3]	2.37E+01	cm^3/g or L/kg	[3]
88-06-2	2,4,6-Trichlorophenol	7.60E-01	cm^3/g or L/kg	[3]	2.86E+01	cm^3/g or L/kg	[3]	1.52E+01	cm^3/g or L/kg	[3]
88-74-4	o-Nitroaniline (2-nitroaniline)	2.93E-01	cm^3/g or L/kg	[2]	4.94E+00	cm^3/g or L/kg	[3]	2.64E+00	cm^3/g or L/kg	[3]
88-75-5	2-Nitrophenol	2.55E-01	cm^3/g or L/kg	[2]	4.31E+00	cm^3/g or L/kg	[3]	2.30E+00	cm^3/g or L/kg	[3]
90-04-0	o-Anisidine	2.04E-01	cm^3/g or L/kg	[2]	3.44E+00	cm^3/g or L/kg	[2]	1.84E+00	cm^3/g or L/kg	[2]
90-12-0	1-Methylnaphthalene	1.02E+01	cm^3/g or L/kg	[2]	1.72E+02	cm^3/g or L/kg	[2]	9.16E+01	cm^3/g or L/kg	[2]
91-20-3	Naphthalene	3.00E+02	cm^3/g or L/kg	[3]	8.93E+01	cm^3/g or L/kg	[3]	4.76E+01	cm^3/g or L/kg	[3]
91-22-5	Quinoline	5.59E+00	cm^3/g or L/kg	[2]	9.44E+01	cm^3/g or L/kg	[2]	5.04E+01	cm^3/g or L/kg	[2]
91-57-6	2-Methylnaphthalene	1.77E+01	cm^3/g or L/kg	[2]	2.99E+02	cm^3/g or L/kg	[2]	1.59E+02	cm^3/g or L/kg	[2]
91-58-7	2-Chloronaphthalene	9.34E+00	cm^3/g or L/kg	[2]	1.58E+02	cm^3/g or L/kg	[3]	8.41E+01	cm^3/g or L/kg	[3]
91-94-1	3,3'-Dichlorobenzidine	3.20E+00	cm^3/g or L/kg	[2]	5.41E+01	cm^3/g or L/kg	[3]	2.88E+01	cm^3/g or L/kg	[3]
92-52-4	1,1`-Biphenyl	8.27E+00	cm^3/g or L/kg	[2]	1.40E+02	cm^3/g or L/kg	[2]	7.45E+01	cm^3/g or L/kg	[2]
924-16-3	N-Nitroso-di-n-Buetylamine	3.43E-01	cm^3/g or L/kg	[2]	5.79E+00	cm^3/g or L/kg	[3]	3.09E+00	cm^3/g or L/kg	[3]
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	1.83E+00	cm^3/g or L/kg	[2]	3.09E+01	cm^3/g or L/kg	[3]	1.65E+01	cm^3/g or L/kg	[3]
94-75-7	2,4-D	2.03E-01	cm^3/g or L/kg	[2]	3.43E+00	cm^3/g or L/kg	[2]	1.83E+00	cm^3/g or L/kg	[2]

Table 2-5 Soil/Water Partitioning Constant, Suspended Sediment/Surface Water Partitioning Coefficient, and Bed Sediment/Sediment Pore Water Partitioning Coefficient

CAS Registry Number	Constituent Name	Soil-water Partition Coeff. (Kd_s)	Units for Soil-Water Partition Coeff.	Reference	Suspended Sediment-Surface Water Partition Coeff. (Kd_{sw})	Units for Suspended Sediment-Surface Water Partition Coeff.	Reference	Bed Sediment-Sediment Pore Water Partition Coeff. (Kd_{bs})	Units for Sediment-Sediment Pore Water Partition Coeff.	Reference
95-48-7	o-Cresol	3.67E-01	cm^3/g or L/kg	[2]	6.20E+00	cm^3/g or L/kg	[3]	3.31E+00	cm^3/g or L/kg	[3]
95-49-8	o-Chlorotoluene	1.70E+00	cm^3/g or L/kg	[2]	2.87E+01	cm^3/g or L/kg	[2]	1.53E+01	cm^3/g or L/kg	[2]
95-50-1	1,2-Dichlorobenzene	1.68E+00	cm^3/g or L/kg	[2]	2.84E+01	cm^3/g or L/kg	[3]	1.52E+01	cm^3/g or L/kg	[3]
95-53-4	o-Toluidine	8.81E-02	cm^3/g or L/kg	[2]	1.49E+00	cm^3/g or L/kg	[3]	7.90E-01	cm^3/g or L/kg	[3]
95-57-8	2-Chlorophenol	1.72E+00	cm^3/g or L/kg	[2]	2.91E+01	cm^3/g or L/kg	[3]	1.55E+01	cm^3/g or L/kg	[3]
95-63-6	1,2,4-Trimethyl benzene	2.73E+00	cm^3/g or L/kg	[2]	4.61E+01	cm^3/g or L/kg	[2]	2.46E+01	cm^3/g or L/kg	[2]
95-94-3	1,2,4,5-Tetrachlorobenzene	1.10E+01	cm^3/g or L/kg	[3]	5.68E+02	cm^3/g or L/kg	[3]	3.03E+02	cm^3/g or L/kg	[3]
95-95-4	2,4,5-Trichlorophenol	7.09E+00	cm^3/g or L/kg	[2]	1.20E+02	cm^3/g or L/kg	[3]	6.39E+01	cm^3/g or L/kg	[3]
96-12-8	1,2-Dibromo-3-chloropropane	1.70E-01	cm^3/g or L/kg	[3]	1.37E+01	cm^3/g or L/kg	[3]	7.30E+00	cm^3/g or L/kg	[3]
96-18-4	1,2,3-Trichloropropane	1.40E-01	cm^3/g or L/kg	[3]	3.45E+00	cm^3/g or L/kg	[3]	1.84E+00	cm^3/g or L/kg	[3]
96-45-7	Ethylene thiourea	5.77E-02	cm^3/g or L/kg	[2]	9.75E-01	cm^3/g or L/kg	[2]	5.20E-01	cm^3/g or L/kg	[2]
97-63-2	Ethyl methacrylate	3.59E-01	cm^3/g or L/kg	[2]	6.06E+00	cm^3/g or L/kg	[3]	3.23E+00	cm^3/g or L/kg	[3]
98-01-1	Furfural	2.70E-02	cm^3/g or L/kg	[2]	4.56E-01	cm^3/g or L/kg	[2]	2.43E-01	cm^3/g or L/kg	[2]
98-06-6	tert-Butyl benzene	4.44E+00	cm^3/g or L/kg	[2]	7.50E+01	cm^3/g or L/kg	[2]	4.00E+01	cm^3/g or L/kg	[2]
98-07-7	Benzotrichloride	4.44E+00	cm^3/g or L/kg	[2]	7.50E+01	cm^3/g or L/kg	[2]	4.00E+01	cm^3/g or L/kg	[2]
98-82-8	Cumene	6.00E+02	cm^3/g or L/kg	[3]	7.65E+01	cm^3/g or L/kg	[3]	4.08E+01	cm^3/g or L/kg	[3]
98-83-9	Methyl styrene (mixed isomers)	3.18E+00	cm^3/g or L/kg	[2]	5.37E+01	cm^3/g or L/kg	[2]	2.86E+01	cm^3/g or L/kg	[2]

Table 2-5 Soil/Water Partitioning Constant, Suspended Sediment/Surface Water Partitioning Coefficient, and Bed Sediment/Sediment Pore Water Partitioning Coefficient

CAS Registry Number	Constituent Name	Soil-water Partition Coeff. (Kd_s)	Units for Soil-Water Partition Coeff.	Reference	Suspended Sediment-Surface Water Partition Coeff. (Kd_{sw})	Units for Suspended Sediment-Surface Water Partition Coeff.	Reference	Bed Sediment-Sediment Pore Water Partition Coeff. (Kd_{bs})	Units for Sediment-Sediment Pore Water Partition Coeff.	Reference
98-86-2	Acetophenone	1.59E-01	cm^3/g or L/kg	[2]	2.68E+00	cm^3/g or L/kg	[3]	1.43E+00	cm^3/g or L/kg	[3]
98-95-3	Nitrobenzene	5.28E-01	cm^3/g or L/kg	[2]	8.93E+00	cm^3/g or L/kg	[3]	4.76E+00	cm^3/g or L/kg	[3]
99-35-4	1,3,5-Trinitrobenzene	2.20E+00	cm^3/g or L/kg	[3]	1.13E+00	cm^3/g or L/kg	[3]	6.10E-01	cm^3/g or L/kg	[3]
99-65-0	1,3-Dinitrobenzene	4.40E+00	cm^3/g or L/kg	[3]	2.24E+00	cm^3/g or L/kg	[3]	1.19E+00	cm^3/g or L/kg	[3]
99-87-6	p-Cymene	4.97E+00	cm^3/g or L/kg	[2]	8.40E+01	cm^3/g or L/kg	[2]	4.48E+01	cm^3/g or L/kg	[2]

Reference **Reference (source) for Soil-Water Partition Coefficient**

[1] Baes CF, Sharp RD, Sjoreen AL, and Shor RW. 1984. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture*, ORNL-5786, Oak Ridge National Laboratory, Oak Ridge, TN (http://homer.ornl.gov/baes/documents/ornl5786.html).

[2] Calculated value per Eq. A-2-10 in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm).

[3] EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013).

[4] Kennedy WE, and Strenge DL. 1992. *Residual Radioactive Contamination from Decommissioning, Vol. 1, Final Report*. NUREG/CR-5512. Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission, Washington DC. (Table 6.7) (http://www.nrc.gov/what-we-do/regulatory/decommissioning/reg-guides-comm.html).

[5] ORNL. *The Risk Assessment Information System (RAIS) Database*. Copyright © 2013 Oak Ridge National Laboratory and The University of Tennessee, Oak Ridge, TN (http://rais.ornl.gov, accessed April 2014).

[6] Risk Assessment Information System (RAIS) database, Copyright © 2013 The University of Tennessee, Knoxville, TN (http://rais.ornl.gov/, accessed April 2014).

[7] Surrogate value from 2,4-Dinitrotoluene.

[8] Surrogate value from Acenaphthene.

[9] Surrogate value from Acrylonitrile.

[10] Surrogate value from Benzo(a)pyrene.

[11] Surrogate value from Chrysene.

Reference	Reference (source) for Soil-Water Partition Coefficient
[12]	Surrogate value from Dibenz[a,h]anthracene.
[13]	Surrogate value from Trichlorofluoromethane.
[14]	Surrogate value from cis-1,2-Dichloroethene.

Reference	Reference (source) for Suspended Sediment-Surface Water Partition Coefficient
[1]	Baes CF, Sharp RD, Sjoreen AL, and Shor RW. 1984. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture*, ORNL-5786, Oak Ridge National Laboratory, Oak Ridge, TN (http://homer.ornl.gov/baes/documents/ornl5786.html).
[2]	Calculated value per Eq. A-2-11 in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm).
[3]	EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013).
[4]	Kennedy WE, and Strenge DL. 1992. *Residual Radioactive Contamination from Decommissioning, Vol. 1, Final Report*. NUREG/CR-5512. Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission, Washington DC. (Table 6.7) (http://www.nrc.gov/what-we-do/regulatory/decommissioning/reg-guides-comm.html).
[5]	Surrogate value from 2,4-Dinitrotoluene.
[6]	Surrogate value from Acenaphthene.
[7]	Surrogate value from Acrylonitrile.
[8]	Surrogate value from Benzo(a)pyrene.
[9]	Surrogate value from Chrysene.
[10]	Surrogate value from Dibenz[a,h]anthracene.
[11]	Surrogate value from Trichlorofluoromethane.
[12]	Surrogate value from cis-1,2-Dichloroethene.

Reference	Reference (source) for Sediment/Sediment Pore Water Partition Coefficient
[1]	Baes CF, Sharp RD, Sjoreen AL, and Shor RW. 1984. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture*, ORNL-5786, Oak Ridge National Laboratory, Oak Ridge, TN (http://homer.ornl.gov/baes/documents/ornl5786.html).
[2]	Calculated value per Eq. A-2-12 in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm).
[3]	EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013).
[4]	Kennedy WE, and Strenge DL. 1992. *Residual Radioactive Contamination from Decommissioning, Vol. 1, Final Report*. NUREG/CR-5512. Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission, Washington DC. (Table 6.7) (http://www.nrc.gov/what-we-do/regulatory/decommissioning/reg-guides-comm.html).
[5]	Surrogate value from 2,4-Dinitrotoluene.
[6]	Surrogate value from Acenaphthene.

Reference	Reference (source) for Sediment/Sediment Pore Water Partition Coefficient
[7]	Surrogate value from Acrylonitrile.
[8]	Surrogate value from Benzo(a)pyrene.
[9]	Surrogate value from Chrysene.
[10]	Surrogate value from Dibenz[a,h]anthracene.
[11]	Surrogate value from Trichlorofluoromethane.
[12]	Surrogate value from cis-1,2-Dichloroethene.

Table 2-6 provides data for constituent biological half-life and the degradation loss constant. The biological half-life is used to estimate soil loss due to biotic and abiotic degradation, as represented by the degradation loss constant. The degradation loss constant is used to compute soil loss over time and the corresponding soil concentration for each receptor. The blank entries in the table indicate where data are not available.

Table 2-6 Biotic and Abiotic Half-life and Degradation Constant

CAS Registry Number	Constituent Name	Biological Half-life (days) ($t_{½}$)	Units for Biological Half-life	Reference	Loss Constant from Biotic/ Abiotic Degradation (ks_g)	Units for Biotic/ Abiotic Degradation Loss Constant	Reference
100-02-7	p-Nitrophenol	3.31E-03	yr	[3]	2.09E+02	1/yr	[1]
100-21-0	Phthalic acid	1.92E-02	yr	[3]	3.61E+01	1/yr	[1]
100-25-4	1,4-Dinitrobenzene						
100-40-3	4-Ethenylcyclohexene						
100-41-4	Ethyl benzene	2.74E-02	yr	[3]	2.53E+01	1/yr	[1]
100-42-5	Styrene	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
100-44-7	Benzyl chloride	3.31E-02	yr	[3]	2.09E+01	1/yr	[1]
100-47-0	Benzonitrile				0.00E+00	1/yr	[2]
100-51-6	Benzyl alcohol				0.00E+00	1/yr	[2]
100-52-7	Benzaldehyde				0.00E+00	1/yr	[2]
10028-15-6	Ozone						
10061-01-5	cis-1,3-Dichloropropene				0.00E+00	1/yr	[3]
10061-02-6	trans-1,3-Dichloropropene						
101-55-3	4-Bromophenylphenyl ether				0.00E+00	1/yr	[2]
101-77-9	4,4-Methylenedianiline	1.92E-02	yr	[3]	3.61E+01	1/yr	[1]
10102-44-0	Nitrogen dioxide						
103-33-3	Azobenzene						
103-65-1	n-Propyl benzene (Isocumene)						
104-51-8	n-Butylbenzene						
104-76-7	2-Ethyl-1-hexanol						
105-67-9	2,4-Dimethylphenol	1.92E-02	yr	[3]	3.61E+01	1/yr	[1]
10595-95-6	n-Nitrosomethylethylamine						
106-43-4	4-Chlorotoluene (p-Tolyl chloride)						
106-44-5	p-Cresol (4-methyl phenol)	1.83E-03	yr	[3]	3.79E+02	1/yr	[1]
106-46-7	1,4-Dichlorobenzene	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
106-47-8	p-Chloroaniline				0.00E+00	1/yr	[2]
106-49-0	p-Toluidine						

Table 2-6 Biotic and Abiotic Half-life and Degradation Constant

CAS Registry Number	Constituent Name	Biological Half-life (days) ($t_{½}$)	Units for Biological Half-life	Reference	Loss Constant from Biotic/ Abiotic Degradation (ks_g)	Units for Biotic/ Abiotic Degradation Loss Constant	Reference
106-51-4	Quinone	1.37E-02	yr	[3]	5.06E+01	1/yr	[1]
106-88-7	1,2-Epoxybutane	3.54E-02	yr	[3]	1.96E+01	1/yr	[1]
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
106-93-4	Ethylene dibromide	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
106-99-0	1,3-Butadiene	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
107-02-8	Acrolein	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
107-05-1	3-Chloropropene	3.82E-02	yr	[3]	1.81E+01	1/yr	[1]
107-06-2	1,2-Dichloroethane	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
107-12-0	Propionitrile						
107-13-1	Acrylonitrile	6.30E-02	yr	[3]	1.10E+01	1/yr	[1]
107-19-7	Propargyl alcohol						
107-21-1	Ethylene glycol (1,2-ethanediol)	3.29E-02	yr	[3]	2.11E+01	1/yr	[1]
107-98-2	Propylene glycol monomethyl ether	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
108-05-4	Acetic acid vinyl ester				0.00E+00	1/yr	[2]
108-10-1	4-Methyl-2-pentanone	1.92E-02	yr	[3]	3.61E+01	1/yr	[1]
108-39-4	m-Cresol	7.95E-02	yr	[3]	8.72E+00	1/yr	[1]
108-60-1	bis (2-Chloroisopropyl)ether	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
108-67-8	1,3,5-Trimethylbenzene						
108-86-1	Bromobenzene (Phenyl bromide)						
108-87-2	Methylcyclohexane						
108-88-3	Toluene	6.03E-02	yr	[3]	1.15E+01	1/yr	[1]
108-90-7	Chlorobenzene	4.11E-01	yr	[3]	1.69E+00	1/yr	[1]
108-94-1	Cyclohexanone						
108-95-2	Phenol	2.74E-02	yr	[3]	2.53E+01	1/yr	[1]
109-74-0	n-Butanenitrile						
109-75-1	3-Butenenitrile						
109-77-3	Malononitrile	5.86E-02	yr	[6]	1.18E+01	1/yr	[1]
109-86-4	2-Methoxyethanol	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
109-99-9	Tetrahydrofuran				0.00E+00	1/yr	[2]
110-00-9	Furan						
110-54-3	n-Hexane						

Table 2-6 Biotic and Abiotic Half-life and Degradation Constant

CAS Registry Number	Constituent Name	Biological Half-life (days) ($t_{½}$)	Units for Biological Half-life	Reference	Loss Constant from Biotic/ Abiotic Degradation (ks_g)	Units for Biotic/ Abiotic Degradation Loss Constant	Reference
110-59-8	Pentanenitrile						
110-80-5	2-Ethoxyethanol	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
110-82-7	Cyclohexane	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
110-83-8	Cyclohexene						
110-86-1	Pyridine	1.92E-02	yr	[3]	3.61E+01	1/yr	[1]
111-15-9	Ethylene glycol monoethyl ether acetate						
111-44-4	Bis(2-chloroethyl)ether	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
111-65-9	n-Octane						
111-76-2	2-Butoxyethanol	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
111-84-2	n-Nonane						
111-91-1	Bis(2-chloroethoxy)methane						
112-30-1	1-Decanol						
112-31-2	Decanal						
112-40-3	Dodecane						
1120-21-4	Undecane						
1120-71-4	1,3-Propane sultone	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
117-81-7	Bis(2-ethylhexyl) phthalate				1.10E+01	1/yr	[2]
117-84-0	Di-n-octylphthalate	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
118-74-1	Hexachlorobenzene	5.72E+00	yr	[3]	1.21E-01	1/yr	[1]
119-90-4	3,3'-Dimethoxybenzidine	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
120-12-7	Anthracene	1.26E+00	yr	[3]	5.50E-01	1/yr	[1]
120-82-1	1,2,4-Trichlorobenzene	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
120-83-2	2,4-Dichlorophenol	1.92E-01	yr	[3]	3.61E+00	1/yr	[1]
121-14-2	2,4-Dinitrotoluene	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
122-39-4	N,N-Diphenylamine	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
122-66-7	1,2-Diphenylhydrazine	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
123-33-1	Maleic hydrazide						
123-38-6	Propionaldehyde	1.92E-02	yr	[3]	3.61E+01	1/yr	[1]
123-72-8	Butanal	1.92E-02	yr	[3]	3.61E+01	1/yr	[1]
123-91-1	1,4-Dioxan	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
124-18-5	Decane						

Table 2-6 Biotic and Abiotic Half-life and Degradation Constant

CAS Registry Number	Constituent Name	Biological Half-life (days) ($t_{½}$)	Units for Biological Half-life	Reference	Loss Constant from Biotic/ Abiotic Degradation (ks_g)	Units for Biotic/ Abiotic Degradation Loss Constant	Reference
124-38-9	Carbon dioxide						
124-48-1	Chlorodibromomethane	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
126-73-8	Tributyl phosphate						
126-98-7	2-Methyl-2-propenenitrile				0.00E+00	1/yr	[2]
127-18-4	1,1,2,2-Tetrachloroethene	1.00E+00	yr	[3]	6.93E-01	1/yr	[1]
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol						
129-00-0	Pyrene	5.21E+00	yr	[3]	1.33E-01	1/yr	[1]
131-11-3	Dimethyl Phthalate	1.92E-02	yr	[3]	3.61E+01	1/yr	[1]
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol						
132-64-9	Dibenzofuran	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
133-06-2	Captan	1.64E-01	yr	[3]	4.22E+00	1/yr	[1]
1330-20-7	Xylenes (mixed isomers)						
1336-36-3	Polychlorinated biphenyls						
134-32-7	alpha-Naphthylamine	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
135-98-8	sec-Butylbenzene	2.74E-02	yr	[14]	2.53E+01	1/yr	[1]
141-78-6	Acetic acid ethyl ester	1.92E-02	yr	[3]	3.61E+01	1/yr	[1]
14265-44-2	Phosphate						
145-73-3	Endothall	2.47E-02	yr	[5]	2.81E+01	1/yr	[1]
14797-55-8	Nitrate						
14797-65-0	Nitrite						
14808-79-8	Sulfate						
156-59-2	cis-1,2-Dichloroethene				0.00E+00	1/yr	[2]
156-60-5	1,2-trans-Dichloroethene				0.00E+00	1/yr	[2]
1634-04-4	Methyl tert-butyl ether	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
16887-00-6	Chloride						
16984-48-8	Fluoride						
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1.62E+00	yr	[3]	4.29E-01	1/yr	[1]
18540-29-9	Chromium(VI)				0.00E+00	1/yr	[2]
189-55-9	Dibenzo[a,i]pyrene	9.89E-01	yr	[3]	7.01E-01	1/yr	[1]
189-64-0	Dibenzo[a,h]pyrene	9.89E-01	yr	[12]	7.01E-01	1/yr	[1]
191-24-2	Benzo(g,h,i)perylene	1.78E+00	yr	[3]	3.89E-01	1/yr	[1]

Table 2-6 Biotic and Abiotic Half-life and Degradation Constant

CAS Registry Number	Constituent Name	Biological Half-life (days) ($t_{½}$)	Units for Biological Half-life	Reference	Loss Constant from Biotic/ Abiotic Degradation (ks_g)	Units for Biotic/ Abiotic Degradation Loss Constant	Reference
191-30-0	Dibenzo(a,l)pyrene						
192-65-4	Dibenzo[a,e]pyrene	1.02E+00	yr	[1]	6.82E-01	1/yr	[1]
192-97-2	Benzo(e)pyrene						
193-39-5	Indeno(1,2,3-cd)pyrene	2.00E+00	yr	[3]	3.47E-01	1/yr	[1]
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	2.00E+01	yr	[1]	3.47E-02	1/yr	[1]
205-82-3	Benzo[j]fluoranthene	1.05E+01	yr	[1]	6.60E-02	1/yr	[1]
205-99-2	Benzo(b)fluoranthene	1.67E+00	yr	[3]	4.15E-01	1/yr	[1]
206-44-0	Fluoranthene	1.21E+00	yr	[3]	5.75E-01	1/yr	[1]
207-08-9	Benzo(k)fluoranthene	5.86E+00	yr	[3]	1.18E-01	1/yr	[1]
208-96-8	Acenaphthylene	1.64E-01	yr	[3]	4.22E+00	1/yr	[1]
218-01-9	Chrysene	2.74E+00	yr	[3]	2.53E-01	1/yr	[1]
224-42-0	Dibenz[a,j]acridine	2.58E+00	yr	[11]	2.69E-01	1/yr	[1]
2245-38-7	2,3,5-Trimethylnaphthalene						
226-36-8	Dibenz[a,h]acridine	2.58E+00	yr	[11]	2.69E-01	1/yr	[1]
22967-92-6	Methyl mercury				0.00E+00	1/yr	[2]
23950-58-5	Pronamide	1.10E-01	yr	[5]	6.32E+00	1/yr	[1]
24959-67-9	Bromide						
27154-33-2	Trichlorofluoroethane	1.00E+00	yr	[13]	6.93E-01	1/yr	[1]
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	7.25E+00	yr	[1]	9.56E-02	1/yr	[1]
319-84-6	alpha-BHC	3.70E-01	yr	[3]	1.87E+00	1/yr	[1]
319-85-7	beta-BHC	3.40E-01	yr	[3]	2.04E+00	1/yr	[1]
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	4.83E+00	yr	[1]	1.44E-01	1/yr	[1]
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	7.25E+00	yr	[1]	9.56E-02	1/yr	[1]
3268-87-9	Octachlorodibenzo(p)dioxin	2.00E+01	yr	[1]	3.47E-02	1/yr	[1]
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)						
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	2.00E+01	yr	[1]	3.47E-02	1/yr	[1]
3697-24-3	5-Methylchrysene	2.74E+00	yr	[10]	2.53E-01	1/yr	[1]

Table 2-6 Biotic and Abiotic Half-life and Degradation Constant

CAS Registry Number	Constituent Name	Biological Half-life (days) ($t_{½}$)	Units for Biological Half-life	Reference	Loss Constant from Biotic/ Abiotic Degradation (ks_g)	Units for Biotic/ Abiotic Degradation Loss Constant	Reference
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)						
39001-02-0	Octachlorodibenzofuran	2.00E+01	yr	[1]	3.47E-02	1/yr	[1]
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	2.00E+01	yr	[1]	3.47E-02	1/yr	[1]
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)						
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	2.00E+01	yr	[1]	3.47E-02	1/yr	[1]
4170-30-3	Crotonaldehyde (Propylene aldehyde)						
41851-50-7	Chlorocyclopentadiene						
460-19-5	Cyanogen (oxalonitrile)						
4786-20-3	2-Butenenitrile						
50-00-0	Formaldehyde	1.92E-02	yr	[3]	3.61E+01	1/yr	[1]
50-32-8	Benzo(a)pyrene	1.45E+00	yr	[3]	4.77E-01	1/yr	[1]
506-68-3	Cyanogen bromide (bromocyanide)						
506-77-4	Cyanogen chloride						
51-28-5	2,4-Dinitrophenol	7.21E-01	yr	[3]	9.62E-01	1/yr	[1]
51-79-6	Ethyl carbamate (urethane)	1.92E-02	yr	[3]	3.61E+01	1/yr	[1]
510-15-6	Chlorobenzilate	9.59E-02	yr	[3]	7.23E+00	1/yr	[1]
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	2.00E+01	yr	[1]	3.47E-02	1/yr	[1]
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)						
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)						
53-70-3	Dibenz[a,h]anthracene	2.58E+00	yr	[3]	2.69E-01	1/yr	[1]
532-27-4	2-Chloroacetophenone	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
534-52-1	4,6-Dinitro-o-cresol	5.75E-02	yr	[3]	1.20E+01	1/yr	[1]
5385-75-1	Dibenzo(a,e)fluoranthene	9.89E-01	yr	[12]	7.01E-01	1/yr	[1]
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
540-73-8	1,2-Dimethylhydrazine	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
540-84-1	2,2,4-Trimethylpentane						
541-73-1	1,3-Dichlorobenzene	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]

Table 2-6 Biotic and Abiotic Half-life and Degradation Constant

CAS Registry Number	Constituent Name	Biological Half-life (days) ($t_{½}$)	Units for Biological Half-life	Reference	Loss Constant from Biotic/ Abiotic Degradation (ks_g)	Units for Biotic/ Abiotic Degradation Loss Constant	Reference
542-75-6	1,3-Dichloropropene	3.09E-02	yr	[3]	2.24E+01	1/yr	[1]
542-88-1	Bis(chloromethyl)ether	1.21E-05	yr	[3]	5.73E+04	1/yr	[1]
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	2.00E+01	yr	[1]	3.47E-02	1/yr	[1]
56-23-5	Carbon tetrachloride	9.86E-01	yr	[3]	7.03E-01	1/yr	[1]
56-49-5	3-Methylcholanthrene	3.84E+00	yr	[3]	1.81E-01	1/yr	[1]
56-55-3	Benzo(a)anthracene	1.86E+00	yr	[3]	3.72E-01	1/yr	[1]
57-12-5	Cyanide				0.00E+00	1/yr	[2]
57-24-9	Strychnine	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
57-74-9	Chlordane	3.80E+00	yr	[3]	1.83E-01	1/yr	[1]
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	2.00E+01	yr	[1]	3.47E-02	1/yr	[1]
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	2.00E+01	yr	[1]	3.47E-02	1/yr	[1]
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	2.00E+01	yr	[1]	3.47E-02	1/yr	[1]
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	7.25E+00	yr	[1]	9.56E-02	1/yr	[1]
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	2.00E+01	yr	[1]	3.47E-02	1/yr	[1]
58-89-9	gamma-BHC (Lindane)	6.58E-01	yr	[3]	1.05E+00	1/yr	[1]
58-90-2	2,3,4,6-Tetrachlorophenol	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
581-42-0	2,6-Dimethylnaphthalene						
584-84-9	2,4-Toluene diisocyanate	4.93E-01	yr	[8]	1.41E+00	1/yr	[1]
589-38-8	3-Hexanone						
59-50-7	4-Chloro-3-methylphenol				0.00E+00	1/yr	[2]
59-89-2	N-Nitrosomorpholine	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
591-50-4	Benzene, iodo-						
591-78-6	2-Hexanone						
593-60-2	Bromoethene (Vinyl bromide)	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
593-74-8	Dimethyl Mercury						
60-11-7	Dimethyl aminoazobenzene	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
60-29-7	Ethyl ether						
60-35-5	Acetamide	1.92E-02	yr	[3]	3.61E+01	1/yr	[1]
602-87-9	5-Nitroacenaphthene	2.79E-01	yr	[9]	2.48E+00	1/yr	[1]
606-20-2	2,6-Dinitrotoluene	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]

Table 2-6 Biotic and Abiotic Half-life and Degradation Constant

CAS Registry Number	Constituent Name	Biological Half-life (days) ($t_{½}$)	Units for Biological Half-life	Reference	Loss Constant from Biotic/ Abiotic Degradation (ks_g)	Units for Biotic/ Abiotic Degradation Loss Constant	Reference
608-93-5	Pentachlorobenzene	9.45E-01	yr	[3]	7.33E-01	1/yr	[1]
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	2.00E+01	yr	[1]	3.47E-02	1/yr	[1]
61626-71-9	Dichloropentadiene						
62-50-0	Ethyl methanesulfonate	8.79E-03	yr	[3]	7.89E+01	1/yr	[1]
62-53-3	Aniline				0.00E+00	1/yr	[2]
62-75-9	N-Nitroso-N,N-dimethylamine	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
621-64-7	N-Nitroso-di-n-propylamine	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
624-83-9	Methyl isocyanate	3.72E-05	yr	[3]	1.86E+04	1/yr	[1]
628-73-9	Hexanenitrile						
630-08-0	Carbon monoxide						
630-20-6	1,1,1,2-Tetrachloroethane	1.83E-01	yr	[3]	3.79E+00	1/yr	[1]
64-18-6	Formic acid (methanoic acid)	1.92E-02	yr	[3]	3.61E+01	1/yr	[1]
65-85-0	Benzoic acid	1.92E-02	yr	[4]	3.61E+01	1/yr	[1]
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	7.25E+00	yr	[1]	9.56E-02	1/yr	[1]
67-56-1	Methyl alcohol	1.92E-02	yr	[3]	3.61E+01	1/yr	[1]
67-63-0	2-Propyl alcohol	1.92E-02	yr	[3]	3.61E+01	1/yr	[1]
67-64-1	2-Propanone (Acetone)	1.92E-02	yr	[3]	3.61E+01	1/yr	[1]
67-66-3	Chloroform	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
67-72-1	Hexachloroethane				1.41E+00	1/yr	[2]
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	2.00E+01	yr	[1]	3.47E-02	1/yr	[1]
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)						
70-30-4	Hexachlorophene	8.99E-01	yr	[3]	7.71E-01	1/yr	[1]
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	7.25E+00	yr	[7]	9.56E-02	1/yr	[1]
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	2.00E+01	yr	[1]	3.47E-02	1/yr	[1]
71-36-3	n-Butyl alcohol	1.92E-02	yr	[3]	3.61E+01	1/yr	[1]
71-43-2	Benzene	4.38E-02	yr	[3]	1.58E+01	1/yr	[1]
71-55-6	1,1,1-Trichloroethane	7.48E-01	yr	[3]	9.27E-01	1/yr	[1]
72-43-5	Methoxychlor	1.00E+00	yr	[3]	6.93E-01	1/yr	[1]
72-55-9	4,4-DDE	1.60E+01	yr	[3]	4.34E-02	1/yr	[1]

Table 2-6 Biotic and Abiotic Half-life and Degradation Constant

CAS Registry Number	Constituent Name	Biological Half-life (days) ($t_{½}$)	Units for Biological Half-life	Reference	Loss Constant from Biotic/ Abiotic Degradation (ks_g)	Units for Biotic/ Abiotic Degradation Loss Constant	Reference
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	2.00E+01	yr	[1]	3.47E-02	1/yr	[1]
74-83-9	Bromomethane	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
74-87-3	Chloromethane	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
74-88-4	Iodomethane	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
74-95-3	Methylene bromide	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
74-97-5	Bromochloromethane						
7429-90-5	Aluminum						
7439-89-6	Iron						
7439-92-1	Lead				0.00E+00	1/yr	[2]
7439-93-2	Lithium						
7439-95-4	Magnesium						
7439-96-5	Manganese						
7439-97-6	Mercury				0.00E+00	1/yr	[2]
7439-98-7	Molybdenum						
7440-02-0	Nickel				0.00E+00	1/yr	[2]
7440-16-6	Rhodium						
7440-22-4	Silver				0.00E+00	1/yr	[2]
7440-23-5	Sodium						
7440-24-6	Strontium (total)	7.97E-01	yr		8.69E-01	1/yr	[1]
7440-25-7	Tantalum						
7440-28-0	Thallium				0.00E+00	1/yr	[2]
7440-31-5	Tin						
7440-33-7	Tungsten						
7440-36-0	Antimony				0.00E+00	1/yr	[2]
7440-38-2	Arsenic				0.00E+00	1/yr	[2]
7440-39-3	Barium				0.00E+00	1/yr	[2]
7440-41-7	Beryllium				0.00E+00	1/yr	[2]
7440-43-9	Cadmium				0.00E+00	1/yr	[2]
7440-47-3	Chromium				0.00E+00	1/yr	[2]
7440-48-4	Cobalt						
7440-50-8	Copper						
7440-61-1	Uranium						

Table 2-6 Biotic and Abiotic Half-life and Degradation Constant

CAS Registry Number	Constituent Name	Biological Half-life (days) ($t_{½}$)	Units for Biological Half-life	Reference	Loss Constant from Biotic/ Abiotic Degradation (ks_g)	Units for Biotic/ Abiotic Degradation Loss Constant	Reference
7440-62-2	Vanadium						
7440-65-5	Yttrium						
7440-66-6	Zinc				0.00E+00	1/yr	[2]
7440-67-7	Zirconium						
7446-09-5	Sulfur dioxide						
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	7.25E+00	yr	[1]	9.56E-02	1/yr	[1]
7487-94-7	Mercuric chloride (HgCl2)				0.00E+00	1/yr	[2]
75-00-3	Chloroethane	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
75-01-4	1-Chloroethene	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
75-02-5	Fluoroethene (vinyl fluoride)						
75-05-8	Acetonitrile	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
75-07-0	Acetaldehyde				0.00E+00	1/yr	[2]
75-09-2	Dichloromethane (Methylene Chloride)	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
75-15-0	Carbon disulfide				0.00E+00	1/yr	[2]
75-21-8	Ethylene oxide (Oxirane)	3.25E-02	yr	[3]	2.13E+01	1/yr	[1]
75-25-2	Bromoform	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
75-27-4	Bromodichloromethane				0.00E+00	1/yr	[2]
75-29-6	2-Chloropropane						
75-34-3	1,1-Dichloroethane	4.22E-01	yr	[3]	1.64E+00	1/yr	[1]
75-35-4	1,1-Dichloroethene	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
75-44-5	Phosgene (hydrogen phosphide)	1.14E-04	yr	[3]	6.07E+03	1/yr	[1]
75-45-6	Chlorodifluoromethane				0.00E+00	1/yr	[2]
75-50-3	Trimethylamine						
75-69-4	Trichlorofluoromethane	1.00E+00	yr	[3]	6.93E-01	1/yr	[1]
75-71-8	Dichlorodifluoromethane	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
76-01-7	Pentachloroethane						
76-13-1	1,2,2-Trichlorotrifluoroethane	1.00E+00	yr	[3]	6.93E-01	1/yr	[1]
76-44-8	Heptachlor	1.48E-02	yr	[3]	4.69E+01	1/yr	[1]
764-41-0	1,4-Dichloro-2-butene						
7647-01-0	Hydrogen chloride				0.00E+00	1/yr	[2]

Table 2-6 Biotic and Abiotic Half-life and Degradation Constant

CAS Registry Number	Constituent Name	Biological Half-life (days) ($t_{½}$)	Units for Biological Half-life	Reference	Loss Constant from Biotic/ Abiotic Degradation (ks_g)	Units for Biotic/ Abiotic Degradation Loss Constant	Reference
765-34-4	Glycidylaldehyde	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
7664-39-3	Hydrogen Fluoride						
7664-41-7	Ammonia/Ammonium						
77-47-4	Hexachlorocyclopentadiene	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
77-78-1	Dimethyl sulfate	1.37E-03	yr	[3]	5.06E+02	1/yr	[1]
7704-34-9	Total Sulfur (thermodynamically stable)						
7723-14-0	Phosphorus						
7782-41-4	Fluorine gas F2						
7782-49-2	Selenium				0.00E+00	1/yr	[2]
7782-50-5	Chlorine				0.00E+00	1/yr	[2]
78-83-1	2-Methylpropyl alcohol	1.97E-02	yr	[3]	3.51E+01	1/yr	[1]
78-87-5	1,2-Dichloropropane	3.53E+00	yr	[3]	1.96E-01	1/yr	[1]
78-93-3	2-Butanone	1.92E-02	yr	[3]	3.61E+01	1/yr	[1]
79-00-5	1,1,2-Trichloroethane	1.00E+00	yr	[3]	6.93E-01	1/yr	[1]
79-01-6	1,1,2-Trichloroethylene	1.00E+00	yr	[3]	6.93E-01	1/yr	[1]
79-10-7	2-Propenoic acid	1.92E-02	yr	[3]	3.61E+01	1/yr	[1]
79-34-5	1,1,2,2-Tetrachloroethane	1.23E-01	yr	[3]	5.62E+00	1/yr	[1]
79-46-9	2-Nitropropane	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
80-62-6	Methyl methacrylate	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
82-68-8	Pentachloronitrobenzene (PCNB)	1.92E+00	yr	[3]	3.62E-01	1/yr	[1]
822-06-0	Hexamethylene-1,5-diisocyanate						
823-40-5	Toluene-2,6-diamine						
83-32-9	Acenaphthene	2.79E-01	yr	[3]	2.48E+00	1/yr	[1]
832-69-9	1-Methylphenanthrene						
84-66-2	Diethyl phthalate	1.53E-01	yr	[3]	4.52E+00	1/yr	[1]
84-74-2	Di-n-butylphthalate	6.30E-02	yr	[3]	1.10E+01	1/yr	[1]
85-01-8	Phenanthrene	5.48E-01	yr	[3]	1.26E+00	1/yr	[1]
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	5.14E-05	yr	[3]	1.35E+04	1/yr	[1]
85-68-7	Butylbenzylphthalate	1.92E-02	yr	[3]	3.61E+01	1/yr	[1]
86-73-7	Fluorene	1.64E-01	yr	[3]	4.22E+00	1/yr	[1]

Table 2-6 Biotic and Abiotic Half-life and Degradation Constant

CAS Registry Number	Constituent Name	Biological Half-life (days) ($t_{½}$)	Units for Biological Half-life	Reference	Loss Constant from Biotic/ Abiotic Degradation (ks_g)	Units for Biotic/ Abiotic Degradation Loss Constant	Reference
87-61-6	1,2,3-Trichlorobenzene				0.00E+00	1/yr	[2]
87-68-3	Hexachlorobutadiene	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
87-86-5	Pentachlorophenol	4.88E-01	yr	[3]	1.42E+00	1/yr	[1]
88-06-2	2,4,6-Trichlorophenol	1.92E-01	yr	[3]	3.61E+00	1/yr	[1]
88-74-4	o-Nitroaniline (2-nitroaniline)				0.00E+00	1/yr	[2]
88-75-5	2-Nitrophenol	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
90-04-0	o-Anisidine	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
90-12-0	1-Methylnaphthalene						
91-20-3	Naphthalene	1.32E-01	yr	[3]	5.27E+00	1/yr	[1]
91-22-5	Quinoline	2.74E-02	yr	[3]	2.53E+01	1/yr	[1]
91-57-6	2-Methylnaphthalene	2.44E-02	yr	[2]	2.85E+01	1/yr	[1]
91-58-7	2-Chloronaphthalene				0.00E+00	1/yr	[2]
91-94-1	3,3'-Dichlorobenzidine	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
92-52-4	1,1`-Biphenyl	1.92E-02	yr	[3]	3.61E+01	1/yr	[1]
924-16-3	N-Nitroso-di-n-Buetylamine	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
94-75-7	2,4-D	1.37E-01	yr	[3]	5.06E+00	1/yr	[1]
95-48-7	o-Cresol	1.92E-02	yr	[3]	3.61E+01	1/yr	[1]
95-49-8	o-Chlorotoluene						
95-50-1	1,2-Dichlorobenzene	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
95-53-4	o-Toluidine	1.92E-02	yr	[3]	3.61E+01	1/yr	[1]
95-57-8	2-Chlorophenol				0.00E+00	1/yr	[2]
95-63-6	1,2,4-Trimethyl benzene	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
95-94-3	1,2,4,5-Tetrachlorobenzene	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
95-95-4	2,4,5-Trichlorophenol	1.89E+00	yr	[3]	3.67E-01	1/yr	[1]
96-12-8	1,2-Dibromo-3-chloropropane	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
96-18-4	1,2,3-Trichloropropane	1.00E+00	yr	[3]	6.93E-01	1/yr	[1]
96-45-7	Ethylene thiourea	7.67E-02	yr	[3]	9.04E+00	1/yr	[1]
97-63-2	Ethyl methacrylate				0.00E+00	1/yr	[2]
98-01-1	Furfural						
98-06-6	tert-Butyl benzene	2.74E-02	yr	[2]	2.53E+01	1/yr	[1]

Table 2-6 Biotic and Abiotic Half-life and Degradation Constant

CAS Registry Number	Constituent Name	Biological Half-life (days) ($t_{½}$)	Units for Biological Half-life	Reference	Loss Constant from Biotic/ Abiotic Degradation (ks_g)	Units for Biotic/ Abiotic Degradation Loss Constant	Reference
98-07-7	Benzotrichloride	5.71E-06	yr	[3]	1.21E+05	1/yr	[1]
98-82-8	Cumene				3.16E+01	1/yr	[2]
98-83-9	Methyl styrene (mixed isomers)	8.78E-03	yr	[2]	7.90E+01	1/yr	[1]
98-86-2	Acetophenone				0.00E+00	1/yr	[2]
98-95-3	Nitrobenzene	5.40E-01	yr	[3]	1.28E+00	1/yr	[1]
99-35-4	1,3,5-Trinitrobenzene				0.00E+00	1/yr	[2]
99-65-0	1,3-Dinitrobenzene	4.93E-01	yr	[3]	1.41E+00	1/yr	[1]
99-87-6	p-Cymene	2.88E-02	yr	[2]	2.41E+01	1/yr	[1]

Reference	Reference (source) for Biological Half-life
[1]	64 FR 687. 1999. "40 CFR Part 372: Persistent Bioaccumulative Toxic (PBT) Chemicals; Proposed Rule," Federal Register, Vol 64, No. 2, January 5, 1999.
[2]	EPA. 2012. *Estimation Programs Interface (EPI) Suite*, v 4.11, Copyright © 2000-2012, US Environmental Protection Agency, Office of Polution Prevention Toxics and Syracuse Research Corporation, Washington, DC [Dermwin v. 2.02 estimate] (http://www.epa.gov/oppt/exposure/docs/episuite.htm).
[3]	Howard PH, Boethling RS, Jarvis WF, and Meylan WM. 1991. Handbook of Environmental Degradation Rates. Lewis Publishers, Chelsea, MI.
[4]	Howard PH. 1989–1997. Handbook of Environmental Fate and Exposure Data for Organic Chemicals, Volume I: Large Production and Priority Pollutants. Lewis Publishers, Chelsea, MI
[5]	Howard PH. 1989–1997. Handbook of Environmental Fate and Exposure Data for Organic Chemicals, Volume III: Pesticides. Lewis Publishers, Chelsea, MI
[6]	Howard PH. 1989–1997. Handbook of Environmental Fate and Exposure Data for Organic Chemicals, Volume IV: Solvents 2. Lewis Publishers, Chelsea, MI
[7]	Surrogate value from 2,3',4,4',5-Pentachlorobiphenyl (PCB 118).
[8]	Surrogate value from 2,4-Dinitrotoluene.
[9]	Surrogate value from Acenaphthene.
[10]	Surrogate value from Chrysene.
[11]	Surrogate value from Dibenz[a,h]anthracene.
[12]	Surrogate value from Dibenzo[a,i]pyrene.
[13]	Surrogate value from Trichlorofluoromethane.
[14]	Surrogate value from tert-Butyl benzene.

Reference	Reference (source) for Biotic/Abiotic Degradation Loss Constant
[1]	Calculated value per Eq. A-2-13 in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm).
[2]	EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013).
[3]	Surrogate value from cis-1,2-Dichloroethene.

Table 2-7 provides data for half-life and radiological decay loss constant for radiological constituents. The radiological half-life is used to estimate soil loss due to radiological decay, as represented by the corresponding radiological decay loss constant. The radiological decay loss constant is used to compute soil loss over time and the corresponding soil concentration for each receptor.

Table 2-7 Radiological Half-life and Radiological Degradation Constant

CAS Registry Number	Constituent Name	Radiological Half-life (t_{half})	Units for Radio-logical Half-life	Reference	Soil Loss Constant due to Radiological Decay (k_{decay})	Units for Radiological Decay Loss Constant	Reference
10028-17-8	Tritium	4.53E+03	days	[1]	5.59E-02	1/yr	[1]
10045-97-3	Cesium-137	1.10E+04	days	[1]	2.31E-02	1/yr	[1]
10098-91-6	Yttrium-90	2.67E+00	days	[1]	9.49E+01	1/yr	[1]
10098-97-2	Strontium-90	1.06E+04	days	[1]	2.38E-02	1/yr	[1]
10198-40-0	Cobalt-60	1.92E+03	days	[1]	1.32E-01	1/yr	[1]
13966-29-5	Uranium-234	8.94E+07	days	[1]	2.83E-06	1/yr	[1]
13967-48-1	Ruthenium-106	3.68E+02	days	[1]	6.87E-01	1/yr	[1]
13967-70-9	Cesium-134	7.52E+02	days	[1]	3.36E-01	1/yr	[1]
13968-55-3	Uranium-233	5.80E+07	days	[1]	4.36E-06	1/yr	[1]
13981-15-2	Curium-244	6.61E+03	days	[1]	3.83E-02	1/yr	[1]
13981-16-3	Plutonium-238	3.20E+04	days	[1]	7.90E-03	1/yr	[1]
13981-37-8	Nickel-63	5.35E+01	days	[1]	4.73E+00	1/yr	[1]
13982-10-0	Plutonium-242	1.37E+08	days	[1]	1.84E-06	1/yr	[1]
13982-63-3	Radium-226	5.84E+05	days	[1]	4.33E-04	1/yr	[1]
13982-70-2	Uranium-236	8.54E+09	days	[1]	2.96E-08	1/yr	[1]
13994-20-2	Neptunium-237	7.81E+08	days	[1]	3.24E-07	1/yr	[1]
14119-32-5	Plutonium-241	5.26E+03	days	[1]	4.81E-02	1/yr	[1]
14119-33-6	Plutonium-240	2.39E+06	days	[1]	1.06E-04	1/yr	[1]
14133-76-7	Technetium-99	7.77E+07	days	[1]	3.25E-06	1/yr	[1]
14158-29-3	Uranium-232	2.63E+04	days	[1]	9.63E-03	1/yr	[1]
14234-35-6	Antimony-125	1.01E+03	days	[1]	2.50E-01	1/yr	[1]
14331-85-2	Protactinium-231	1.20E+07	days	[1]	2.11E-05	1/yr	[1]
14336-70-0	Nickel-59	9.64E+02	days	[1]	2.63E-01	1/yr	[1]
14391-16-3	Europium-155	1.81E+03	days	[1]	1.40E-01	1/yr	[1]
14596-10-2	Americium-241	1.58E+05	days	[1]	1.60E-03	1/yr	[1]
14683-23-9	Europium-152	4.85E+03	days	[1]	5.21E-02	1/yr	[1]
14762-75-5	Carbon-14	2.09E+06	days	[1]	1.21E-04	1/yr	[1]
14952-40-0	Actinium-227	7.96E+03	days	[1]	3.18E-02	1/yr	[1]

Table 2-7 Radiological Half-life and Radiological Degradation Constant

CAS Registry Number	Constituent Name	Radiological Half-life (t_{half})	Units for Radio-logical Half-life	Reference	Soil Loss Constant due to Radiological Decay (k_{decay})	Units for Radiological Decay Loss Constant	Reference
14993-75-0	Americium-243	2.69E+06	days	[1]	9.39E-05	1/yr	[1]
15046-84-1	Iodine-129	5.73E+09	days	[1]	4.41E-08	1/yr	[1]
15117-48-3	Plutonium-239	8.80E+06	days	[1]	2.88E-05	1/yr	[1]
15117-96-1	Uranium-235	2.57E+11	days	[1]	9.85E-10	1/yr	[1]
15262-20-1	Radium-228	2.10E+03	days	[1]	1.21E-01	1/yr	[1]
15510-73-3	Curium-242	1.63E+02	days	[1]	1.55E+00	1/yr	[1]
15585-10-1	Europium-154	3.21E+03	days	[1]	7.88E-02	1/yr	[1]
15594-54-4	Thorium-229	2.68E+06	days	[1]	9.44E-05	1/yr	[1]
15715-94-3	Samarium-151	3.29E+04	days	[1]	7.70E-03	1/yr	[1]
15751-77-6	Zirconium-93	5.58E+08	days	[1]	4.53E-07	1/yr	[1]
15757-87-6	Curium-243	1.04E+04	days	[1]	2.43E-02	1/yr	[1]
15758-45-9	Selenium-79	2.37E+07	days	[1]	1.07E-05	1/yr	[1]
15832-50-5	Tin-126	3.65E+07	days	[1]	6.93E-06	1/yr	[1]
378253-40-8	Barium-137m	1.77E-03	days	[1]	1.43E+05	1/yr	[1]
378253-44-2	Cadmium-113m	4.96E+03	days	[1]	5.10E-02	1/yr	[1]
378782-82-2	Niobium-93m	4.96E+03	days	[1]	5.10E-02	1/yr	[1]
7440-29-1	Thorium-232	5.15E+12	days	[1]	4.92E-11	1/yr	[1]
7440-61-1R	Uranium-238	1.63E+12	days	[1]	1.55E-10	1/yr	[1]

Reference	**Reference (source) for Radiological Half-life**
[1]	EPA. 2001. Health Effects Assessment Summary Tables (HEAST) - Radionuclides Table (formerly Table 4), Office of Radiation and Indoor Air, Radiation Protection Division, Washington, D.C. (http://www.epa.gov/radiation/heast/index.html, accessed online May 2014).

Reference	**Reference (source) for Radiological Decay Loss Constant**
[1]	Calculated value per Eq. A-2-13 in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm).

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3 Vegetation Bioaccumulation Factors

Table 3-1 provides data on root concentration factors in units of dry weight (DW) concentration of plant matter per unit of soil water concentration. This constituent parameter is used to compute the belowground transfer of contaminants from soil to a root vegetable. Blank entries in the table indicate where data are not available.

Table 3-1 Root Concentration Factors for Produce

CAS Registry Number	Constituent Name	Root Concentration Factor (*RCF*)	Units for Root Concentration Factor	Reference
100-02-7	p-Nitrophenol	1.32E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
100-21-0	Phthalic acid	8.05E+00	(µg/g DW plant)/(µg/mL soil water)	[2]
100-25-4	1,4-Dinitrobenzene	9.40E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
100-40-3	4-Ethenylcyclohexene	2.47E+02	(µg/g DW plant)/(µg/mL soil water)	[2]
100-41-4	Ethyl benzene	5.66E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
100-42-5	Styrene	4.74E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
100-44-7	Benzyl chloride	1.37E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
100-47-0	Benzonitrile	1.00E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
100-51-6	Benzyl alcohol	7.94E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
100-52-7	Benzaldehyde	9.51E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
10028-15-6	Ozone	6.39E+00	(µg/g DW plant)/(µg/mL soil water)	[3]
10028-17-8	Tritium	6.39E+00	(µg/g DW plant)/(µg/mL soil water)	[3]
10045-97-3	Cesium-137			
10061-01-5	cis-1,3-Dichloropropene	1.31E+01	(µg/g DW plant)/(µg/mL soil water)	[13]
10061-02-6	trans-1,3-Dichloropropene	8.49E+00	(µg/g DW plant)/(µg/mL soil water)	[2]
10098-91-6	Yttrium-90			
10098-97-2	Strontium-90			
101-55-3	4-Bromophenylphenyl ether	2.53E+03	(µg/g DW plant)/(µg/mL soil water)	[5]
101-77-9	4,4-Methylenedianiline	1.02E+01	(µg/g DW plant)/(µg/mL soil water)	[4]
10102-44-0	Nitrogen dioxide	6.39E+00	(µg/g DW plant)/(µg/mL soil water)	[3]
10198-40-0	Cobalt-60			
103-33-3	Azobenzene	2.03E+02	(µg/g DW plant)/(µg/mL soil water)	[2]
103-65-1	n-Propyl benzene (Isocumene)	1.61E+02	(µg/g DW plant)/(µg/mL soil water)	[2]
104-51-8	n-Butylbenzene	5.48E+02	(µg/g DW plant)/(µg/mL soil water)	[2]
104-76-7	2-Ethyl-1-hexanol	2.94E+01	(µg/g DW plant)/(µg/mL soil water)	[2]
105-67-9	2,4-Dimethylphenol	1.37E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
10595-95-6	n-Nitrosomethylethylamine	6.56E+00	(µg/g DW plant)/(µg/mL soil water)	[4]

Table 3-1 Root Concentration Factors for Produce

CAS Registry Number	Constituent Name	Root Concentration Factor (*RCF*)	Units for Root Concentration Factor	Reference
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	8.51E+01	(µg/g DW plant)/(µg/mL soil water)	[2]
106-44-5	p-Cresol (4-methyl phenol)	1.31E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
106-46-7	1,4-Dichlorobenzene	1.15E+02	(µg/g DW plant)/(µg/mL soil water)	[5]
106-47-8	p-Chloroaniline	1.23E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
106-49-0	p-Toluidine	9.04E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
106-51-4	Quinone	6.64E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
106-88-7	1,2-Epoxybutane	7.37E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	6.47E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
106-93-4	Ethylene dibromide	8.05E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
106-99-0	1,3-Butadiene	1.42E+01	(µg/g DW plant)/(µg/mL soil water)	[4]
107-02-8	Acrolein	6.54E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
107-05-1	3-Chloropropene	1.34E+01	(µg/g DW plant)/(µg/mL soil water)	[4]
107-06-2	1,2-Dichloroethane	9.63E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
107-12-0	Propionitrile	6.62E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
107-13-1	Acrylonitrile	6.67E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
107-19-7	Propargyl alcohol	6.43E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
107-21-1	Ethylene glycol (1,2-ethanediol)	6.39E+00	(µg/g DW plant)/(µg/mL soil water)	[3]
107-98-2	Propylene glycol monomethyl ether	6.41E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
108-05-4	Acetic acid vinyl ester	7.16E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
108-10-1	4-Methyl-2-pentanone	8.26E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
108-39-4	m-Cresol	1.38E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
108-60-1	bis (2-Chloroisopropyl)ether	1.89E+01	(µg/g DW plant)/(µg/mL soil water)	[2]
108-67-8	1,3,5-Trimethylbenzene	9.99E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
108-86-1	Bromobenzene (Phenyl bromide)	4.66E+01	(µg/g DW plant)/(µg/mL soil water)	[2]
108-87-2	Methylcyclohexane	1.40E+02	(µg/g DW plant)/(µg/mL soil water)	[2]
108-88-3	Toluene	2.79E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
108-90-7	Chlorobenzene	3.33E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
108-94-1	Cyclohexanone	7.28E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
108-95-2	Phenol	9.63E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
109-74-0	n-Butanenitrile	6.90E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
109-75-1	3-Butenenitrile	6.78E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
109-77-3	Malononitrile	6.39E+00	(µg/g DW plant)/(µg/mL soil water)	[3]
109-86-4	2-Methoxyethanol	6.39E+00	(µg/g DW plant)/(µg/mL soil water)	[3]

Table 3-1 Root Concentration Factors for Produce

CAS Registry Number	Constituent Name	Root Concentration Factor (*RCF*)	Units for Root Concentration Factor	Reference
109-99-9	Tetrahydrofuran	6.83E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
110-00-9	Furan	8.81E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
110-54-3	n-Hexane	2.34E+02	(µg/g DW plant)/(µg/mL soil water)	[2]
110-59-8	Pentanenitrile	8.00E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
110-80-5	2-Ethoxyethanol	6.44E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
110-82-7	Cyclohexane	1.03E+02	(µg/g DW plant)/(µg/mL soil water)	[2]
110-83-8	Cyclohexene	3.70E+01	(µg/g DW plant)/(µg/mL soil water)	[2]
110-86-1	Pyridine	7.04E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
111-15-9	Ethylene glycol monoethyl ether acetate	6.97E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
111-44-4	Bis(2-chloroethyl)ether	8.60E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
111-65-9	n-Octane	2.26E+03	(µg/g DW plant)/(µg/mL soil water)	[2]
111-76-2	2-Butoxyethanol	7.32E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
111-84-2	n-Nonane	5.21E+03	(µg/g DW plant)/(µg/mL soil water)	[2]
111-91-1	Bis(2-chloroethoxy)methane	8.64E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
112-30-1	1-Decanol	7.67E+02	(µg/g DW plant)/(µg/mL soil water)	[2]
112-31-2	Decanal	1.82E+02	(µg/g DW plant)/(µg/mL soil water)	[2]
112-40-3	Dodecane	1.16E+04	(µg/g DW plant)/(µg/mL soil water)	[2]
1120-21-4	Undecane	6.11E+03	(µg/g DW plant)/(µg/mL soil water)	[2]
1120-71-4	1,3-Propane sultone	6.45E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
117-81-7	Bis(2-ethylhexyl) phthalate	1.96E+03	(µg/g DW plant)/(µg/mL soil water)	[5]
117-84-0	Di-n-octylphthalate	4.01E+05	(µg/g DW plant)/(µg/mL soil water)	[5]
118-74-1	Hexachlorobenzene	2.80E+03	(µg/g DW plant)/(µg/mL soil water)	[5]
119-90-4	3,3'-Dimethoxybenzidine	1.21E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
120-12-7	Anthracene	6.78E+02	(µg/g DW plant)/(µg/mL soil water)	[5]
120-82-1	1,2,4-Trichlorobenzene	2.79E+02	(µg/g DW plant)/(µg/mL soil water)	[5]
120-83-2	2,4-Dichlorophenol	3.97E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
121-14-2	2,4-Dinitrotoluene	1.41E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
122-39-4	N,N-Diphenylamine	1.15E+02	(µg/g DW plant)/(µg/mL soil water)	[2]
122-66-7	1,2-Diphenylhydrazine	3.97E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
123-33-1	Maleic hydrazide	6.39E+00	(µg/g DW plant)/(µg/mL soil water)	[3]
123-38-6	Propionaldehyde	6.97E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
123-72-8	Butanal	7.41E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
123-91-1	1,4-Dioxan	6.45E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
124-18-5	Decane	1.67E+03	(µg/g DW plant)/(µg/mL soil water)	[2]

Table 3-1 Root Concentration Factors for Produce

CAS Registry Number	Constituent Name	Root Concentration Factor (*RCF*)	Units for Root Concentration Factor	Reference
124-38-9	Carbon dioxide	7.32E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
124-48-1	Chlorodibromomethane	1.21E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
126-73-8	Tributyl phosphate	2.79E+02	(µg/g DW plant)/(µg/mL soil water)	[2]
126-98-7	2-Methyl-2-propenenitrile	6.91E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
127-18-4	1,1,2,2-Tetrachloroethene	9.64E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	1.96E+03	(µg/g DW plant)/(µg/mL soil water)	[2]
129-00-0	Pyrene	1.38E+03	(µg/g DW plant)/(µg/mL soil water)	[5]
131-11-3	Dimethyl Phthalate	1.00E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	3.46E+02	(µg/g DW plant)/(µg/mL soil water)	[2]
132-64-9	Dibenzofuran	3.46E+02	(µg/g DW plant)/(µg/mL soil water)	[2]
133-06-2	Captan	3.33E+01	(µg/g DW plant)/(µg/mL soil water)	[2]
1330-20-7	Xylenes (mixed isomers)	6.30E+01	(µg/g DW plant)/(µg/mL soil water)	[2]
1336-36-3	Polychlorinated biphenyls	1.62E+04	(µg/g DW plant)/(µg/mL soil water)	[2]
134-32-7	alpha-Naphthylamine	1.25E+01	(µg/g DW plant)/(µg/mL soil water)	[2]
135-98-8	sec-Butylbenzene	7.67E+02	(µg/g DW plant)/(µg/mL soil water)	[2]
13966-29-5	Uranium-234			
13967-48-1	Ruthenium-106			
13967-70-9	Cesium-134			
13968-55-3	Uranium-233			
13981-15-2	Curium-244			
13981-16-3	Plutonium-238			
13981-37-8	Nickel-63			
13982-10-0	Plutonium-242			
13982-63-3	Radium-226			
13982-70-2	Uranium-236			
13994-20-2	Neptunium-237			
141-78-6	Acetic acid ethyl ester	7.16E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
14119-32-5	Plutonium-241			
14119-33-6	Plutonium-240			
14133-76-7	Technetium-99			
14158-29-3	Uranium-232			
14234-35-6	Antimony-125			
14265-44-2	Phosphate			
14331-85-2	Protactinium-231			

Table 3-1 Root Concentration Factors for Produce

CAS Registry Number	Constituent Name	Root Concentration Factor (*RCF*)	Units for Root Concentration Factor	Reference
14336-70-0	Nickel-59			
14391-16-3	Europium-155			
145-73-3	Endothall	1.32E+01	(µg/g DW plant)/(µg/mL soil water)	[4]
14596-10-2	Americium-241			
14683-23-9	Europium-152			
14762-75-5	Carbon-14			
14797-55-8	Nitrate	6.64E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
14797-65-0	Nitrite			
14808-79-8	Sulfate			
14952-40-0	Actinium-227			
14993-75-0	Americium-243			
15046-84-1	Iodine-129			
15117-48-3	Plutonium-239			
15117-96-1	Uranium-235			
15262-20-1	Radium-228			
15510-73-3	Curium-242			
15585-10-1	Europium-154			
15594-54-4	Thorium-229			
156-59-2	cis-1,2-Dichloroethene	1.31E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
156-60-5	1,2-trans-Dichloroethene	9.62E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
15715-94-3	Samarium-151			
15751-77-6	Zirconium-93			
15757-87-6	Curium-243			
15758-45-9	Selenium-79			
15832-50-5	Tin-126			
1634-04-4	Methyl tert-butyl ether	7.54E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
16887-00-6	Chloride	6.91E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
16984-48-8	Fluoride			
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	4.00E+04	(µg/g DW plant)/(µg/mL soil water)	[5]
18540-29-9	Chromium(VI)	6.54E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
189-55-9	Dibenzo[a,i]pyrene	9.68E+03	(µg/g DW plant)/(µg/mL soil water)	[9]
189-64-0	Dibenzo[a,h]pyrene	9.37E+04	(µg/g DW plant)/(µg/mL soil water)	[2]
191-24-2	Benzo(g,h,i)perylene	2.96E+04	(µg/g DW plant)/(µg/mL soil water)	[2]

Table 3-1 Root Concentration Factors for Produce

CAS Registry Number	Constituent Name	Root Concentration Factor (*RCF*)	Units for Root Concentration Factor	Reference
191-30-0	Dibenzo(a,l)pyrene	2.01E+05	(µg/g DW plant)/(µg/mL soil water)	[2]
192-65-4	Dibenzo[a,e]pyrene	9.37E+04	(µg/g DW plant)/(µg/mL soil water)	[2]
192-97-2	Benzo(e)pyrene	2.11E+04	(µg/g DW plant)/(µg/mL soil water)	[2]
193-39-5	Indeno(1,2,3-cd)pyrene	2.81E+04	(µg/g DW plant)/(µg/mL soil water)	[5]
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	9.71E+04	(µg/g DW plant)/(µg/mL soil water)	[5]
205-82-3	Benzo[j]fluoranthene	1.18E+04	(µg/g DW plant)/(µg/mL soil water)	[2]
205-99-2	Benzo(b)fluoranthene	1.21E+04	(µg/g DW plant)/(µg/mL soil water)	[5]
206-44-0	Fluoranthene	1.64E+03	(µg/g DW plant)/(µg/mL soil water)	[5]
207-08-9	Benzo(k)fluoranthene	1.16E+04	(µg/g DW plant)/(µg/mL soil water)	[5]
208-96-8	Acenaphthylene	2.51E+02	(µg/g DW plant)/(µg/mL soil water)	[2]
218-01-9	Chrysene	5.69E+03	(µg/g DW plant)/(µg/mL soil water)	[5]
224-42-0	Dibenz[a,j]acridine	2.35E+04	(µg/g DW plant)/(µg/mL soil water)	[11]
2245-38-7	2,3,5-Trimethylnaphthalene	1.17E+03	(µg/g DW plant)/(µg/mL soil water)	[2]
226-36-8	Dibenz[a,h]acridine	2.35E+04	(µg/g DW plant)/(µg/mL soil water)	[11]
22967-92-6	Methyl mercury			
23950-58-5	Pronamide	1.02E+02	(µg/g DW plant)/(µg/mL soil water)	[5]
24959-67-9	Bromide	7.02E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
27154-33-2	Trichlorofluoroethane	1.95E+01	(µg/g DW plant)/(µg/mL soil water)	[12]
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	7.05E+04	(µg/g DW plant)/(µg/mL soil water)	[2]
319-84-6	alpha-BHC	1.96E+02	(µg/g DW plant)/(µg/mL soil water)	[5]
319-85-7	beta-BHC	1.96E+02	(µg/g DW plant)/(µg/mL soil water)	[5]
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	2.96E+04	(µg/g DW plant)/(µg/mL soil water)	[2]
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	3.93E+04	(µg/g DW plant)/(µg/mL soil water)	[2]
3268-87-9	Octachlorodibenzo(p)dioxin	4.79E+05	(µg/g DW plant)/(µg/mL soil water)	[5]
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	1.18E+05	(µg/g DW plant)/(µg/mL soil water)	[2]
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	3.36E+05	(µg/g DW plant)/(µg/mL soil water)	[5]
3697-24-3	5-Methylchrysene	5.69E+03	(µg/g DW plant)/(µg/mL soil water)	[10]
378253-40-8	Barium-137m			
378253-44-2	Cadmium-113m			
378782-82-2	Niobium-93m			
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	1.65E+05	(µg/g DW plant)/(µg/mL soil water)	[2]
39001-02-0	Octachlorodibenzofuran	4.79E+05	(µg/g DW plant)/(µg/mL soil water)	[5]

Table 3-1 Root Concentration Factors for Produce

CAS Registry Number	Constituent Name	Root Concentration Factor (*RCF*)	Units for Root Concentration Factor	Reference
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	2.36E+05	(µg/g DW plant)/(µg/mL soil water)	[5]
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	4.79E+05	(µg/g DW plant)/(µg/mL soil water)	[1]
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	3.01E+04	(µg/g DW plant)/(µg/mL soil water)	[5]
4170-30-3	Crotonaldehyde (Propylene aldehyde)	6.98E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
41851-50-7	Chlorocyclopentadiene	1.73E+01	(µg/g DW plant)/(µg/mL soil water)	[2]
460-19-5	Cyanogen (oxalonitrile)	6.57E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
4786-20-3	2-Butenenitrile	7.01E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
50-00-0	Formaldehyde	6.74E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
50-32-8	Benzo(a)pyrene	9.68E+03	(µg/g DW plant)/(µg/mL soil water)	[5]
506-68-3	Cyanogen bromide (bromocyanide)	6.45E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
506-77-4	Cyanogen chloride	6.43E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
51-28-5	2,4-Dinitrophenol	9.87E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
51-79-6	Ethyl carbamate (urethane)	6.49E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
510-15-6	Chlorobenzilate	5.29E+02	(µg/g DW plant)/(µg/mL soil water)	[5]
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	1.16E+04	(µg/g DW plant)/(µg/mL soil water)	[5]
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	1.38E+05	(µg/g DW plant)/(µg/mL soil water)	[2]
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	1.10E+01	(µg/g DW plant)/(µg/mL soil water)	[4]
53-70-3	Dibenz[a,h]anthracene	2.35E+04	(µg/g DW plant)/(µg/mL soil water)	[5]
532-27-4	2-Chloroacetophenone	1.34E+01	(µg/g DW plant)/(µg/mL soil water)	[4]
534-52-1	4,6-Dinitro-o-cresol	1.01E+01	(µg/g DW plant)/(µg/mL soil water)	[2]
5385-75-1	Dibenzo(a,e)fluoranthene	9.37E+04	(µg/g DW plant)/(µg/mL soil water)	[2]
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	8.05E+00	(µg/g DW plant)/(µg/mL soil water)	[2]
540-73-8	1,2-Dimethylhydrazine	6.40E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
540-84-1	2,2,4-Trimethylpentane	3.28E+02	(µg/g DW plant)/(µg/mL soil water)	[2]
541-73-1	1,3-Dichlorobenzene	1.37E+02	(µg/g DW plant)/(µg/mL soil water)	[5]
542-75-6	1,3-Dichloropropene	1.03E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
542-88-1	Bis(chloromethyl)ether	6.95E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	1.16E+05	(µg/g DW plant)/(µg/mL soil water)	[5]
56-23-5	Carbon tetrachloride	3.33E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
56-49-5	3-Methylcholanthrene	2.04E+04	(µg/g DW plant)/(µg/mL soil water)	[2]
56-55-3	Benzo(a)anthracene	5.69E+03	(µg/g DW plant)/(µg/mL soil water)	[5]
57-12-5	Cyanide	6.39E+00	(µg/g DW plant)/(µg/mL soil water)	[5]

Table 3-1 Root Concentration Factors for Produce

CAS Registry Number	Constituent Name	Root Concentration Factor (*RCF*)	Units for Root Concentration Factor	Reference
57-24-9	Strychnine	1.34E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
57-74-9	Chlordane	3.99E+03	(µg/g DW plant)/(µg/mL soil water)	[5]
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	2.35E+04	(µg/g DW plant)/(µg/mL soil water)	[5]
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	3.93E+04	(µg/g DW plant)/(µg/mL soil water)	[5]
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	5.70E+04	(µg/g DW plant)/(µg/mL soil water)	[5]
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	7.05E+04	(µg/g DW plant)/(µg/mL soil water)	[2]
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	9.71E+04	(µg/g DW plant)/(µg/mL soil water)	[5]
58-89-9	gamma-BHC (Lindane)	3.58E+02	(µg/g DW plant)/(µg/mL soil water)	[2]
58-90-2	2,3,4,6-Tetrachlorophenol	6.20E+02	(µg/g DW plant)/(µg/mL soil water)	[5]
581-42-0	2,6-Dimethylnaphthalene	4.84E+02	(µg/g DW plant)/(µg/mL soil water)	[2]
584-84-9	2,4-Toluene diisocyanate	1.41E+01	(µg/g DW plant)/(µg/mL soil water)	[6]
589-38-8	3-Hexanone	8.40E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
59-50-7	4-Chloro-3-methylphenol	5.66E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
59-89-2	N-Nitrosomorpholine	6.41E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
591-50-4	Benzene, iodo-	7.39E+01	(µg/g DW plant)/(µg/mL soil water)	[2]
591-78-6	2-Hexanone	8.99E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
593-60-2	Bromoethene (Vinyl bromide)	1.01E+01	(µg/g DW plant)/(µg/mL soil water)	[4]
593-74-8	Dimethyl Mercury	2.29E+01	(µg/g DW plant)/(µg/mL soil water)	[2]
60-11-7	Dimethyl aminoazobenzene	7.81E+02	(µg/g DW plant)/(µg/mL soil water)	[2]
60-29-7	Ethyl ether	7.43E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
60-35-5	Acetamide	6.39E+00	(µg/g DW plant)/(µg/mL soil water)	[3]
602-87-9	5-Nitroacenaphthene	2.34E+02	(µg/g DW plant)/(µg/mL soil water)	[7]
606-20-2	2,6-Dinitrotoluene	1.12E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
608-93-5	Pentachlorobenzene	2.22E+03	(µg/g DW plant)/(µg/mL soil water)	[5]
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	5.70E+04	(µg/g DW plant)/(µg/mL soil water)	[5]
61626-71-9	Dichloropentadiene	1.73E+01	(µg/g DW plant)/(µg/mL soil water)	[2]
62-50-0	Ethyl methanesulfonate	6.56E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
62-53-3	Aniline	7.45E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
62-75-9	N-Nitroso-N,N-dimethylamine	6.39E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
621-64-7	N-Nitroso-di-n-propylamine	8.90E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
624-83-9	Methyl isocyanate	6.67E+00	(µg/g DW plant)/(µg/mL soil water)	[8]
628-73-9	Hexanenitrile	1.07E+01	(µg/g DW plant)/(µg/mL soil water)	[4]
630-08-0	Carbon monoxide	1.18E+01	(µg/g DW plant)/(µg/mL soil water)	[4]
630-20-6	1,1,1,2-Tetrachloroethane	5.00E+01	(µg/g DW plant)/(µg/mL soil water)	[5]

Table 3-1 Root Concentration Factors for Produce

CAS Registry Number	Constituent Name	Root Concentration Factor (*RCF*)	Units for Root Concentration Factor	Reference
64-18-6	Formic acid (methanoic acid)	6.40E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
65-85-0	Benzoic acid	1.27E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	7.05E+04	(µg/g DW plant)/(µg/mL soil water)	[2]
67-56-1	Methyl alcohol	6.39E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
67-63-0	2-Propyl alcohol	6.56E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
67-64-1	2-Propanone (Acetone)	6.46E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
67-66-3	Chloroform	8.05E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
67-72-1	Hexachloroethane	2.47E+02	(µg/g DW plant)/(µg/mL soil water)	[5]
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	1.16E+05	(µg/g DW plant)/(µg/mL soil water)	[5]
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	1.65E+05	(µg/g DW plant)/(µg/mL soil water)	[2]
70-30-4	Hexachlorophene	1.49E+05	(µg/g DW plant)/(µg/mL soil water)	[5]
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	7.05E+04	(µg/g DW plant)/(µg/mL soil water)	[2]
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	5.70E+04	(µg/g DW plant)/(µg/mL soil water)	[5]
71-36-3	n-Butyl alcohol	7.41E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
71-43-2	Benzene	9.62E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
71-55-6	1,1,1-Trichloroethane	1.95E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
72-43-5	Methoxychlor	1.15E+03	(µg/g DW plant)/(µg/mL soil water)	[5]
72-55-9	4,4-DDE	5.69E+03	(µg/g DW plant)/(µg/mL soil water)	[5]
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	5.70E+04	(µg/g DW plant)/(µg/mL soil water)	[5]
74-83-9	Bromomethane	8.22E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
74-87-3	Chloromethane	7.47E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
74-88-4	Iodomethane	9.69E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
74-95-3	Methylene bromide	9.80E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
74-97-5	Bromochloromethane	9.14E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
7429-90-5	Aluminum			
7439-89-6	Iron			
7439-92-1	Lead	7.16E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
7439-93-2	Lithium			
7439-95-4	Magnesium			
7439-96-5	Manganese			
7439-97-6	Mercury	7.01E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
7439-98-7	Molybdenum			
7440-02-0	Nickel	6.39E+00	(µg/g DW plant)/(µg/mL soil water)	[3]

Table 3-1 Root Concentration Factors for Produce

CAS Registry Number	Constituent Name	Root Concentration Factor (*RCF*)	Units for Root Concentration Factor	Reference
7440-16-6	Rhodium			
7440-22-4	Silver	6.66E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
7440-23-5	Sodium			
7440-24-6	Strontium (total)	6.66E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
7440-25-7	Tantalum			
7440-28-0	Thallium	6.66E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
7440-29-1	Thorium-232			
7440-31-5	Tin			
7440-33-7	Tungsten			
7440-36-0	Antimony	7.16E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
7440-38-2	Arsenic	7.08E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
7440-39-3	Barium	6.66E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
7440-41-7	Beryllium	6.39E+00	(µg/g DW plant)/(µg/mL soil water)	[3]
7440-43-9	Cadmium	6.51E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
7440-47-3	Chromium	6.66E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
7440-48-4	Cobalt			
7440-50-8	Copper			
7440-61-1	Uranium			
7440-61-1R	Uranium-238			
7440-62-2	Vanadium			
7440-65-5	Yttrium			
7440-66-6	Zinc	6.41E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
7440-67-7	Zirconium			
7446-09-5	Sulfur dioxide	6.39E+00	(µg/g DW plant)/(µg/mL soil water)	[3]
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	5.50E+04	(µg/g DW plant)/(µg/mL soil water)	[2]
7487-94-7	Mercuric chloride (HgCl2)	6.47E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
75-00-3	Chloroethane	9.09E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
75-01-4	1-Chloroethene	9.09E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
75-02-5	Fluoroethene (vinyl fluoride)	8.22E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
75-05-8	Acetonitrile	6.43E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
75-07-0	Acetaldehyde	6.46E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
75-09-2	Dichloromethane (Methylene Chloride)	8.64E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
75-15-0	Carbon disulfide	1.15E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
75-21-8	Ethylene oxide (Oxirane)	6.44E+00	(µg/g DW plant)/(µg/mL soil water)	[5]

Table 3-1 Root Concentration Factors for Produce

CAS Registry Number	Constituent Name	Root Concentration Factor (*RCF*)	Units for Root Concentration Factor	Reference
75-25-2	Bromoform	1.55E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
75-27-4	Bromodichloromethane	9.62E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
75-29-6	2-Chloropropane	1.31E+01	(µg/g DW plant)/(µg/mL soil water)	[4]
75-34-3	1,1-Dichloroethane	1.20E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
75-35-4	1,1-Dichloroethene	9.62E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
75-44-5	Phosgene (hydrogen phosphide)	1.31E+01	(µg/g DW plant)/(µg/mL soil water)	[13]
75-45-6	Chlorodifluoromethane	7.88E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
75-50-3	Trimethylamine	6.62E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
75-69-4	Trichlorofluoromethane	1.95E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
75-71-8	Dichlorodifluoromethane	1.07E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
76-01-7	Pentachloroethane	7.01E+01	(µg/g DW plant)/(µg/mL soil water)	[2]
76-13-1	1,2,2-Trichlorotrifluoroethane	6.30E+01	(µg/g DW plant)/(µg/mL soil water)	[2]
76-44-8	Heptachlor	4.75E+02	(µg/g DW plant)/(µg/mL soil water)	[5]
764-41-0	1,4-Dichloro-2-butene	2.33E+01	(µg/g DW plant)/(µg/mL soil water)	[2]
7647-01-0	Hydrogen chloride			
765-34-4	Glycidylaldehyde	6.50E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
7664-39-3	Hydrogen Fluoride	6.66E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
7664-41-7	Ammonia/Ammonium	6.66E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
77-47-4	Hexachlorocyclopentadiene	1.77E+03	(µg/g DW plant)/(µg/mL soil water)	[5]
77-78-1	Dimethyl sulfate	8.12E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
7704-34-9	Total Sulfur (thermodynamically stable)	6.39E+00	(µg/g DW plant)/(µg/mL soil water)	[3]
7723-14-0	Phosphorus	6.45E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
7782-41-4	Fluorine gas F2	6.65E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
7782-49-2	Selenium	6.66E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
7782-50-5	Chlorine	7.36E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
78-83-1	2-Methylpropyl alcohol	7.20E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
78-87-5	1,2-Dichloropropane	8.05E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
78-93-3	2-Butanone	6.70E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
79-00-5	1,1,2-Trichloroethane	8.05E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
79-01-6	1,1,2-Trichloroethylene	1.64E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
79-10-7	2-Propenoic acid	6.74E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
79-34-5	1,1,2,2-Tetrachloroethane	1.64E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
79-46-9	2-Nitropropane	7.52E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
80-62-6	Methyl methacrylate	8.99E+00	(µg/g DW plant)/(µg/mL soil water)	[4]

Table 3-1 Root Concentration Factors for Produce

CAS Registry Number	Constituent Name	Root Concentration Factor (*RCF*)	Units for Root Concentration Factor	Reference
82-68-8	Pentachloronitrobenzene (PCNB)	8.69E+02	(µg/g DW plant)/(µg/mL soil water)	[5]
822-06-0	Hexamethylene-1,5-diisocyanate	6.76E+01	(µg/g DW plant)/(µg/mL soil water)	[2]
823-40-5	Toluene-2,6-diamine	6.62E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
83-32-9	Acenaphthene	2.34E+02	(µg/g DW plant)/(µg/mL soil water)	[5]
832-69-9	1-Methylphenanthrene	1.90E+03	(µg/g DW plant)/(µg/mL soil water)	[2]
84-66-2	Diethyl phthalate	1.95E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
84-74-2	Di-n-butylphthalate	9.66E+02	(µg/g DW plant)/(µg/mL soil water)	[5]
85-01-8	Phenanthrene	6.78E+02	(µg/g DW plant)/(µg/mL soil water)	[5]
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	6.39E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
85-68-7	Butylbenzylphthalate	1.38E+03	(µg/g DW plant)/(µg/mL soil water)	[5]
86-73-7	Fluorene	3.98E+02	(µg/g DW plant)/(µg/mL soil water)	[5]
87-61-6	1,2,3-Trichlorobenzene	3.05E+02	(µg/g DW plant)/(µg/mL soil water)	[5]
87-68-3	Hexachlorobutadiene	1.15E+03	(µg/g DW plant)/(µg/mL soil water)	[5]
87-86-5	Pentachlorophenol	1.96E+03	(µg/g DW plant)/(µg/mL soil water)	[5]
88-06-2	2,4,6-Trichlorophenol	1.64E+02	(µg/g DW plant)/(µg/mL soil water)	[5]
88-74-4	o-Nitroaniline (2-nitroaniline)	1.25E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
88-75-5	2-Nitrophenol	1.19E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
90-04-0	o-Anisidine	8.19E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
90-12-0	1-Methylnaphthalene	2.22E+02	(µg/g DW plant)/(µg/mL soil water)	[2]
91-20-3	Naphthalene	8.07E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
91-22-5	Quinoline	8.49E+00	(µg/g DW plant)/(µg/mL soil water)	[2]
91-57-6	2-Methylnaphthalene	2.18E+02	(µg/g DW plant)/(µg/mL soil water)	[2]
91-58-7	2-Chloronaphthalene	9.30E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
91-94-1	3,3'-Dichlorobenzidine	1.17E+02	(µg/g DW plant)/(µg/mL soil water)	[5]
92-52-4	1,1`-Biphenyl	2.84E+02	(µg/g DW plant)/(µg/mL soil water)	[2]
924-16-3	N-Nitroso-di-n-Buetylamine	1.33E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	2.60E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
94-75-7	2,4-D	3.39E+01	(µg/g DW plant)/(µg/mL soil water)	[2]
95-48-7	o-Cresol	1.37E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
95-49-8	o-Chlorotoluene	9.99E+01	(µg/g DW plant)/(µg/mL soil water)	[2]
95-50-1	1,2-Dichlorobenzene	9.30E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
95-53-4	o-Toluidine	8.72E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
95-57-8	2-Chlorophenol	1.05E+01	(µg/g DW plant)/(µg/mL soil water)	[5]

Table 3-1 Root Concentration Factors for Produce

CAS Registry Number	Constituent Name	Root Concentration Factor (*RCF*)	Units for Root Concentration Factor	Reference
95-63-6	1,2,4-Trimethyl benzene	1.45E+02	(µg/g DW plant)/(µg/mL soil water)	[2]
95-94-3	1,2,4,5-Tetrachlorobenzene	1.15E+03	(µg/g DW plant)/(µg/mL soil water)	[5]
95-95-4	2,4,5-Trichlorophenol	1.70E+02	(µg/g DW plant)/(µg/mL soil water)	[5]
96-12-8	1,2-Dibromo-3-chloropropane	1.37E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
96-18-4	1,2,3-Trichloropropane	8.05E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
96-45-7	Ethylene thiourea	6.39E+00	(µg/g DW plant)/(µg/mL soil water)	[3]
97-63-2	Ethyl methacrylate	1.35E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
98-01-1	Furfural	6.79E+00	(µg/g DW plant)/(µg/mL soil water)	[4]
98-06-6	tert-Butyl benzene	3.39E+02	(µg/g DW plant)/(µg/mL soil water)	[2]
98-07-7	Benzotrichloride	2.34E+02	(µg/g DW plant)/(µg/mL soil water)	[2]
98-82-8	Cumene	1.64E+02	(µg/g DW plant)/(µg/mL soil water)	[5]
98-83-9	Methyl styrene (mixed isomers)	1.11E+02	(µg/g DW plant)/(µg/mL soil water)	[2]
98-86-2	Acetophenone	1.01E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
98-95-3	Nitrobenzene	1.25E+01	(µg/g DW plant)/(µg/mL soil water)	[5]
99-35-4	1,3,5-Trinitrobenzene	8.26E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
99-65-0	1,3-Dinitrobenzene	9.63E+00	(µg/g DW plant)/(µg/mL soil water)	[5]
99-87-6	p-Cymene	3.33E+02	(µg/g DW plant)/(µg/mL soil water)	[2]

Reference	**Reference (source) for Root Concentration Factor**
[1]	Calculated value per Eq. A-2-14 (using log(K_{ow})=8.2) in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm)
[2]	Calculated value per Eq. A-2-14 in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm)
[3]	Calculated value per Eq. A-2-15 (using log(K_{ow})=-0.57) in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm)
[4]	Calculated value per Eq. A-2-15 in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm)
[5]	EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013)
[6]	Surrogate value from 2,4-Dinitrotoluene
[7]	Surrogate value from Acenaphthene
[8]	Surrogate value from Acrylonitrile

Reference	Reference (source) for Root Concentration Factor
[9]	Surrogate value from Benzo(a)pyrene
[10]	Surrogate value from Chrysene
[11]	Surrogate value from Dibenz[a,h]anthracene
[12]	Surrogate value from Trichlorofluoromethane
[13]	Surrogate value from cis-1,2-Dichloroethene

Table 3-2 provides data on plant-soil concentration factors units of dry weight (DW) concentration of plant matter per unit of soil concentration. This constituent parameter accounts for uptake from soil to the belowground root vegetables or produce. The data in the third column show values that were found in studies and published reports. The subsequent $Br_{rootveg}$ values shown in the 7th and 8th columns are values used in the environmental risk assessment for domestic and wild produce, respectively. The data are presented this way to distinguish mass-limited uptake values used in risk assessment from those values found in the literature (refer to the RAWP, Section 6.6.3.3). Blank entries in the table indicate where data are not available.

Table 3-2 Plant-Soil Bioconcentration Factors in Root Vegetables

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Belowground Produce from Literature, Database, or Study	Units For Plant-Soil Bioconcentration Factor for Belowground Produce	Reference	Plant-Soil Bioconcentration Factor for Belowground Domestic Produce ($Br_{rootveg}$)	Reference	Plant-Soil Bioconcentration Factor for Belowground Wild Produce ($Br_{rootveg}$)	Reference	Units for Plant-Soil Bioconcentration Factor for Belowground Domestic and Wild Produce
100-02-7	p-Nitrophenol	1.75E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
100-21-0	Phthalic acid	2.29E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
100-25-4	1,4-Dinitrobenzene	6.01E+00	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
100-40-3	4-Ethenylcyclohexene	3.58E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
100-41-4	Ethyl benzene	7.76E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
100-42-5	Styrene	3.95E-01	(µg/g DW plant)/ (µg/g soil)	[3]	3.95E-01	[3]	3.95E-01	[3]	(µg/g DW plant)/ (µg/g soil)
100-44-7	Benzyl chloride	7.51E+00	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
100-47-0	Benzonitrile	2.93E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
100-51-6	Benzyl alcohol	6.58E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
100-52-7	Benzaldehyde	3.34E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
10028-15-6	Ozone								
10028-17-8	Tritium								
10045-97-3	Cesium-137	1.30E-01	(µg/g DW plant)/ (µg/g soil)	[4]	1.30E-01	[5]	1.30E-01	[5]	(µg/g DW plant)/ (µg/g soil)

Table 3-2 Plant-Soil Bioconcentration Factors in Root Vegetables

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Belowground Produce from Literature, Database, or Study	Units For Plant-Soil Bioconcentration Factor for Belowground Produce	Reference	Plant-Soil Bioconcentration Factor for Belowground Domestic Produce ($Br_{rootveg}$)	Reference	Plant-Soil Bioconcentration Factor for Belowground Wild Produce ($Br_{rootveg}$)	Reference	Units for Plant-Soil Bioconcentration Factor for Belowground Domestic and Wild Produce
10061-01-5	cis-1,3-Dichloropropene	1.84E+02	(µg/g DW plant)/(µg/g soil)	[12]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
10061-02-6	trans-1,3-Dichloropropene	2.90E+01	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
10098-91-6	Yttrium-90	1.00E-02	(µg/g DW plant)/(µg/g soil)	[4]	1.00E-02	[5]	1.00E-02	[5]	(µg/g DW plant)/(µg/g soil)
10098-97-2	Strontium-90	5.00E-01	(µg/g DW plant)/(µg/g soil)	[4]	5.00E-01	[5]	5.00E-01	[5]	(µg/g DW plant)/(µg/g soil)
101-55-3	4-Bromophenylphenyl ether	1.77E+00	(µg/g DW plant)/(µg/g soil)	[3]	1.77E+00	[3]	1.77E+00	[3]	(µg/g DW plant)/(µg/g soil)
101-77-9	4,4-Methylenedianiline	1.08E+00	(µg/g DW plant)/(µg/g soil)	[2]	1.08E+00	[2]	1.08E+00	[2]	(µg/g DW plant)/(µg/g soil)
10102-44-0	Nitrogen dioxide								
10198-40-0	Cobalt-60	6.70E-02	(µg/g DW plant)/(µg/g soil)	[4]	6.70E-02	[5]	6.70E-02	[5]	(µg/g DW plant)/(µg/g soil)
103-33-3	Azobenzene	2.29E+01	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
103-65-1	n-Propyl benzene (Isocumene)	4.90E+01	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
104-51-8	n-Butylbenzene	3.50E+01	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
104-76-7	2-Ethyl-1-hexanol	1.37E+01	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
105-67-9	2,4-Dimethylphenol	4.28E-01	(µg/g DW plant)/(µg/g soil)	[3]	4.28E-01	[3]	4.28E-01	[3]	(µg/g DW plant)/(µg/g soil)
10595-95-6	n-Nitrosomethylethylamine	3.39E+01	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	5.11E+01	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)

Table 3-2 Plant-Soil Bioconcentration Factors in Root Vegetables

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Belowground Produce from Literature, Database, or Study	Units For Plant-Soil Bioconcentration Factor for Belowground Produce	Reference	Plant-Soil Bioconcentration Factor for Belowground Domestic Produce ($Br_{rootveg}$)	Reference	Plant-Soil Bioconcentration Factor for Belowground Wild Produce ($Br_{rootveg}$)	Reference	Units for Plant-Soil Bioconcentration Factor for Belowground Domestic and Wild Produce
106-44-5	p-Cresol (4-methyl phenol)	1.09E+00	(µg/g DW plant)/ (µg/g soil)	[3]	1.09E+00	[3]	1.09E+00	[3]	(µg/g DW plant)/ (µg/g soil)
106-46-7	1,4-Dichlorobenzene	9.59E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
106-47-8	p-Chloroaniline	1.95E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
106-49-0	p-Toluidine	2.56E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
106-51-4	Quinone	9.50E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
106-88-7	1,2-Epoxybutane	1.68E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	1.04E+03	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
106-93-4	Ethylene dibromide	9.48E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
106-99-0	1,3-Butadiene	8.09E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
107-02-8	Acrolein	4.36E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
107-05-1	3-Chloropropene	7.63E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
107-06-2	1,2-Dichloroethane	2.75E+02	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
107-12-0	Propionitrile	1.75E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
107-13-1	Acrylonitrile	3.79E+02	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
107-19-7	Propargyl alcohol	7.62E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)

Table 3-2 Plant-Soil Bioconcentration Factors in Root Vegetables

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Belowground Produce from Literature, Database, or Study	Units For Plant-Soil Bioconcentration Factor for Belowground Produce	Reference	Plant-Soil Bioconcentration Factor for Belowground Domestic Produce ($Br_{rootveg}$)	Reference	Plant-Soil Bioconcentration Factor for Belowground Wild Produce ($Br_{rootveg}$)	Reference	Units for Plant-Soil Bioconcentration Factor for Belowground Domestic and Wild Produce
107-21-1	Ethylene glycol (1,2-ethanediol)	1.44E+03	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
107-98-2	Propylene glycol monomethyl ether	1.44E+03	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
108-05-4	Acetic acid vinyl ester	9.06E+00	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
108-10-1	4-Methyl-2-pentanone	3.75E+00	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
108-39-4	m-Cresol	1.63E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
108-60-1	bis (2-Chloroisopropyl)ether	9.08E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
108-67-8	1,3,5-Trimethylbenzene	1.63E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
108-86-1	Bromobenzene (Phenyl bromide)	3.40E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
108-87-2	Methylcyclohexane	1.35E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
108-88-3	Toluene	7.74E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
108-90-7	Chlorobenzene	7.56E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
108-94-1	Cyclohexanone	9.43E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
108-95-2	Phenol	2.19E+00	(µg/g DW plant)/ (µg/g soil)	[3]	2.19E+00	[3]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
109-74-0	n-Butanenitrile	4.68E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
109-75-1	3-Butenenitrile	6.17E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)

Table 3-2 Plant-Soil Bioconcentration Factors in Root Vegetables

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Belowground Produce from Literature, Database, or Study	Units For Plant-Soil Bioconcentration Factor for Belowground Produce	Reference	Plant-Soil Bioconcentration Factor for Belowground Domestic Produce ($Br_{rootveg}$)	Reference	Plant-Soil Bioconcentration Factor for Belowground Wild Produce ($Br_{rootveg}$)	Reference	Units for Plant-Soil Bioconcentration Factor for Belowground Domestic and Wild Produce
109-77-3	Malononitrile	4.32E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
109-86-4	2-Methoxyethanol	1.44E+03	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
109-99-9	Tetrahydrofuran	2.41E+02	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
110-00-9	Furan	2.48E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
110-54-3	n-Hexane	1.54E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
110-59-8	Pentanenitrile	1.43E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
110-80-5	2-Ethoxyethanol	1.45E+03	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
110-82-7	Cyclohexane	1.60E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
110-83-8	Cyclohexene	5.71E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
110-86-1	Pyridine	1.62E+02	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
111-15-9	Ethylene glycol monoethyl ether acetate	3.46E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
111-44-4	Bis(2-chloroethyl)ether	1.13E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
111-65-9	n-Octane	3.36E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
111-76-2	2-Butoxyethanol	5.85E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
111-84-2	n-Nonane	1.47E+03	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)

Table 3-2 Plant-Soil Bioconcentration Factors in Root Vegetables

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Belowground Produce from Literature, Database, or Study	Units For Plant-Soil Bioconcentration Factor for Belowground Produce	Reference	Plant-Soil Bioconcentration Factor for Belowground Domestic Produce ($Br_{rootveg}$)	Reference	Plant-Soil Bioconcentration Factor for Belowground Wild Produce ($Br_{rootveg}$)	Reference	Units for Plant-Soil Bioconcentration Factor for Belowground Domestic and Wild Produce
111-91-1	Bis(2-chloroethoxy)methane	1.35E+02	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
112-30-1	1-Decanol	4.44E+02	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
112-31-2	Decanal	8.27E+00	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
112-40-3	Dodecane	3.21E+01	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
1120-21-4	Undecane	3.27E+01	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
1120-71-4	1,3-Propane sultone	1.54E+02	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
117-81-7	Bis(2-ethylhexyl) phthalate	8.54E-04	(µg/g DW plant)/(µg/g soil)	[3]	8.54E-04	[3]	8.54E-04	[3]	(µg/g DW plant)/(µg/g soil)
117-84-0	Di-n-octylphthalate	3.08E-02	(µg/g DW plant)/(µg/g soil)	[3]	3.08E-02	[3]	3.08E-02	[3]	(µg/g DW plant)/(µg/g soil)
118-74-1	Hexachlorobenzene	2.50E+01	(µg/g DW plant)/(µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
119-90-4	3,3'-Dimethoxybenzidine	2.00E+01	(µg/g DW plant)/(µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
120-12-7	Anthracene	1.51E-01	(µg/g DW plant)/(µg/g soil)	[3]	1.51E-01	[3]	1.51E-01	[3]	(µg/g DW plant)/(µg/g soil)
120-82-1	1,2,4-Trichlorobenzene	7.76E+01	(µg/g DW plant)/(µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
120-83-2	2,4-Dichlorophenol	1.37E+02	(µg/g DW plant)/(µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
121-14-2	2,4-Dinitrotoluene	1.59E+01	(µg/g DW plant)/(µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
122-39-4	N,N-Diphenylamine	4.30E+01	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)

Table 3-2 Plant-Soil Bioconcentration Factors in Root Vegetables

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Belowground Produce from Literature, Database, or Study	Units For Plant-Soil Bioconcentration Factor for Belowground Produce	Reference	Plant-Soil Bioconcentration Factor for Belowground Domestic Produce ($Br_{rootveg}$)	Reference	Plant-Soil Bioconcentration Factor for Belowground Wild Produce ($Br_{rootveg}$)	Reference	Units for Plant-Soil Bioconcentration Factor for Belowground Domestic and Wild Produce
122-66-7	1,2-Diphenylhydrazine	3.31E-01	(µg/g DW plant)/(µg/g soil)	[3]	3.31E-01	[3]	3.31E-01	[3]	(µg/g DW plant)/(µg/g soil)
123-33-1	Maleic hydrazide	5.11E+02	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
123-38-6	Propionaldehyde	1.57E+03	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
123-72-8	Butanal	2.28E+02	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
123-91-1	1,4-Dioxan	1.19E+03	(µg/g DW plant)/(µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
124-18-5	Decane	2.60E+02	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
124-38-9	Carbon dioxide	3.03E+02	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
124-48-1	Chlorodibromomethane	1.73E+01	(µg/g DW plant)/(µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
126-73-8	Tributyl phosphate	2.68E+01	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
126-98-7	2-Methyl-2-propenenitrile	2.03E+02	(µg/g DW plant)/(µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
127-18-4	1,1,2,2-Tetrachloroethene	3.11E+02	(µg/g DW plant)/(µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol				2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
129-00-0	Pyrene	1.45E-01	(µg/g DW plant)/(µg/g soil)	[3]	1.45E-01	[3]	1.45E-01	[3]	(µg/g DW plant)/(µg/g soil)
131-11-3	Dimethyl Phthalate	2.93E+01	(µg/g DW plant)/(µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	4.72E+00	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
132-64-9	Dibenzofuran	9.57E+00	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)

Table 3-2 Plant-Soil Bioconcentration Factors in Root Vegetables

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Belowground Produce from Literature, Database, or Study	Units For Plant-Soil Bioconcentration Factor for Belowground Produce	Reference	Plant-Soil Bioconcentration Factor for Belowground Domestic Produce ($Br_{rootveg}$)	Reference	Plant-Soil Bioconcentration Factor for Belowground Wild Produce ($Br_{rootveg}$)	Reference	Units for Plant-Soil Bioconcentration Factor for Belowground Domestic and Wild Produce
133-06-2	Captan	3.76E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
1330-20-7	Xylenes (mixed isomers)	7.98E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
1336-36-3	Polychlorinated biphenyls	4.67E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
134-32-7	alpha-Naphthylamine				2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
135-98-8	sec-Butylbenzene	1.30E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
13966-29-5	Uranium-234	1.20E-02	(µg/g DW plant)/ (µg/g soil)	[4]	1.20E-02	[5]	1.20E-02	[5]	(µg/g DW plant)/ (µg/g soil)
13967-48-1	Ruthenium-106	4.00E-02	(µg/g DW plant)/ (µg/g soil)	[4]	4.00E-02	[5]	4.00E-02	[5]	(µg/g DW plant)/ (µg/g soil)
13967-70-9	Cesium-134	1.30E-01	(µg/g DW plant)/ (µg/g soil)	[4]	1.30E-01	[5]	1.30E-01	[5]	(µg/g DW plant)/ (µg/g soil)
13968-55-3	Uranium-233	1.20E-02	(µg/g DW plant)/ (µg/g soil)	[4]	1.20E-02	[5]	1.20E-02	[5]	(µg/g DW plant)/ (µg/g soil)
13981-15-2	Curium-244	4.30E-04	(µg/g DW plant)/ (µg/g soil)	[4]	4.30E-04	[5]	4.30E-04	[5]	(µg/g DW plant)/ (µg/g soil)
13981-16-3	Plutonium-238	1.10E-03	(µg/g DW plant)/ (µg/g soil)	[4]	1.10E-03	[5]	1.10E-03	[5]	(µg/g DW plant)/ (µg/g soil)
13981-37-8	Nickel-63	6.00E-02	(µg/g DW plant)/ (µg/g soil)	[4]	6.00E-02	[5]	6.00E-02	[5]	(µg/g DW plant)/ (µg/g soil)
13982-10-0	Plutonium-242	1.10E-03	(µg/g DW plant)/ (µg/g soil)	[4]	1.10E-03	[5]	1.10E-03	[5]	(µg/g DW plant)/ (µg/g soil)
13982-63-3	Radium-226	2.00E-03	(µg/g DW plant)/ (µg/g soil)	[4]	2.00E-03	[5]	2.00E-03	[5]	(µg/g DW plant)/ (µg/g soil)
13982-70-2	Uranium-236	1.20E-02	(µg/g DW plant)/ (µg/g soil)	[4]	1.20E-02	[5]	1.20E-02	[5]	(µg/g DW plant)/ (µg/g soil)
13994-20-2	Neptunium-237	1.30E-02	(µg/g DW plant)/ (µg/g soil)	[4]	1.30E-02	[5]	1.30E-02	[5]	(µg/g DW plant)/ (µg/g soil)

Table 3-2 Plant-Soil Bioconcentration Factors in Root Vegetables

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Belowground Produce from Literature, Database, or Study	Units For Plant-Soil Bioconcentration Factor for Belowground Produce	Reference	Plant-Soil Bioconcentration Factor for Belowground Domestic Produce ($Br_{rootveg}$)	Reference	Plant-Soil Bioconcentration Factor for Belowground Wild Produce ($Br_{rootveg}$)	Reference	Units for Plant-Soil Bioconcentration Factor for Belowground Domestic and Wild Produce
141-78-6	Acetic acid ethyl ester	2.89E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
14119-32-5	Plutonium-241	1.10E-03	(µg/g DW plant)/ (µg/g soil)	[4]	1.10E-03	[5]	1.10E-03	[5]	(µg/g DW plant)/ (µg/g soil)
14119-33-6	Plutonium-240	1.10E-03	(µg/g DW plant)/ (µg/g soil)	[4]	1.10E-03	[5]	1.10E-03	[5]	(µg/g DW plant)/ (µg/g soil)
14133-76-7	Technetium-99	2.40E-01	(µg/g DW plant)/ (µg/g soil)	[4]	2.40E-01	[5]	2.40E-01	[5]	(µg/g DW plant)/ (µg/g soil)
14158-29-3	Uranium-232	1.20E-02	(µg/g DW plant)/ (µg/g soil)	[4]	1.20E-02	[5]	1.20E-02	[5]	(µg/g DW plant)/ (µg/g soil)
14234-35-6	Antimony-125	5.60E-04	(µg/g DW plant)/ (µg/g soil)	[4]	5.60E-04	[5]	5.60E-04	[5]	(µg/g DW plant)/ (µg/g soil)
14265-44-2	Phosphate								
14331-85-2	Protactinium-231	3.50E-04	(µg/g DW plant)/ (µg/g soil)	[4]	3.50E-04	[5]	3.50E-04	[5]	(µg/g DW plant)/ (µg/g soil)
14336-70-0	Nickel-59	6.00E-02	(µg/g DW plant)/ (µg/g soil)	[4]	6.00E-02	[5]	6.00E-02	[5]	(µg/g DW plant)/ (µg/g soil)
14391-16-3	Europium-155	2.00E-02	(µg/g DW plant)/ (µg/g soil)	[4]	2.00E-02	[5]	2.00E-02	[5]	(µg/g DW plant)/ (µg/g soil)
145-73-3	Endothall	3.49E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
14596-10-2	Americium-241	3.50E-04	(µg/g DW plant)/ (µg/g soil)	[4]	3.50E-04	[5]	3.50E-04	[5]	(µg/g DW plant)/ (µg/g soil)
14683-23-9	Europium-152	2.00E-02	(µg/g DW plant)/ (µg/g soil)	[4]	2.00E-02	[5]	2.00E-02	[5]	(µg/g DW plant)/ (µg/g soil)
14762-75-5	Carbon-14	7.00E-01	(µg/g DW plant)/ (µg/g soil)	[4]	7.00E-01	[5]	7.00E-01	[5]	(µg/g DW plant)/ (µg/g soil)
14797-55-8	Nitrate								
14797-65-0	Nitrite								
14808-79-8	Sulfate								

Table 3-2 Plant-Soil Bioconcentration Factors in Root Vegetables

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Belowground Produce from Literature, Database, or Study	Units For Plant-Soil Bioconcentration Factor for Belowground Produce	Reference	Plant-Soil Bioconcentration Factor for Belowground Domestic Produce ($Br_{rootveg}$)	Reference	Plant-Soil Bioconcentration Factor for Belowground Wild Produce ($Br_{rootveg}$)	Reference	Units for Plant-Soil Bioconcentration Factor for Belowground Domestic and Wild Produce
14952-40-0	Actinium-227	3.50E-04	(µg/g DW plant)/ (µg/g soil)	[4]	3.50E-04	[5]	3.50E-04	[5]	(µg/g DW plant)/ (µg/g soil)
14993-75-0	Americium-243	3.50E-04	(µg/g DW plant)/ (µg/g soil)	[4]	3.50E-04	[5]	3.50E-04	[5]	(µg/g DW plant)/ (µg/g soil)
15046-84-1	Iodine-129	4.00E-02	(µg/g DW plant)/ (µg/g soil)	[4]	4.00E-02	[5]	4.00E-02	[5]	(µg/g DW plant)/ (µg/g soil)
15117-48-3	Plutonium-239	1.10E-03	(µg/g DW plant)/ (µg/g soil)	[4]	1.10E-03	[5]	1.10E-03	[5]	(µg/g DW plant)/ (µg/g soil)
15117-96-1	Uranium-235	1.20E-02	(µg/g DW plant)/ (µg/g soil)	[4]	1.20E-02	[5]	1.20E-02	[5]	(µg/g DW plant)/ (µg/g soil)
15262-20-1	Radium-228	2.00E-03	(µg/g DW plant)/ (µg/g soil)	[4]	2.00E-03	[5]	2.00E-03	[5]	(µg/g DW plant)/ (µg/g soil)
15510-73-3	Curium-242	4.30E-04	(µg/g DW plant)/ (µg/g soil)	[4]	4.30E-04	[5]	4.30E-04	[5]	(µg/g DW plant)/ (µg/g soil)
15585-10-1	Europium-154	2.00E-02	(µg/g DW plant)/ (µg/g soil)	[4]	2.00E-02	[5]	2.00E-02	[5]	(µg/g DW plant)/ (µg/g soil)
15594-54-4	Thorium-229	3.30E-04	(µg/g DW plant)/ (µg/g soil)	[4]	3.30E-04	[5]	3.30E-04	[5]	(µg/g DW plant)/ (µg/g soil)
156-59-2	cis-1,2-Dichloroethene	1.84E+02	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
156-60-5	1,2-trans-Dichloroethene	9.62E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
15715-94-3	Samarium-151	2.00E-02	(µg/g DW plant)/ (µg/g soil)	[4]	2.00E-02	[5]	2.00E-02	[5]	(µg/g DW plant)/ (µg/g soil)
15751-77-6	Zirconium-93	1.00E-03	(µg/g DW plant)/ (µg/g soil)	[4]	1.00E-03	[5]	1.00E-03	[5]	(µg/g DW plant)/ (µg/g soil)
15757-87-6	Curium-243	4.30E-04	(µg/g DW plant)/ (µg/g soil)	[4]	4.30E-04	[5]	4.30E-04	[5]	(µg/g DW plant)/ (µg/g soil)
15758-45-9	Selenium-79	5.00E-02	(µg/g DW plant)/ (µg/g soil)	[4]	5.00E-02	[5]	5.00E-02	[5]	(µg/g DW plant)/ (µg/g soil)
15832-50-5	Tin-126	6.00E-03	(µg/g DW plant)/ (µg/g soil)	[4]	6.00E-03	[5]	6.00E-03	[5]	(µg/g DW plant)/ (µg/g soil)

Table 3-2 Plant-Soil Bioconcentration Factors in Root Vegetables

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Belowground Produce from Literature, Database, or Study	Units For Plant-Soil Bioconcentration Factor for Belowground Produce	Reference	Plant-Soil Bioconcentration Factor for Belowground Domestic Produce ($Br_{rootveg}$)	Reference	Plant-Soil Bioconcentration Factor for Belowground Wild Produce ($Br_{rootveg}$)	Reference	Units for Plant-Soil Bioconcentration Factor for Belowground Domestic and Wild Produce
1634-04-4	Methyl tert-butyl ether	1.54E+02	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
16887-00-6	Chloride								
16984-48-8	Fluoride								
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1.03E+00	(µg/g DW plant)/(µg/g soil)	[3]	1.03E+00	[3]	1.03E+00	[3]	(µg/g DW plant)/(µg/g soil)
18540-29-9	Chromium(VI)	4.50E-03	(µg/g DW plant)/(µg/g soil)	[1]	4.50E-03	[1]	4.50E-03	[1]	(µg/g DW plant)/(µg/g soil)
189-55-9	Dibenzo[a,i]pyrene	6.05E-02	(µg/g DW plant)/(µg/g soil)	[8]	6.05E-02	[7]	6.05E-02	[7]	(µg/g DW plant)/(µg/g soil)
189-64-0	Dibenzo[a,h]pyrene	3.32E+00	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
191-24-2	Benzo(g,h,i)perylene	3.42E+00	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
191-30-0	Dibenzo(a,l)pyrene	6.98E+00	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
192-65-4	Dibenzo[a,e]pyrene	3.26E+00	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
192-97-2	Benzo(e)pyrene	2.22E+00	(µg/g DW plant)/(µg/g soil)	[2]	2.22E+00	[2]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
193-39-5	Indeno(1,2,3-cd)pyrene	5.29E-02	(µg/g DW plant)/(µg/g soil)	[3]	5.29E-02	[3]	5.29E-02	[3]	(µg/g DW plant)/(µg/g soil)
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	7.89E-01	(µg/g DW plant)/(µg/g soil)	[3]	7.89E-01	[3]	7.89E-01	[3]	(µg/g DW plant)/(µg/g soil)
205-82-3	Benzo[j]fluoranthene	4.43E+00	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
205-99-2	Benzo(b)fluoranthene	1.15E+00	(µg/g DW plant)/(µg/g soil)	[3]	1.15E+00	[3]	1.15E+00	[3]	(µg/g DW plant)/(µg/g soil)
206-44-0	Fluoranthene	1.50E-01	(µg/g DW plant)/(µg/g soil)	[3]	1.50E-01	[3]	1.50E-01	[3]	(µg/g DW plant)/(µg/g soil)

Table 3-2 Plant-Soil Bioconcentration Factors in Root Vegetables

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Belowground Produce from Literature, Database, or Study	Units For Plant-Soil Bioconcentration Factor for Belowground Produce	Reference	Plant-Soil Bioconcentration Factor for Belowground Domestic Produce ($Br_{rootveg}$)	Reference	Plant-Soil Bioconcentration Factor for Belowground Wild Produce ($Br_{rootveg}$)	Reference	Units for Plant-Soil Bioconcentration Factor for Belowground Domestic and Wild Produce
207-08-9	Benzo(k)fluoranthene	6.09E-02	(µg/g DW plant)/(µg/g soil)	[3]	6.09E-02	[3]	6.09E-02	[3]	(µg/g DW plant)/(µg/g soil)
208-96-8	Acenaphthylene	1.01E+01	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
218-01-9	Chrysene	9.48E-02	(µg/g DW plant)/(µg/g soil)	[3]	9.48E-02	[3]	9.48E-02	[3]	(µg/g DW plant)/(µg/g soil)
224-42-0	Dibenz[a,j]acridine	4.05E-02	(µg/g DW plant)/(µg/g soil)	[10]	4.05E-02	[9]	4.05E-02	[9]	(µg/g DW plant)/(µg/g soil)
2245-38-7	2,3,5-Trimethylnaphthalene	4.94E+00	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
226-36-8	Dibenz[a,h]acridine	4.05E-02	(µg/g DW plant)/(µg/g soil)	[10]	4.05E-02	[9]	4.05E-02	[9]	(µg/g DW plant)/(µg/g soil)
22967-92-6	Methyl mercury	9.90E-02	(µg/g DW plant)/(µg/g soil)	[3]	9.90E-02	[3]	9.90E-02	[3]	(µg/g DW plant)/(µg/g soil)
23950-58-5	Pronamide	4.32E+00	(µg/g DW plant)/(µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
24959-67-9	Bromide								
27154-33-2	Trichlorofluoroethane	8.14E+01	(µg/g DW plant)/(µg/g soil)	[11]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	1.24E+02	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
319-84-6	alpha-BHC	7.84E+01	(µg/g DW plant)/(µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
319-85-7	beta-BHC	7.84E+01	(µg/g DW plant)/(µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	8.53E+01	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	6.76E+01	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)

Table 3-2 Plant-Soil Bioconcentration Factors in Root Vegetables

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Belowground Produce from Literature, Database, or Study	Units For Plant-Soil Bioconcentration Factor for Belowground Produce	Reference	Plant-Soil Bioconcentration Factor for Belowground Domestic Produce ($Br_{rootveg}$)	Reference	Plant-Soil Bioconcentration Factor for Belowground Wild Produce ($Br_{rootveg}$)	Reference	Units for Plant-Soil Bioconcentration Factor for Belowground Domestic and Wild Produce
3268-87-9	Octachlorodibenzo(p)dioxin	4.90E-01	(µg/g DW plant)/(µg/g soil)	[3]	4.90E-01	[3]	4.90E-01	[3]	(µg/g DW plant)/(µg/g soil)
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	1.27E+02	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	5.45E-01	(µg/g DW plant)/(µg/g soil)	[3]	5.45E-01	[3]	5.45E-01	[3]	(µg/g DW plant)/(µg/g soil)
3697-24-3	5-Methylchrysene	9.48E-02	(µg/g DW plant)/(µg/g soil)	[9]	9.48E-02	[8]	9.48E-02	[8]	(µg/g DW plant)/(µg/g soil)
378253-40-8	Barium-137m	1.50E-02	(µg/g DW plant)/(µg/g soil)	[4]	1.50E-02	[5]	1.50E-02	[5]	(µg/g DW plant)/(µg/g soil)
378253-44-2	Cadmium-113m	1.50E-01	(µg/g DW plant)/(µg/g soil)	[4]	1.50E-01	[5]	1.50E-01	[5]	(µg/g DW plant)/(µg/g soil)
378782-82-2	Niobium-93m	2.50E-02	(µg/g DW plant)/(µg/g soil)	[4]	2.50E-02	[5]	2.50E-02	[5]	(µg/g DW plant)/(µg/g soil)
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	1.74E+02	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
39001-02-0	Octachlorodibenzofuran	7.76E-01	(µg/g DW plant)/(µg/g soil)	[3]	7.76E-01	[3]	7.76E-01	[3]	(µg/g DW plant)/(µg/g soil)
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	6.05E-01	(µg/g DW plant)/(µg/g soil)	[3]	6.05E-01	[3]	6.05E-01	[3]	(µg/g DW plant)/(µg/g soil)
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	3.08E+02	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	1.12E+00	(µg/g DW plant)/(µg/g soil)	[3]	1.12E+00	[3]	1.12E+00	[3]	(µg/g DW plant)/(µg/g soil)
4170-30-3	Crotonaldehyde (Propylene aldehyde)	8.78E+02	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)

Table 3-2 Plant-Soil Bioconcentration Factors in Root Vegetables

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Belowground Produce from Literature, Database, or Study	Units For Plant-Soil Bioconcentration Factor for Belowground Produce	Reference	Plant-Soil Bioconcentration Factor for Belowground Domestic Produce ($Br_{rootveg}$)	Reference	Plant-Soil Bioconcentration Factor for Belowground Wild Produce ($Br_{rootveg}$)	Reference	Units for Plant-Soil Bioconcentration Factor for Belowground Domestic and Wild Produce
41851-50-7	Chlorocyclopentadiene	3.04E+01	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
460-19-5	Cyanogen (oxalonitrile)	1.26E+03	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
4786-20-3	2-Butenenitrile	3.88E+02	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
50-00-0	Formaldehyde	3.05E+02	(µg/g DW plant)/(µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
50-32-8	Benzo(a)pyrene	6.05E-02	(µg/g DW plant)/(µg/g soil)	[3]	6.05E-02	[3]	6.05E-02	[3]	(µg/g DW plant)/(µg/g soil)
506-68-3	Cyanogen bromide (bromocyanide)	2.80E+03	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
506-77-4	Cyanogen chloride	2.42E+03	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
51-28-5	2,4-Dinitrophenol	9.87E+04	(µg/g DW plant)/(µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
51-79-6	Ethyl carbamate (urethane)	1.21E+02	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
510-15-6	Chlorobenzilate	2.74E+00	(µg/g DW plant)/(µg/g soil)	[3]	2.74E+00	[3]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	1.49E+00	(µg/g DW plant)/(µg/g soil)	[3]	1.49E+00	[3]	1.49E+00	[3]	(µg/g DW plant)/(µg/g soil)
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	1.49E+02	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	6.87E+00	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
53-70-3	Dibenz[a,h]anthracene	4.05E-02	(µg/g DW plant)/(µg/g soil)	[3]	4.05E-02	[3]	4.05E-02	[3]	(µg/g DW plant)/(µg/g soil)
532-27-4	2-Chloroacetophenone	3.06E+01	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)

Table 3-2 Plant-Soil Bioconcentration Factors in Root Vegetables

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Belowground Produce from Literature, Database, or Study	Units For Plant-Soil Bioconcentration Factor for Belowground Produce	Reference	Plant-Soil Bioconcentration Factor for Belowground Domestic Produce ($Br_{rootveg}$)	Reference	Plant-Soil Bioconcentration Factor for Belowground Wild Produce ($Br_{rootveg}$)	Reference	Units for Plant-Soil Bioconcentration Factor for Belowground Domestic and Wild Produce
534-52-1	4,6-Dinitro-o-cresol	8.89E+00	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
5385-75-1	Dibenzo(a,e)fluoranthene	3.32E+00	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	4.77E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
540-73-8	1,2-Dimethylhydrazine	9.67E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
540-84-1	2,2,4-Trimethylpentane	3.07E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
541-73-1	1,3-Dichlorobenzene	1.62E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
542-75-6	1,3-Dichloropropene	1.13E+02	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
542-88-1	Bis(chloromethyl)ether	1.61E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	7.48E-01	(µg/g DW plant)/ (µg/g soil)	[3]	7.48E-01	[3]	7.48E-01	[3]	(µg/g DW plant)/ (µg/g soil)
56-23-5	Carbon tetrachloride	9.51E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
56-49-5	3-Methylcholanthrene	2.24E+00	(µg/g DW plant)/ (µg/g soil)	[2]	2.24E+00	[2]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
56-55-3	Benzo(a)anthracene	9.48E-02	(µg/g DW plant)/ (µg/g soil)	[3]	9.48E-02	[3]	9.48E-02	[3]	(µg/g DW plant)/ (µg/g soil)
57-12-5	Cyanide	6.46E-01	(µg/g DW plant)/ (µg/g soil)	[3]	6.46E-01	[3]	6.46E-01	[3]	(µg/g DW plant)/ (µg/g soil)
57-24-9	Strychnine	1.70E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
57-74-9	Chlordane	1.66E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)

Table 3-2 Plant-Soil Bioconcentration Factors in Root Vegetables

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Belowground Produce from Literature, Database, or Study	Units For Plant-Soil Bioconcentration Factor for Belowground Produce	Reference	Plant-Soil Bioconcentration Factor for Belowground Domestic Produce ($Br_{rootveg}$)	Reference	Plant-Soil Bioconcentration Factor for Belowground Wild Produce ($Br_{rootveg}$)	Reference	Units for Plant-Soil Bioconcentration Factor for Belowground Domestic and Wild Produce
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	1.21E+00	(µg/g DW plant)/(µg/g soil)	[3]	1.21E+00	[3]	1.21E+00	[3]	(µg/g DW plant)/(µg/g soil)
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	1.03E+00	(µg/g DW plant)/(µg/g soil)	[3]	1.03E+00	[3]	1.03E+00	[3]	(µg/g DW plant)/(µg/g soil)
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	9.25E-01	(µg/g DW plant)/(µg/g soil)	[3]	9.25E-01	[3]	9.25E-01	[3]	(µg/g DW plant)/(µg/g soil)
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	1.24E+02	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	7.89E-01	(µg/g DW plant)/(µg/g soil)	[3]	7.89E-01	[3]	7.89E-01	[3]	(µg/g DW plant)/(µg/g soil)
58-89-9	gamma-BHC (Lindane)	5.96E+01	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
58-90-2	2,3,4,6-Tetrachlorophenol	2.22E+02	(µg/g DW plant)/(µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
581-42-0	2,6-Dimethylnaphthalene	6.31E+00	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
584-84-9	2,4-Toluene diisocyanate	1.59E+01	(µg/g DW plant)/(µg/g soil)	[5]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
589-38-8	3-Hexanone	1.14E+02	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
59-50-7	4-Chloro-3-methylphenol	5.08E+00	(µg/g DW plant)/(µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
59-89-2	N-Nitrosomorpholine	6.42E+01	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
591-50-4	Benzene, iodo-	1.06E+01	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)

Table 3-2 Plant-Soil Bioconcentration Factors in Root Vegetables

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Belowground Produce from Literature, Database, or Study	Units For Plant-Soil Bioconcentration Factor for Belowground Produce	Reference	Plant-Soil Bioconcentration Factor for Belowground Domestic Produce ($Br_{rootveg}$)	Reference	Plant-Soil Bioconcentration Factor for Belowground Wild Produce ($Br_{rootveg}$)	Reference	Units for Plant-Soil Bioconcentration Factor for Belowground Domestic and Wild Produce
591-78-6	2-Hexanone	1.35E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
593-60-2	Bromoethene (Vinyl bromide)	1.04E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
593-74-8	Dimethyl Mercury								
60-11-7	Dimethyl aminoazobenzene	8.67E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
60-29-7	Ethyl ether	1.73E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
60-35-5	Acetamide	4.82E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
602-87-9	5-Nitroacenaphthene	2.13E-01	(µg/g DW plant)/ (µg/g soil)	[6]	2.13E-01	[6]	2.13E-01	[6]	(µg/g DW plant)/ (µg/g soil)
606-20-2	2,6-Dinitrotoluene	2.28E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
608-93-5	Pentachlorobenzene	1.84E+00	(µg/g DW plant)/ (µg/g soil)	[3]	1.84E+00	[3]	1.84E+00	[3]	(µg/g DW plant)/ (µg/g soil)
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	9.25E-01	(µg/g DW plant)/ (µg/g soil)	[3]	9.25E-01	[3]	9.25E-01	[3]	(µg/g DW plant)/ (µg/g soil)
61626-71-9	Dichloropentadiene	3.04E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
62-50-0	Ethyl methanesulfonate	5.84E+02	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
62-53-3	Aniline	6.21E+00	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
62-75-9	N-Nitroso-N,N-dimethylamine	6.31E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
621-64-7	N-Nitroso-di-n-propylamine	4.09E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
624-83-9	Methyl isocyanate	3.79E+02	(µg/g DW plant)/ (µg/g soil)	[7]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)

Table 3-2 Plant-Soil Bioconcentration Factors in Root Vegetables

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Belowground Produce from Literature, Database, or Study	Units For Plant-Soil Bioconcentration Factor for Belowground Produce	Reference	Plant-Soil Bioconcentration Factor for Belowground Domestic Produce ($Br_{rootveg}$)	Reference	Plant-Soil Bioconcentration Factor for Belowground Wild Produce ($Br_{rootveg}$)	Reference	Units for Plant-Soil Bioconcentration Factor for Belowground Domestic and Wild Produce
628-73-9	Hexanenitrile	5.63E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
630-08-0	Carbon monoxide								
630-20-6	1,1,1,2-Tetrachloroethane	1.66E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
64-18-6	Formic acid (methanoic acid)	2.17E+03	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
65-85-0	Benzoic acid	2.12E+03	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	1.21E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
67-56-1	Methyl alcohol	3.65E+03	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
67-63-0	2-Propyl alcohol	9.66E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
67-64-1	2-Propanone (Acetone)	7.42E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
67-66-3	Chloroform	1.01E+02	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
67-72-1	Hexachloroethane	1.59E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzo furan	7.48E-01	(µg/g DW plant)/ (µg/g soil)	[3]	7.48E-01	[3]	7.48E-01	[3]	(µg/g DW plant)/ (µg/g soil)
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	1.74E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
70-30-4	Hexachlorophene	5.75E-01	(µg/g DW plant)/ (µg/g soil)	[3]	5.75E-01	[3]	5.75E-01	[3]	(µg/g DW plant)/ (µg/g soil)
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	2.03E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)

Table 3-2 Plant-Soil Bioconcentration Factors in Root Vegetables

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Belowground Produce from Literature, Database, or Study	Units For Plant-Soil Bioconcentration Factor for Belowground Produce	Reference	Plant-Soil Bioconcentration Factor for Belowground Domestic Produce ($Br_{rootveg}$)	Reference	Plant-Soil Bioconcentration Factor for Belowground Wild Produce ($Br_{rootveg}$)	Reference	Units for Plant-Soil Bioconcentration Factor for Belowground Domestic and Wild Produce
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	9.25E-01	(µg/g DW plant)/(µg/g soil)	[3]	9.25E-01	[3]	9.25E-01	[3]	(µg/g DW plant)/(µg/g soil)
71-36-3	n-Butyl alcohol	5.28E+02	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
71-43-2	Benzene	8.01E+01	(µg/g DW plant)/(µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
71-55-6	1,1,1-Trichloroethane	8.88E+01	(µg/g DW plant)/(µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
72-43-5	Methoxychlor	7.69E-02	(µg/g DW plant)/(µg/g soil)	[3]	7.69E-02	[3]	7.69E-02	[3]	(µg/g DW plant)/(µg/g soil)
72-55-9	4,4-DDE	8.37E-03	(µg/g DW plant)/(µg/g soil)	[3]	8.37E-03	[3]	8.37E-03	[3]	(µg/g DW plant)/(µg/g soil)
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	9.25E-01	(µg/g DW plant)/(µg/g soil)	[3]	9.25E-01	[3]	9.25E-01	[3]	(µg/g DW plant)/(µg/g soil)
74-83-9	Bromomethane	9.14E+01	(µg/g DW plant)/(µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
74-87-3	Chloromethane	1.19E+02	(µg/g DW plant)/(µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
74-88-4	Iodomethane	1.65E+02	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
74-95-3	Methylene bromide	3.08E+01	(µg/g DW plant)/(µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
74-97-5	Bromochloromethane	9.48E+01	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
7429-90-5	Aluminum	6.50E-04	(µg/g DW plant)/(µg/g soil)	[1]	6.50E-04	[1]	6.50E-04	[1]	(µg/g DW plant)/(µg/g soil)
7439-89-6	Iron	5.00E-02	(µg/g DW plant)/(µg/g soil)	[4]	5.00E-02	[5]	5.00E-02	[5]	(µg/g DW plant)/(µg/g soil)
7439-92-1	Lead	9.00E-03	(µg/g DW plant)/(µg/g soil)	[1]	9.00E-03	[1]	9.00E-03	[1]	(µg/g DW plant)/(µg/g soil)

Table 3-2 Plant-Soil Bioconcentration Factors in Root Vegetables

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Belowground Produce from Literature, Database, or Study	Units For Plant-Soil Bioconcentration Factor for Belowground Produce	Reference	Plant-Soil Bioconcentration Factor for Belowground Domestic Produce ($Br_{rootveg}$)	Reference	Plant-Soil Bioconcentration Factor for Belowground Wild Produce ($Br_{rootveg}$)	Reference	Units for Plant-Soil Bioconcentration Factor for Belowground Domestic and Wild Produce
7439-93-2	Lithium	4.00E-03	(µg/g DW plant)/ (µg/g soil)	[1]	4.00E-03	[1]	4.00E-03	[1]	(µg/g DW plant)/ (µg/g soil)
7439-95-4	Magnesium	5.50E-01	(µg/g DW plant)/ (µg/g soil)	[4]	5.50E-01	[5]	5.50E-01	[5]	(µg/g DW plant)/ (µg/g soil)
7439-96-5	Manganese	2.00E-01	(µg/g DW plant)/ (µg/g soil)	[4]	2.00E-01	[5]	2.00E-01	[5]	(µg/g DW plant)/ (µg/g soil)
7439-97-6	Mercury	2.00E-01	(µg/g DW plant)/ (µg/g soil)	[4]	2.00E-01	[5]	2.00E-01	[5]	(µg/g DW plant)/ (µg/g soil)
7439-98-7	Molybdenum	8.00E-01	(µg/g DW plant)/ (µg/g soil)	[4]	8.00E-01	[5]	8.00E-01	[5]	(µg/g DW plant)/ (µg/g soil)
7440-02-0	Nickel	8.00E-03	(µg/g DW plant)/ (µg/g soil)	[3]	8.00E-03	[3]	8.00E-03	[3]	(µg/g DW plant)/ (µg/g soil)
7440-16-6	Rhodium	4.00E-02	(µg/g DW plant)/ (µg/g soil)	[4]	4.00E-02	[5]	4.00E-02	[5]	(µg/g DW plant)/ (µg/g soil)
7440-22-4	Silver	1.00E-01	(µg/g DW plant)/ (µg/g soil)	[1]	1.00E-01	[1]	1.00E-01	[1]	(µg/g DW plant)/ (µg/g soil)
7440-23-5	Sodium	3.00E-01	(µg/g DW plant)/ (µg/g soil)	[4]	3.00E-01	[5]	3.00E-01	[5]	(µg/g DW plant)/ (µg/g soil)
7440-24-6	Strontium (total)	5.00E-01	(µg/g DW plant)/ (µg/g soil)	[4]	5.00E-01	[5]	5.00E-01	[5]	(µg/g DW plant)/ (µg/g soil)
7440-25-7	Tantalum	2.50E-02	(µg/g DW plant)/ (µg/g soil)	[4]	2.50E-02	[5]	2.50E-02	[5]	(µg/g DW plant)/ (µg/g soil)
7440-28-0	Thallium	4.00E-04	(µg/g DW plant)/ (µg/g soil)	[1]	4.00E-04	[1]	4.00E-04	[1]	(µg/g DW plant)/ (µg/g soil)
7440-29-1	Thorium-232	3.30E-04	(µg/g DW plant)/ (µg/g soil)	[4]	3.30E-04	[5]	3.30E-04	[5]	(µg/g DW plant)/ (µg/g soil)
7440-31-5	Tin	6.00E-03	(µg/g DW plant)/ (µg/g soil)	[4]	6.00E-03	[5]	6.00E-03	[5]	(µg/g DW plant)/ (µg/g soil)
7440-33-7	Tungsten	3.00E+00	(µg/g DW plant)/ (µg/g soil)	[4]	3.00E+00	[5]	3.00E+00	[5]	(µg/g DW plant)/ (µg/g soil)
7440-36-0	Antimony	3.00E-02	(µg/g DW plant)/ (µg/g soil)	[1]	3.00E-02	[1]	3.00E-02	[1]	(µg/g DW plant)/ (µg/g soil)

Table 3-2 Plant-Soil Bioconcentration Factors in Root Vegetables

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Belowground Produce from Literature, Database, or Study	Units For Plant-Soil Bioconcentration Factor for Belowground Produce	Reference	Plant-Soil Bioconcentration Factor for Belowground Domestic Produce ($Br_{rootveg}$)	Reference	Plant-Soil Bioconcentration Factor for Belowground Wild Produce ($Br_{rootveg}$)	Reference	Units for Plant-Soil Bioconcentration Factor for Belowground Domestic and Wild Produce
7440-38-2	Arsenic	8.00E-03	(µg/g DW plant)/ (µg/g soil)	[3]	8.00E-03	[3]	8.00E-03	[3]	(µg/g DW plant)/ (µg/g soil)
7440-39-3	Barium	1.50E-02	(µg/g DW plant)/ (µg/g soil)	[1]	1.50E-02	[1]	1.50E-02	[1]	(µg/g DW plant)/ (µg/g soil)
7440-41-7	Beryllium	1.50E-03	(µg/g DW plant)/ (µg/g soil)	[1]	1.50E-03	[1]	1.50E-03	[1]	(µg/g DW plant)/ (µg/g soil)
7440-43-9	Cadmium	6.40E-02	(µg/g DW plant)/ (µg/g soil)	[3]	6.40E-02	[3]	6.40E-02	[3]	(µg/g DW plant)/ (µg/g soil)
7440-47-3	Chromium	4.50E-03	(µg/g DW plant)/ (µg/g soil)	[1]	4.50E-03	[1]	4.50E-03	[1]	(µg/g DW plant)/ (µg/g soil)
7440-48-4	Cobalt	6.70E-02	(µg/g DW plant)/ (µg/g soil)	[4]	6.70E-02	[5]	6.70E-02	[5]	(µg/g DW plant)/ (µg/g soil)
7440-50-8	Copper	2.50E-01	(µg/g DW plant)/ (µg/g soil)	[4]	2.50E-01	[5]	2.50E-01	[5]	(µg/g DW plant)/ (µg/g soil)
7440-61-1	Uranium	1.20E-02	(µg/g DW plant)/ (µg/g soil)	[4]	1.20E-02	[5]	1.20E-02	[5]	(µg/g DW plant)/ (µg/g soil)
7440-61-1R	Uranium-238	4.00E-03	(µg/g DW plant)/ (µg/g soil)	[1]	4.00E-03	[1]	4.00E-03	[1]	(µg/g DW plant)/ (µg/g soil)
7440-62-2	Vanadium	3.00E-03	(µg/g DW plant)/ (µg/g soil)	[1]	3.00E-03	[1]	3.00E-03	[1]	(µg/g DW plant)/ (µg/g soil)
7440-65-5	Yttrium	1.00E-02	(µg/g DW plant)/ (µg/g soil)	[4]	1.00E-02	[5]	1.00E-02	[5]	(µg/g DW plant)/ (µg/g soil)
7440-66-6	Zinc	9.00E-01	(µg/g DW plant)/ (µg/g soil)	[1]	9.00E-01	[1]	9.00E-01	[1]	(µg/g DW plant)/ (µg/g soil)
7440-67-7	Zirconium	1.00E-03	(µg/g DW plant)/ (µg/g soil)	[4]	1.00E-03	[5]	1.00E-03	[5]	(µg/g DW plant)/ (µg/g soil)
7446-09-5	Sulfur dioxide								
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	9.46E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
7487-94-7	Mercuric chloride (HgCl2)	3.60E-02	(µg/g DW plant)/ (µg/g soil)	[3]	3.60E-02	[3]	3.60E-02	[3]	(µg/g DW plant)/ (µg/g soil)

Table 3-2 Plant-Soil Bioconcentration Factors in Root Vegetables

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Belowground Produce from Literature, Database, or Study	Units For Plant-Soil Bioconcentration Factor for Belowground Produce	Reference	Plant-Soil Bioconcentration Factor for Belowground Domestic Produce ($Br_{rootveg}$)	Reference	Plant-Soil Bioconcentration Factor for Belowground Wild Produce ($Br_{rootveg}$)	Reference	Units for Plant-Soil Bioconcentration Factor for Belowground Domestic and Wild Produce
75-00-3	Chloroethane	2.84E+02	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
75-01-4	1-Chloroethene	2.46E+02	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
75-02-5	Fluoroethene (vinyl fluoride)	1.77E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
75-05-8	Acetonitrile	1.39E+03	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
75-07-0	Acetaldehyde	1.06E+03	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
75-09-2	Dichloromethane (Methylene Chloride)	3.59E+02	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
75-15-0	Carbon disulfide	1.26E+02	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
75-21-8	Ethylene oxide (Oxirane)	1.27E+03	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
75-25-2	Bromoform	1.23E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
75-27-4	Bromodichloromethane	8.74E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
75-29-6	2-Chloropropane	9.25E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
75-34-3	1,1-Dichloroethane	1.89E+02	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
75-35-4	1,1-Dichloroethene	8.01E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
75-44-5	Phosgene (hydrogen phosphide)	1.84E+02	(µg/g DW plant)/ (µg/g soil)	[12]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
75-45-6	Chlorodifluoromethane	9.19E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)

Table 3-2 Plant-Soil Bioconcentration Factors in Root Vegetables

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Belowground Produce from Literature, Database, or Study	Units For Plant-Soil Bioconcentration Factor for Belowground Produce	Reference	Plant-Soil Bioconcentration Factor for Belowground Domestic Produce ($Br_{rootveg}$)	Reference	Plant-Soil Bioconcentration Factor for Belowground Wild Produce ($Br_{rootveg}$)	Reference	Units for Plant-Soil Bioconcentration Factor for Belowground Domestic and Wild Produce
75-50-3	Trimethylamine				2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
75-69-4	Trichlorofluoromethane	8.14E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
75-71-8	Dichlorodifluoromethane	1.74E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
76-01-7	Pentachloroethane	1.16E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
76-13-1	1,2,2-Trichlorotrifluoroethane	7.20E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
76-44-8	Heptachlor	2.26E-03	(µg/g DW plant)/ (µg/g soil)	[3]	2.26E-03	[3]	2.26E-03	[3]	(µg/g DW plant)/ (µg/g soil)
764-41-0	1,4-Dichloro-2-butene	3.98E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
7647-01-0	Hydrogen chloride								
765-34-4	Glycidylaldehyde	1.46E+03	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
7664-39-3	Hydrogen Fluoride								
7664-41-7	Ammonia/Ammonium								
77-47-4	Hexachlorocyclopentadiene	1.50E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
77-78-1	Dimethyl sulfate	2.16E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
7704-34-9	Total Sulfur (thermodynamically stable)								
7723-14-0	Phosphorus	3.50E+00	(µg/g DW plant)/ (µg/g soil)	[4]	3.50E+00	[5]	3.50E+00	[5]	(µg/g DW plant)/ (µg/g soil)
7782-41-4	Fluorine gas F2	4.43E-02	(µg/g DW plant)/ (µg/g soil)	[2]	4.43E-02	[2]	4.43E-02	[2]	(µg/g DW plant)/ (µg/g soil)

Table 3-2 Plant-Soil Bioconcentration Factors in Root Vegetables

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Belowground Produce from Literature, Database, or Study	Units For Plant-Soil Bioconcentration Factor for Belowground Produce	Reference	Plant-Soil Bioconcentration Factor for Belowground Domestic Produce ($Br_{rootveg}$)	Reference	Plant-Soil Bioconcentration Factor for Belowground Wild Produce ($Br_{rootveg}$)	Reference	Units for Plant-Soil Bioconcentration Factor for Belowground Domestic and Wild Produce
7782-49-2	Selenium	2.20E-02	(µg/g DW plant)/ (µg/g soil)	[3]	2.20E-02	[3]	2.20E-02	[3]	(µg/g DW plant)/ (µg/g soil)
7782-50-5	Chlorine	7.00E+01	(µg/g DW plant)/ (µg/g soil)	[4]	7.00E+01	[5]	7.00E+01	[5]	(µg/g DW plant)/ (µg/g soil)
78-83-1	2-Methylpropyl alcohol	5.55E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
78-87-5	1,2-Dichloropropane	9.26E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
78-93-3	2-Butanone	2.31E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
79-00-5	1,1,2-Trichloroethane	8.05E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
79-01-6	1,1,2-Trichloroethylene	4.96E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
79-10-7	2-Propenoic acid	1.05E+03	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
79-34-5	1,1,2,2-Tetrachloroethane	8.62E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
79-46-9	2-Nitropropane	5.50E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
80-62-6	Methyl methacrylate	2.22E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
82-68-8	Pentachloronitrobenzene (PCNB)	2.38E+00	(µg/g DW plant)/ (µg/g soil)	[3]	2.38E+00	[3]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
822-06-0	Hexamethylene-1,5-diisocyanate	3.16E+00	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
823-40-5	Toluene-2,6-diamine	2.64E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
83-32-9	Acenaphthene	2.13E-01	(µg/g DW plant)/ (µg/g soil)	[3]	2.13E-01	[3]	2.13E-01	[3]	(µg/g DW plant)/ (µg/g soil)
832-69-9	1-Methylphenanthrene	4.33E+00	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)

Table 3-2 Plant-Soil Bioconcentration Factors in Root Vegetables

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Belowground Produce from Literature, Database, or Study	Units For Plant-Soil Bioconcentration Factor for Belowground Produce	Reference	Plant-Soil Bioconcentration Factor for Belowground Domestic Produce ($Br_{rootveg}$)	Reference	Plant-Soil Bioconcentration Factor for Belowground Wild Produce ($Br_{rootveg}$)	Reference	Units for Plant-Soil Bioconcentration Factor for Belowground Domestic and Wild Produce
84-66-2	Diethyl phthalate	4.44E-01	(µg/g DW plant)/ (µg/g soil)	[3]	4.44E-01	[3]	4.44E-01	[3]	(µg/g DW plant)/ (µg/g soil)
84-74-2	Di-n-butylphthalate	1.86E-01	(µg/g DW plant)/ (µg/g soil)	[3]	1.86E-01	[3]	1.86E-01	[3]	(µg/g DW plant)/ (µg/g soil)
85-01-8	Phenanthrene	1.83E-01	(µg/g DW plant)/ (µg/g soil)	[3]	1.83E-01	[3]	1.83E-01	[3]	(µg/g DW plant)/ (µg/g soil)
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	2.60E+03	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
85-68-7	Butylbenzylphthalate	1.58E-01	(µg/g DW plant)/ (µg/g soil)	[3]	1.58E-01	[3]	1.58E-01	[3]	(µg/g DW plant)/ (µg/g soil)
86-73-7	Fluorene	1.90E-01	(µg/g DW plant)/ (µg/g soil)	[3]	1.90E-01	[3]	1.90E-01	[3]	(µg/g DW plant)/ (µg/g soil)
87-61-6	1,2,3-Trichlorobenzene	1.58E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
87-68-3	Hexachlorobutadiene	1.52E-01	(µg/g DW plant)/ (µg/g soil)	[3]	1.52E-01	[3]	1.52E-01	[3]	(µg/g DW plant)/ (µg/g soil)
87-86-5	Pentachlorophenol	1.64E+03	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
88-06-2	2,4,6-Trichlorophenol	2.16E+02	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
88-74-4	o-Nitroaniline (2-nitroaniline)	1.89E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
88-75-5	2-Nitrophenol	2.06E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
90-04-0	o-Anisidine	4.02E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
90-12-0	1-Methylnaphthalene	2.18E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
91-20-3	Naphthalene	2.69E-01	(µg/g DW plant)/ (µg/g soil)	[3]	2.69E-01	[3]	2.69E-01	[3]	(µg/g DW plant)/ (µg/g soil)

Table 3-2 Plant-Soil Bioconcentration Factors in Root Vegetables

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Belowground Produce from Literature, Database, or Study	Units For Plant-Soil Bioconcentration Factor for Belowground Produce	Reference	Plant-Soil Bioconcentration Factor for Belowground Domestic Produce ($Br_{rootveg}$)	Reference	Plant-Soil Bioconcentration Factor for Belowground Wild Produce ($Br_{rootveg}$)	Reference	Units for Plant-Soil Bioconcentration Factor for Belowground Domestic and Wild Produce
91-22-5	Quinoline	1.52E+00	(µg/g DW plant)/ (µg/g soil)	[2]	1.52E+00	[2]	1.52E+00	[2]	(µg/g DW plant)/ (µg/g soil)
91-57-6	2-Methylnaphthalene	1.23E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
91-58-7	2-Chloronaphthalene	4.42E+00	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
91-94-1	3,3'-Dichlorobenzidine	1.62E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
92-52-4	1,1`-Biphenyl	3.44E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
924-16-3	N-Nitroso-di-n-Buetylamine	1.72E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	6.30E+00	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
94-75-7	2,4-D	1.67E+02	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
95-48-7	o-Cresol	1.66E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
95-49-8	o-Chlorotoluene	5.87E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
95-50-1	1,2-Dichlorobenzene	2.45E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
95-53-4	o-Toluidine	4.39E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
95-57-8	2-Chlorophenol	2.71E+00	(µg/g DW plant)/ (µg/g soil)	[3]	2.71E+00	[3]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
95-63-6	1,2,4-Trimethyl benzene	5.32E+01	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)
95-94-3	1,2,4,5-Tetrachlorobenzene	1.05E+02	(µg/g DW plant)/ (µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/ (µg/g soil)

Table 3-2 Plant-Soil Bioconcentration Factors in Root Vegetables

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Belowground Produce from Literature, Database, or Study	Units For Plant-Soil Bioconcentration Factor for Belowground Produce	Reference	Plant-Soil Bioconcentration Factor for Belowground Domestic Produce ($Br_{rootveg}$)	Reference	Plant-Soil Bioconcentration Factor for Belowground Wild Produce ($Br_{rootveg}$)	Reference	Units for Plant-Soil Bioconcentration Factor for Belowground Domestic and Wild Produce
95-95-4	2,4,5-Trichlorophenol	1.06E+01	(µg/g DW plant)/(µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
96-12-8	1,2-Dibromo-3-chloropropane	8.07E+01	(µg/g DW plant)/(µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
96-18-4	1,2,3-Trichloropropane	5.75E+01	(µg/g DW plant)/(µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
96-45-7	Ethylene thiourea	1.11E+02	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
97-63-2	Ethyl methacrylate	1.68E+01	(µg/g DW plant)/(µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
98-01-1	Furfural	2.51E+02	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
98-06-6	tert-Butyl benzene	7.64E+01	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
98-07-7	Benzotrichloride	5.27E+01	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
98-82-8	Cumene	2.73E-01	(µg/g DW plant)/(µg/g soil)	[3]	2.73E-01	[3]	2.73E-01	[3]	(µg/g DW plant)/(µg/g soil)
98-83-9	Methyl styrene (mixed isomers)	3.49E+01	(µg/g DW plant)/(µg/g soil)	[2]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
98-86-2	Acetophenone	2.83E+01	(µg/g DW plant)/(µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
98-95-3	Nitrobenzene	1.05E+01	(µg/g DW plant)/(µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
99-35-4	1,3,5-Trinitrobenzene	3.75E+00	(µg/g DW plant)/(µg/g soil)	[3]	2.78E+00	[4]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)
99-65-0	1,3-Dinitrobenzene	2.19E+00	(µg/g DW plant)/(µg/g soil)	[3]	2.19E+00	[3]	2.08E+00	[4]	(µg/g DW plant)/(µg/g soil)

Reference	Reference (source) for Plant-Soil Bioconcentration Factor for Belowground Produce (from literature, study, or database)
[1]	Baes CF, Sharp RD, Sjoreen AL, and Shor RW. 1984. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture*, ORNL-5786, Oak Ridge National Laboratory, Oak Ridge, TN (http://homer.ornl.gov/baes/documents/ornl5786.html)
[2]	Calculated value per Eq. A-2-16 in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm)
[3]	EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013)
[4]	Staven LH, Rhoads K, Napier BA, Strenge DL, *A Compendium of Transfer Factors for Agricultural and Animal Products*, PNNL-13421, Pacific Northwest National Laboratory, Richland, WA. June 2003
[5]	Surrogate value from 2,4-Dinitrotoluene
[6]	Surrogate value from Acenaphthene
[7]	Surrogate value from Acrylonitrile
[8]	Surrogate value from Benzo(a)pyrene
[9]	Surrogate value from Chrysene
[10]	Surrogate value from Dibenz[a,h]anthracene
[11]	Surrogate value from Trichlorofluoromethane

Reference	Reference (source) for Plant-Soil Bioconcentration Factor for Belowground Domestic Produce
[1]	Baes CF, Sharp RD, Sjoreen AL, and Shor RW. 1984. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture*, ORNL-5786, Oak Ridge National Laboratory, Oak Ridge, TN (http://homer.ornl.gov/baes/documents/ornl5786.html)
[2]	Calculated value per Eq. A-2-16 in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm)
[3]	EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013)
[4]	Mass-limited plant-soil bioconcentration factor for belowground domestic produce (tilled soil)
[5]	Staven LH, Rhoads K, Napier BA, Strenge DL, *A Compendium of Transfer Factors for Agricultural and Animal Products*, PNNL-13421, Pacific Northwest National Laboratory, Richland, WA. June 2003
[6]	Surrogate value from Acenaphthene
[7]	Surrogate value from Benzo(a)pyrene
[8]	Surrogate value from Chrysene
[9]	Surrogate value from Dibenz[a,h]anthracene

Reference	Reference (source) for Plant-Soil Bioconcentration Factor for Belowground Wild Produce
[1]	Baes CF, Sharp RD, Sjoreen AL, and Shor RW. 1984. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture*, ORNL-5786, Oak Ridge National Laboratory, Oak Ridge, TN (http://homer.ornl.gov/baes/documents/ornl5786.html)

Reference	Reference (source) for Plant-Soil Bioconcentration Factor for Belowground Wild Produce
[2]	Calculated value per Eq. A-2-16 in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm)
[3]	EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013)
[4]	Mass-limited plant-soil bioconcentration factor for belowground wild produce (root zone soil)
[5]	Staven LH, Rhoads K, Napier BA, Strenge DL, *A Compendium of Transfer Factors for Agricultural and Animal Products*, PNNL-13421, Pacific Northwest National Laboratory, Richland, WA. June 2003
[6]	Surrogate value from Acenaphthene
[7]	Surrogate value from Benzo(a)pyrene
[8]	Surrogate value from Chrysene
[9]	Surrogate value from Dibenz[a,h]anthracene

Table 3-3 provides data on aboveground bioconcentration factors for silage and forage units of dry weight (DW) concentration of plant matter per unit of soil concentration. This constituent parameter accounts for the uptake from soil and the subsequent transport of contaminants through the roots to the aboveground plant parts. The data in the third column show values that were found in studies and published reports. The subsequent Br_{silage} and Br_{forage} values shown in the 6th and 8th columns are values used in the environmental risk assessment. The data are presented this way to distinguish mass-limited uptake values used in risk assessment from those values found in the literature (refer to the RAWP, Section 6.6.3.3). Blank entries in the table indicate where data are not available.

Table 3-3 Plant-Soil Bioconcentration Factors for Aboveground Silage and Forage

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Forage from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Forage	Reference	Plant-Soil Bioconcentration Factor in Silage (Br_{silage})	Reference	Plant-Soil Bioconcentration Factor in Forage (Br_{forage})	Reference	Units for Plant-Soil Bioconcentration Factor in Silage and Forage
100-02-7	p-Nitrophenol	3.05E+00	(µg/g DW plant)/ (µg/g soil)	[4]	3.05E+00	[8]	3.05E+00	[4]	(µg/g DW plant)/ (µg/g soil)
100-21-0	Phthalic acid	2.66E+00	(µg/g DW plant)/ (µg/g soil)	[5]	2.66E+00	[10]	2.66E+00	[5]	(µg/g DW plant)/ (µg/g soil)
100-25-4	1,4-Dinitrobenzene	5.48E+00	(µg/g DW plant)/ (µg/g soil)	[5]	5.48E+00	[10]	5.48E+00	[5]	(µg/g DW plant)/ (µg/g soil)
100-40-3	4-Ethenylcyclohexene	2.07E-01	(µg/g DW plant)/ (µg/g soil)	[3]	2.07E-01	[2]	2.07E-01	[3]	(µg/g DW plant)/ (µg/g soil)
100-41-4	Ethyl benzene	6.25E-01	(µg/g DW plant)/ (µg/g soil)	[4]	6.25E-01	[8]	6.25E-01	[4]	(µg/g DW plant)/ (µg/g soil)
100-42-5	Styrene	7.14E-01	(µg/g DW plant)/ (µg/g soil)	[4]	7.14E-01	[8]	7.14E-01	[4]	(µg/g DW plant)/ (µg/g soil)
100-44-7	Benzyl chloride	1.81E+00	(µg/g DW plant)/ (µg/g soil)	[4]	1.81E+00	[8]	1.81E+00	[4]	(µg/g DW plant)/ (µg/g soil)
100-47-0	Benzonitrile	4.86E+00	(µg/g DW plant)/ (µg/g soil)	[4]	4.86E+00	[8]	4.86E+00	[4]	(µg/g DW plant)/ (µg/g soil)
100-51-6	Benzyl alcohol	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[4]	8.13E+00	[9]	8.38E+00	[4]	(µg/g DW plant)/ (µg/g soil)
100-52-7	Benzaldehyde	5.40E+00	(µg/g DW plant)/ (µg/g soil)	[4]	5.40E+00	[8]	5.40E+00	[4]	(µg/g DW plant)/ (µg/g soil)
10028-15-6	Ozone	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.38E+00	[7]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
10028-17-8	Tritium	2.40E+01	(µg/g DW plant)/ (µg/g soil)	[5]	2.40E+01	[10]	2.40E+01	[5]	(µg/g DW plant)/ (µg/g soil)
10045-97-3	Cesium-137	8.00E-02	(µg/g DW plant)/ (µg/g soil)	[1]	8.00E-02	[1]	8.00E-02	[1]	(µg/g DW plant)/ (µg/g soil)

Table 3-3 Plant-Soil Bioconcentration Factors for Aboveground Silage and Forage

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Forage from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Forage	Reference	Plant-Soil Bioconcentration Factor in Silage (Br_{silage})	Reference	Plant-Soil Bioconcentration Factor in Forage (Br_{forage})	Reference	Units for Plant-Soil Bioconcentration Factor in Silage and Forage
10061-01-5	cis-1,3-Dichloropropene	2.46E+00	(µg/g DW plant)/(µg/g soil)	[5]	2.46E+00	[10]	2.46E+00	[5]	(µg/g DW plant)/(µg/g soil)
10061-02-6	trans-1,3-Dichloropropene	2.56E+00	(µg/g DW plant)/(µg/g soil)	[5]	2.56E+00	[10]	2.56E+00	[5]	(µg/g DW plant)/(µg/g soil)
10098-91-6	Yttrium-90	1.50E-02	(µg/g DW plant)/(µg/g soil)	[1]	1.50E-02	[1]	1.50E-02	[1]	(µg/g DW plant)/(µg/g soil)
10098-97-2	Strontium-90	2.50E+00	(µg/g DW plant)/(µg/g soil)	[1]	2.50E+00	[1]	2.50E+00	[1]	(µg/g DW plant)/(µg/g soil)
101-55-3	4-Bromophenylphenyl ether	3.61E-02	(µg/g DW plant)/(µg/g soil)	[4]	3.61E-02	[8]	3.61E-02	[4]	(µg/g DW plant)/(µg/g soil)
101-77-9	4,4-Methylenedianiline	4.61E+00	(µg/g DW plant)/(µg/g soil)	[5]	4.61E+00	[10]	4.61E+00	[5]	(µg/g DW plant)/(µg/g soil)
10102-44-0	Nitrogen dioxide	8.38E+00	(µg/g DW plant)/(µg/g soil)	[2]	8.38E+00	[7]	8.38E+00	[2]	(µg/g DW plant)/(µg/g soil)
10198-40-0	Cobalt-60	2.00E-02	(µg/g DW plant)/(µg/g soil)	[1]	2.00E-02	[1]	2.00E-02	[1]	(µg/g DW plant)/(µg/g soil)
103-33-3	Azobenzene	2.34E-01	(µg/g DW plant)/(µg/g soil)	[5]	2.34E-01	[10]	2.34E-01	[5]	(µg/g DW plant)/(µg/g soil)
103-65-1	n-Propyl benzene (Isocumene)	2.79E-01	(µg/g DW plant)/(µg/g soil)	[5]	2.79E-01	[10]	2.79E-01	[5]	(µg/g DW plant)/(µg/g soil)
104-51-8	n-Butylbenzene	1.11E-01	(µg/g DW plant)/(µg/g soil)	[5]	1.11E-01	[10]	1.11E-01	[5]	(µg/g DW plant)/(µg/g soil)
104-76-7	2-Ethyl-1-hexanol	1.02E+00	(µg/g DW plant)/(µg/g soil)	[3]	1.02E+00	[2]	1.02E+00	[3]	(µg/g DW plant)/(µg/g soil)
105-67-9	2,4-Dimethylphenol	1.81E+00	(µg/g DW plant)/(µg/g soil)	[4]	1.81E+00	[8]	1.81E+00	[4]	(µg/g DW plant)/(µg/g soil)
10595-95-6	n-Nitrosomethylethylamine	3.65E+01	(µg/g DW plant)/(µg/g soil)	[5]	8.13E+00	[9]	3.65E+01	[5]	(µg/g DW plant)/(µg/g soil)
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	4.51E-01	(µg/g DW plant)/(µg/g soil)	[5]	4.51E-01	[10]	4.51E-01	[5]	(µg/g DW plant)/(µg/g soil)
106-44-5	p-Cresol (4-methyl phenol)	3.09E+00	(µg/g DW plant)/(µg/g soil)	[4]	3.09E+00	[8]	3.09E+00	[4]	(µg/g DW plant)/(µg/g soil)
106-46-7	1,4-Dichlorobenzene	3.67E-01	(µg/g DW plant)/(µg/g soil)	[4]	3.67E-01	[8]	3.67E-01	[4]	(µg/g DW plant)/(µg/g soil)

Table 3-3 Plant-Soil Bioconcentration Factors for Aboveground Silage and Forage

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Forage from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Forage	Reference	Plant-Soil Bioconcentration Factor in Silage (Br_{silage})	Reference	Plant-Soil Bioconcentration Factor in Forage (Br_{forage})	Reference	Units for Plant-Soil Bioconcentration Factor in Silage and Forage
106-47-8	p-Chloroaniline	3.39E+00	(µg/g DW plant)/ (µg/g soil)	[4]	3.39E+00	[8]	3.39E+00	[4]	(µg/g DW plant)/ (µg/g soil)
106-49-0	p-Toluidine	6.02E+00	(µg/g DW plant)/ (µg/g soil)	[5]	6.02E+00	[10]	6.02E+00	[5]	(µg/g DW plant)/ (µg/g soil)
106-51-4	Quinone	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.13E+00	[9]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
106-88-7	1,2-Epoxybutane	1.22E+01	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	1.22E+01	[5]	(µg/g DW plant)/ (µg/g soil)
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[4]	8.13E+00	[9]	8.38E+00	[4]	(µg/g DW plant)/ (µg/g soil)
106-93-4	Ethylene dibromide	2.70E+00	(µg/g DW plant)/ (µg/g soil)	[4]	2.70E+00	[8]	2.70E+00	[4]	(µg/g DW plant)/ (µg/g soil)
106-99-0	1,3-Butadiene	2.70E+00	(µg/g DW plant)/ (µg/g soil)	[5]	2.70E+00	[10]	2.70E+00	[5]	(µg/g DW plant)/ (µg/g soil)
107-02-8	Acrolein	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[4]	8.13E+00	[9]	8.38E+00	[4]	(µg/g DW plant)/ (µg/g soil)
107-05-1	3-Chloropropene	2.92E+00	(µg/g DW plant)/ (µg/g soil)	[5]	2.92E+00	[10]	2.92E+00	[5]	(µg/g DW plant)/ (µg/g soil)
107-06-2	1,2-Dichloroethane	5.26E+00	(µg/g DW plant)/ (µg/g soil)	[4]	5.26E+00	[8]	5.26E+00	[4]	(µg/g DW plant)/ (µg/g soil)
107-12-0	Propionitrile	3.11E+01	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	3.11E+01	[5]	(µg/g DW plant)/ (µg/g soil)
107-13-1	Acrylonitrile	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[4]	8.13E+00	[9]	8.38E+00	[4]	(µg/g DW plant)/ (µg/g soil)
107-19-7	Propargyl alcohol	6.40E+01	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	6.40E+01	[5]	(µg/g DW plant)/ (µg/g soil)
107-21-1	Ethylene glycol (1,2-ethanediol)	2.37E+02	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	2.37E+02	[5]	(µg/g DW plant)/ (µg/g soil)
107-98-2	Propylene glycol monomethyl ether	7.41E+01	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	7.41E+01	[5]	(µg/g DW plant)/ (µg/g soil)
108-05-4	Acetic acid vinyl ester	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[4]	8.13E+00	[9]	8.38E+00	[4]	(µg/g DW plant)/ (µg/g soil)
108-10-1	4-Methyl-2-pentanone	7.84E+00	(µg/g DW plant)/ (µg/g soil)	[4]	7.84E+00	[8]	7.84E+00	[4]	(µg/g DW plant)/ (µg/g soil)

Table 3-3 Plant-Soil Bioconcentration Factors for Aboveground Silage and Forage

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Forage from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Forage	Reference	Plant-Soil Bioconcentration Factor in Silage (Br_{silage})	Reference	Plant-Soil Bioconcentration Factor in Forage (Br_{forage})	Reference	Units for Plant-Soil Bioconcentration Factor in Silage and Forage
108-39-4	m-Cresol	2.85E+00	(µg/g DW plant)/ (µg/g soil)	[4]	2.85E+00	[8]	2.85E+00	[4]	(µg/g DW plant)/ (µg/g soil)
108-60-1	bis (2-Chloroisopropyl)ether	1.40E+00	(µg/g DW plant)/ (µg/g soil)	[5]	1.40E+00	[10]	1.40E+00	[5]	(µg/g DW plant)/ (µg/g soil)
108-67-8	1,3,5-Trimethylbenzene	4.09E-01	(µg/g DW plant)/ (µg/g soil)	[4]	4.09E-01	[8]	4.09E-01	[4]	(µg/g DW plant)/ (µg/g soil)
108-86-1	Bromobenzene (Phenyl bromide)	7.10E-01	(µg/g DW plant)/ (µg/g soil)	[5]	7.10E-01	[10]	7.10E-01	[5]	(µg/g DW plant)/ (µg/g soil)
108-87-2	Methylcyclohexane	3.10E-01	(µg/g DW plant)/ (µg/g soil)	[5]	3.10E-01	[10]	3.10E-01	[5]	(µg/g DW plant)/ (µg/g soil)
108-88-3	Toluene	1.07E+00	(µg/g DW plant)/ (µg/g soil)	[4]	1.07E+00	[8]	1.07E+00	[4]	(µg/g DW plant)/ (µg/g soil)
108-90-7	Chlorobenzene	9.32E-01	(µg/g DW plant)/ (µg/g soil)	[4]	9.32E-01	[8]	9.32E-01	[4]	(µg/g DW plant)/ (µg/g soil)
108-94-1	Cyclohexanone	1.31E+01	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	1.31E+01	[5]	(µg/g DW plant)/ (µg/g soil)
108-95-2	Phenol	5.26E+00	(µg/g DW plant)/ (µg/g soil)	[4]	5.26E+00	[8]	5.26E+00	[4]	(µg/g DW plant)/ (µg/g soil)
109-74-0	n-Butanenitrile	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.13E+00	[9]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
109-75-1	3-Butenenitrile	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.13E+00	[9]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
109-77-3	Malononitrile	8.58E+01	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	8.58E+01	[5]	(µg/g DW plant)/ (µg/g soil)
109-86-4	2-Methoxyethanol	1.08E+02	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	1.08E+02	[5]	(µg/g DW plant)/ (µg/g soil)
109-99-9	Tetrahydrofuran	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[4]	8.13E+00	[9]	8.38E+00	[4]	(µg/g DW plant)/ (µg/g soil)
110-00-9	Furan	6.43E+00	(µg/g DW plant)/ (µg/g soil)	[5]	6.43E+00	[10]	6.43E+00	[5]	(µg/g DW plant)/ (µg/g soil)
110-54-3	n-Hexane	2.10E-01	(µg/g DW plant)/ (µg/g soil)	[5]	2.10E-01	[10]	2.10E-01	[5]	(µg/g DW plant)/ (µg/g soil)
110-59-8	Pentanenitrile	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.13E+00	[9]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)

Table 3-3 Plant-Soil Bioconcentration Factors for Aboveground Silage and Forage

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Forage from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Forage	Reference	Plant-Soil Bioconcentration Factor in Silage (Br_{silage})	Reference	Plant-Soil Bioconcentration Factor in Forage (Br_{forage})	Reference	Units for Plant-Soil Bioconcentration Factor in Silage and Forage
110-80-5	2-Ethoxyethanol	5.90E+01	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	5.90E+01	[5]	(µg/g DW plant)/ (µg/g soil)
110-82-7	Cyclohexane	3.89E-01	(µg/g DW plant)/ (µg/g soil)	[5]	3.89E-01	[10]	3.89E-01	[5]	(µg/g DW plant)/ (µg/g soil)
110-83-8	Cyclohexene	8.45E-01	(µg/g DW plant)/ (µg/g soil)	[5]	8.45E-01	[10]	8.45E-01	[5]	(µg/g DW plant)/ (µg/g soil)
110-86-1	Pyridine	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[4]	8.13E+00	[9]	8.38E+00	[4]	(µg/g DW plant)/ (µg/g soil)
111-15-9	Ethylene glycol monoethyl ether acetate	1.75E+01	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	1.75E+01	[5]	(µg/g DW plant)/ (µg/g soil)
111-44-4	Bis(2-chloroethyl)ether	6.96E+00	(µg/g DW plant)/ (µg/g soil)	[4]	6.96E+00	[8]	6.96E+00	[4]	(µg/g DW plant)/ (µg/g soil)
111-65-9	n-Octane	3.93E-02	(µg/g DW plant)/ (µg/g soil)	[3]	3.93E-02	[2]	3.93E-02	[3]	(µg/g DW plant)/ (µg/g soil)
111-76-2	2-Butoxyethanol	1.27E+01	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	1.27E+01	[5]	(µg/g DW plant)/ (µg/g soil)
111-84-2	n-Nonane	2.03E-02	(µg/g DW plant)/ (µg/g soil)	[5]	2.03E-02	[10]	2.03E-02	[5]	(µg/g DW plant)/ (µg/g soil)
111-91-1	Bis(2-chloroethoxy)methane	6.78E+00	(µg/g DW plant)/ (µg/g soil)	[5]	6.78E+00	[10]	6.78E+00	[5]	(µg/g DW plant)/ (µg/g soil)
112-30-1	1-Decanol	8.61E-02	(µg/g DW plant)/ (µg/g soil)	[5]	8.61E-02	[10]	8.61E-02	[5]	(µg/g DW plant)/ (µg/g soil)
112-31-2	Decanal	2.60E-01	(µg/g DW plant)/ (µg/g soil)	[3]	2.60E-01	[2]	2.60E-01	[3]	(µg/g DW plant)/ (µg/g soil)
112-40-3	Dodecane	1.15E-02	(µg/g DW plant)/ (µg/g soil)	[3]	1.15E-02	[2]	1.15E-02	[3]	(µg/g DW plant)/ (µg/g soil)
1120-21-4	Undecane	1.86E-02	(µg/g DW plant)/ (µg/g soil)	[3]	1.86E-02	[2]	1.86E-02	[3]	(µg/g DW plant)/ (µg/g soil)
1120-71-4	1,3-Propane sultone	5.60E+01	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	5.60E+01	[5]	(µg/g DW plant)/ (µg/g soil)
117-81-7	Bis(2-ethylhexyl) phthalate	4.37E-02	(µg/g DW plant)/ (µg/g soil)	[4]	4.37E-02	[8]	4.37E-02	[4]	(µg/g DW plant)/ (µg/g soil)
117-84-0	Di-n-octylphthalate	8.06E-04	(µg/g DW plant)/ (µg/g soil)	[4]	8.06E-04	[8]	8.06E-04	[4]	(µg/g DW plant)/ (µg/g soil)

Table 3-3 Plant-Soil Bioconcentration Factors for Aboveground Silage and Forage

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Forage from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Forage	Reference	Plant-Soil Bioconcentration Factor in Silage (Br_{silage})	Reference	Plant-Soil Bioconcentration Factor in Forage (Br_{forage})	Reference	Units for Plant-Soil Bioconcentration Factor in Silage and Forage
118-74-1	Hexachlorobenzene	3.30E-02	(µg/g DW plant)/ (µg/g soil)	[4]	3.30E-02	[8]	3.30E-02	[4]	(µg/g DW plant)/ (µg/g soil)
119-90-4	3,3'-Dimethoxybenzidine	3.48E+00	(µg/g DW plant)/ (µg/g soil)	[4]	3.48E+00	[8]	3.48E+00	[4]	(µg/g DW plant)/ (µg/g soil)
120-12-7	Anthracene	9.71E-02	(µg/g DW plant)/ (µg/g soil)	[4]	9.71E-02	[8]	9.71E-02	[4]	(µg/g DW plant)/ (µg/g soil)
120-82-1	1,2,4-Trichlorobenzene	1.89E-01	(µg/g DW plant)/ (µg/g soil)	[4]	1.89E-01	[8]	1.89E-01	[4]	(µg/g DW plant)/ (µg/g soil)
120-83-2	2,4-Dichlorophenol	8.16E-01	(µg/g DW plant)/ (µg/g soil)	[4]	8.16E-01	[8]	8.16E-01	[4]	(µg/g DW plant)/ (µg/g soil)
121-14-2	2,4-Dinitrotoluene	2.78E+00	(µg/g DW plant)/ (µg/g soil)	[4]	2.78E+00	[8]	2.78E+00	[4]	(µg/g DW plant)/ (µg/g soil)
122-39-4	N,N-Diphenylamine	3.59E-01	(µg/g DW plant)/ (µg/g soil)	[5]	3.59E-01	[10]	3.59E-01	[5]	(µg/g DW plant)/ (µg/g soil)
122-66-7	1,2-Diphenylhydrazine	8.16E-01	(µg/g DW plant)/ (µg/g soil)	[4]	8.16E-01	[8]	8.16E-01	[4]	(µg/g DW plant)/ (µg/g soil)
123-33-1	Maleic hydrazide	1.18E+02	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	1.18E+02	[5]	(µg/g DW plant)/ (µg/g soil)
123-38-6	Propionaldehyde	1.75E+01	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	1.75E+01	[5]	(µg/g DW plant)/ (µg/g soil)
123-72-8	Butanal	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.13E+00	[9]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
123-91-1	1,4-Dioxan	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[4]	8.13E+00	[9]	8.38E+00	[4]	(µg/g DW plant)/ (µg/g soil)
124-18-5	Decane	4.78E-02	(µg/g DW plant)/ (µg/g soil)	[5]	4.78E-02	[10]	4.78E-02	[5]	(µg/g DW plant)/ (µg/g soil)
124-38-9	Carbon dioxide	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.13E+00	[9]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
124-48-1	Chlorodibromomethane	1.99E+00	(µg/g DW plant)/ (µg/g soil)	[4]	1.99E+00	[8]	1.99E+00	[4]	(µg/g DW plant)/ (µg/g soil)
126-73-8	Tributyl phosphate	1.84E-01	(µg/g DW plant)/ (µg/g soil)	[5]	1.84E-01	[10]	1.84E-01	[5]	(µg/g DW plant)/ (µg/g soil)
126-98-7	2-Methyl-2-propenenitrile	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[4]	8.13E+00	[9]	8.38E+00	[4]	(µg/g DW plant)/ (µg/g soil)

Table 3-3 Plant-Soil Bioconcentration Factors for Aboveground Silage and Forage

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Forage from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Forage	Reference	Plant-Soil Bioconcentration Factor in Silage (Br_{silage})	Reference	Plant-Soil Bioconcentration Factor in Forage (Br_{forage})	Reference	Units for Plant-Soil Bioconcentration Factor in Silage and Forage
127-18-4	1,1,2,2-Tetrachloroethene	4.20E-01	(µg/g DW plant)/(µg/g soil)	[4]	4.20E-01	[8]	4.20E-01	[4]	(µg/g DW plant)/(µg/g soil)
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	4.24E-02	(µg/g DW plant)/(µg/g soil)	[5]	4.24E-02	[10]	4.24E-02	[5]	(µg/g DW plant)/(µg/g soil)
129-00-0	Pyrene	5.70E-02	(µg/g DW plant)/(µg/g soil)	[4]	5.70E-02	[8]	5.70E-02	[4]	(µg/g DW plant)/(µg/g soil)
131-11-3	Dimethyl Phthalate	4.86E+00	(µg/g DW plant)/(µg/g soil)	[4]	4.86E+00	[8]	4.86E+00	[4]	(µg/g DW plant)/(µg/g soil)
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	1.57E-01	(µg/g DW plant)/(µg/g soil)	[5]	1.57E-01	[10]	1.57E-01	[5]	(µg/g DW plant)/(µg/g soil)
132-64-9	Dibenzofuran	1.57E-01	(µg/g DW plant)/(µg/g soil)	[5]	1.57E-01	[10]	1.57E-01	[5]	(µg/g DW plant)/(µg/g soil)
133-06-2	Captan	9.15E-01	(µg/g DW plant)/(µg/g soil)	[5]	9.15E-01	[10]	9.15E-01	[5]	(µg/g DW plant)/(µg/g soil)
1330-20-7	Xylenes (mixed isomers)	5.66E-01	(µg/g DW plant)/(µg/g soil)	[5]	5.66E-01	[10]	5.66E-01	[5]	(µg/g DW plant)/(µg/g soil)
1336-36-3	Polychlorinated biphenyls	2.93E-03	(µg/g DW plant)/(µg/g soil)	[5]	2.93E-03	[10]	2.93E-03	[5]	(µg/g DW plant)/(µg/g soil)
134-32-7	alpha-Naphthylamine	1.91E+00	(µg/g DW plant)/(µg/g soil)	[5]	1.91E+00	[10]	1.91E+00	[5]	(µg/g DW plant)/(µg/g soil)
135-98-8	sec-Butylbenzene	8.61E-02	(µg/g DW plant)/(µg/g soil)	[5]	8.61E-02	[10]	8.61E-02	[5]	(µg/g DW plant)/(µg/g soil)
13966-29-5	Uranium-234	8.50E-03	(µg/g DW plant)/(µg/g soil)	[1]	8.50E-03	[1]	8.50E-03	[1]	(µg/g DW plant)/(µg/g soil)
13967-48-1	Ruthenium-106	7.50E-02	(µg/g DW plant)/(µg/g soil)	[1]	7.50E-02	[1]	7.50E-02	[1]	(µg/g DW plant)/(µg/g soil)
13967-70-9	Cesium-134	8.00E-02	(µg/g DW plant)/(µg/g soil)	[1]	8.00E-02	[1]	8.00E-02	[1]	(µg/g DW plant)/(µg/g soil)
13968-55-3	Uranium-233	8.50E-03	(µg/g DW plant)/(µg/g soil)	[1]	8.50E-03	[1]	8.50E-03	[1]	(µg/g DW plant)/(µg/g soil)
13981-15-2	Curium-244	8.50E-04	(µg/g DW plant)/(µg/g soil)	[1]	8.50E-04	[1]	8.50E-04	[1]	(µg/g DW plant)/(µg/g soil)
13981-16-3	Plutonium-238	4.50E-04	(µg/g DW plant)/(µg/g soil)	[1]	4.50E-04	[1]	4.50E-04	[1]	(µg/g DW plant)/(µg/g soil)

Table 3-3 Plant-Soil Bioconcentration Factors for Aboveground Silage and Forage

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Forage from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Forage	Reference	Plant-Soil Bioconcentration Factor in Silage (Br_{silage})	Reference	Plant-Soil Bioconcentration Factor in Forage (Br_{forage})	Reference	Units for Plant-Soil Bioconcentration Factor in Silage and Forage
13981-37-8	Nickel-63	6.00E-02	(µg/g DW plant)/ (µg/g soil)	[1]	6.00E-02	[1]	6.00E-02	[1]	(µg/g DW plant)/ (µg/g soil)
13982-10-0	Plutonium-242	4.50E-04	(µg/g DW plant)/ (µg/g soil)	[1]	4.50E-04	[1]	4.50E-04	[1]	(µg/g DW plant)/ (µg/g soil)
13982-63-3	Radium-226	1.50E-02	(µg/g DW plant)/ (µg/g soil)	[1]	1.50E-02	[1]	1.50E-02	[1]	(µg/g DW plant)/ (µg/g soil)
13982-70-2	Uranium-236	8.50E-03	(µg/g DW plant)/ (µg/g soil)	[1]	8.50E-03	[1]	8.50E-03	[1]	(µg/g DW plant)/ (µg/g soil)
13994-20-2	Neptunium-237	1.00E-01	(µg/g DW plant)/ (µg/g soil)	[1]	1.00E-01	[1]	1.00E-01	[1]	(µg/g DW plant)/ (µg/g soil)
141-78-6	Acetic acid ethyl ester	1.45E+01	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	1.45E+01	[5]	(µg/g DW plant)/ (µg/g soil)
14119-32-5	Plutonium-241	4.50E-04	(µg/g DW plant)/ (µg/g soil)	[1]	4.50E-04	[1]	4.50E-04	[1]	(µg/g DW plant)/ (µg/g soil)
14119-33-6	Plutonium-240	4.50E-04	(µg/g DW plant)/ (µg/g soil)	[1]	4.50E-04	[1]	4.50E-04	[1]	(µg/g DW plant)/ (µg/g soil)
14133-76-7	Technetium-99	9.50E+00	(µg/g DW plant)/ (µg/g soil)	[1]	9.50E+00	[1]	9.50E+00	[1]	(µg/g DW plant)/ (µg/g soil)
14158-29-3	Uranium-232	8.50E-03	(µg/g DW plant)/ (µg/g soil)	[1]	8.50E-03	[1]	8.50E-03	[1]	(µg/g DW plant)/ (µg/g soil)
14234-35-6	Antimony-125	2.00E-01	(µg/g DW plant)/ (µg/g soil)	[1]	2.00E-01	[1]	2.00E-01	[1]	(µg/g DW plant)/ (µg/g soil)
14265-44-2	Phosphate								
14331-85-2	Protactinium-231	2.50E-03	(µg/g DW plant)/ (µg/g soil)	[1]	2.50E-03	[1]	2.50E-03	[1]	(µg/g DW plant)/ (µg/g soil)
14336-70-0	Nickel-59	6.00E-02	(µg/g DW plant)/ (µg/g soil)	[1]	6.00E-02	[1]	6.00E-02	[1]	(µg/g DW plant)/ (µg/g soil)
14391-16-3	Europium-155	1.00E-02	(µg/g DW plant)/ (µg/g soil)	[1]	1.00E-02	[1]	1.00E-02	[1]	(µg/g DW plant)/ (µg/g soil)
145-73-3	Endothall	3.00E+00	(µg/g DW plant)/ (µg/g soil)	[5]	3.00E+00	[10]	3.00E+00	[5]	(µg/g DW plant)/ (µg/g soil)
14596-10-2	Americium-241	5.50E-03	(µg/g DW plant)/ (µg/g soil)	[1]	5.50E-03	[1]	5.50E-03	[1]	(µg/g DW plant)/ (µg/g soil)
14683-23-9	Europium-152	1.00E-02	(µg/g DW plant)/ (µg/g soil)	[1]	1.00E-02	[1]	1.00E-02	[1]	(µg/g DW plant)/ (µg/g soil)

Table 3-3 Plant-Soil Bioconcentration Factors for Aboveground Silage and Forage

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Forage from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Forage	Reference	Plant-Soil Bioconcentration Factor in Silage (Br_{silage})	Reference	Plant-Soil Bioconcentration Factor in Forage (Br_{forage})	Reference	Units for Plant-Soil Bioconcentration Factor in Silage and Forage
14762-75-5	Carbon-14	7.00E-01	(µg/g DW plant)/ (µg/g soil)	[6]	7.00E-01	[11]	7.00E-01	[6]	(µg/g DW plant)/ (µg/g soil)
14797-55-8	Nitrate	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.38E+00	[7]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
14797-65-0	Nitrite								
14808-79-8	Sulfate								
14952-40-0	Actinium-227	3.50E-03	(µg/g DW plant)/ (µg/g soil)	[1]	3.50E-03	[1]	3.50E-03	[1]	(µg/g DW plant)/ (µg/g soil)
14993-75-0	Americium-243	5.50E-03	(µg/g DW plant)/ (µg/g soil)	[1]	5.50E-03	[1]	5.50E-03	[1]	(µg/g DW plant)/ (µg/g soil)
15046-84-1	Iodine-129	1.50E-01	(µg/g DW plant)/ (µg/g soil)	[1]	1.50E-01	[1]	1.50E-01	[1]	(µg/g DW plant)/ (µg/g soil)
15117-48-3	Plutonium-239	4.50E-04	(µg/g DW plant)/ (µg/g soil)	[1]	4.50E-04	[1]	4.50E-04	[1]	(µg/g DW plant)/ (µg/g soil)
15117-96-1	Uranium-235	8.50E-03	(µg/g DW plant)/ (µg/g soil)	[1]	8.50E-03	[1]	8.50E-03	[1]	(µg/g DW plant)/ (µg/g soil)
15262-20-1	Radium-228	1.50E-02	(µg/g DW plant)/ (µg/g soil)	[1]	1.50E-02	[1]	1.50E-02	[1]	(µg/g DW plant)/ (µg/g soil)
15510-73-3	Curium-242	8.50E-04	(µg/g DW plant)/ (µg/g soil)	[1]	8.50E-04	[1]	8.50E-04	[1]	(µg/g DW plant)/ (µg/g soil)
15585-10-1	Europium-154	1.00E-02	(µg/g DW plant)/ (µg/g soil)	[1]	1.00E-02	[1]	1.00E-02	[1]	(µg/g DW plant)/ (µg/g soil)
15594-54-4	Thorium-229	8.50E-04	(µg/g DW plant)/ (µg/g soil)	[1]	8.50E-04	[1]	8.50E-04	[1]	(µg/g DW plant)/ (µg/g soil)
156-59-2	cis-1,2-Dichloroethene	3.09E+00	(µg/g DW plant)/ (µg/g soil)	[4]	3.09E+00	[8]	3.09E+00	[4]	(µg/g DW plant)/ (µg/g soil)
156-60-5	1,2-trans-Dichloroethene	2.37E+00	(µg/g DW plant)/ (µg/g soil)	[4]	2.37E+00	[8]	2.37E+00	[4]	(µg/g DW plant)/ (µg/g soil)
15715-94-3	Samarium-151	1.00E-02	(µg/g DW plant)/ (µg/g soil)	[1]	1.00E-02	[1]	1.00E-02	[1]	(µg/g DW plant)/ (µg/g soil)
15751-77-6	Zirconium-93	2.00E-03	(µg/g DW plant)/ (µg/g soil)	[1]	2.00E-03	[1]	2.00E-03	[1]	(µg/g DW plant)/ (µg/g soil)
15757-87-6	Curium-243	8.50E-04	(µg/g DW plant)/ (µg/g soil)	[1]	8.50E-04	[1]	8.50E-04	[1]	(µg/g DW plant)/ (µg/g soil)

Table 3-3 Plant-Soil Bioconcentration Factors for Aboveground Silage and Forage

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Forage from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Forage	Reference	Plant-Soil Bioconcentration Factor in Silage (Br_{silage})	Reference	Plant-Soil Bioconcentration Factor in Forage (Br_{forage})	Reference	Units for Plant-Soil Bioconcentration Factor in Silage and Forage
15758-45-9	Selenium-79	2.50E-02	(µg/g DW plant)/ (µg/g soil)	[1]	2.50E-02	[1]	2.50E-02	[1]	(µg/g DW plant)/ (µg/g soil)
15832-50-5	Tin-126	3.00E-02	(µg/g DW plant)/ (µg/g soil)	[1]	3.00E-02	[1]	3.00E-02	[1]	(µg/g DW plant)/ (µg/g soil)
1634-04-4	Methyl tert-butyl ether	1.10E+01	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	1.10E+01	[5]	(µg/g DW plant)/ (µg/g soil)
16887-00-6	Chloride	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.38E+00	[7]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
16984-48-8	Fluoride	6.00E-02	(µg/g DW plant)/ (µg/g soil)	[5]	6.00E-02	[10]	6.00E-02	[5]	(µg/g DW plant)/ (µg/g soil)
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	4.55E-03	(µg/g DW plant)/ (µg/g soil)	[4]	4.55E-03	[8]	4.55E-03	[4]	(µg/g DW plant)/ (µg/g soil)
18540-29-9	Chromium(VI)	7.50E-03	(µg/g DW plant)/ (µg/g soil)	[1]	7.50E-03	[1]	7.50E-03	[1]	(µg/g DW plant)/ (µg/g soil)
189-55-9	Dibenzo[a,i]pyrene	2.31E-03	(µg/g DW plant)/ (µg/g soil)	[5]	2.31E-03	[10]	2.31E-03	[5]	(µg/g DW plant)/ (µg/g soil)
189-64-0	Dibenzo[a,h]pyrene	2.31E-03	(µg/g DW plant)/ (µg/g soil)	[5]	2.31E-03	[10]	2.31E-03	[5]	(µg/g DW plant)/ (µg/g soil)
191-24-2	Benzo(g,h,i)perylene	5.50E-03	(µg/g DW plant)/ (µg/g soil)	[5]	5.50E-03	[10]	5.50E-03	[5]	(µg/g DW plant)/ (µg/g soil)
191-30-0	Dibenzo(a,l)pyrene	1.30E-03	(µg/g DW plant)/ (µg/g soil)	[5]	1.30E-03	[10]	1.30E-03	[5]	(µg/g DW plant)/ (µg/g soil)
192-65-4	Dibenzo[a,e]pyrene	1.30E-03	(µg/g DW plant)/ (µg/g soil)	[5]	1.30E-03	[10]	1.30E-03	[5]	(µg/g DW plant)/ (µg/g soil)
192-97-2	Benzo(e)pyrene	7.34E-03	(µg/g DW plant)/ (µg/g soil)	[3]	7.34E-03	[2]	7.34E-03	[3]	(µg/g DW plant)/ (µg/g soil)
193-39-5	Indeno(1,2,3-cd)pyrene	5.93E-03	(µg/g DW plant)/ (µg/g soil)	[4]	5.93E-03	[8]	5.93E-03	[4]	(µg/g DW plant)/ (µg/g soil)
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	2.34E-03	(µg/g DW plant)/ (µg/g soil)	[4]	2.34E-03	[8]	2.34E-03	[4]	(µg/g DW plant)/ (µg/g soil)
205-82-3	Benzo[j]fluoranthene	1.10E-02	(µg/g DW plant)/ (µg/g soil)	[5]	1.10E-02	[10]	1.10E-02	[5]	(µg/g DW plant)/ (µg/g soil)
205-99-2	Benzo(b)fluoranthene	1.12E-02	(µg/g DW plant)/ (µg/g soil)	[4]	1.12E-02	[8]	1.12E-02	[4]	(µg/g DW plant)/ (µg/g soil)

Table 3-3 Plant-Soil Bioconcentration Factors for Aboveground Silage and Forage

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Forage from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Forage	Reference	Plant-Soil Bioconcentration Factor in Silage (Br_{silage})	Reference	Plant-Soil Bioconcentration Factor in Forage (Br_{forage})	Reference	Units for Plant-Soil Bioconcentration Factor in Silage and Forage
206-44-0	Fluoranthene	4.99E-02	(µg/g DW plant)/ (µg/g soil)	[4]	4.99E-02	[8]	4.99E-02	[4]	(µg/g DW plant)/ (µg/g soil)
207-08-9	Benzo(k)fluoranthene	1.15E-02	(µg/g DW plant)/ (µg/g soil)	[4]	1.15E-02	[8]	1.15E-02	[4]	(µg/g DW plant)/ (µg/g soil)
208-96-8	Acenaphthylene	2.00E-01	(µg/g DW plant)/ (µg/g soil)	[5]	2.00E-01	[10]	2.00E-01	[5]	(µg/g DW plant)/ (µg/g soil)
218-01-9	Chrysene	1.97E-02	(µg/g DW plant)/ (µg/g soil)	[4]	1.97E-02	[8]	1.97E-02	[4]	(µg/g DW plant)/ (µg/g soil)
224-42-0	Dibenz[a,j]acridine	2.09E-02	(µg/g DW plant)/ (µg/g soil)	[5]	2.09E-02	[10]	2.09E-02	[5]	(µg/g DW plant)/ (µg/g soil)
2245-38-7	2,3,5-Trimethylnaphthalene	6.42E-02	(µg/g DW plant)/ (µg/g soil)	[3]	6.42E-02	[2]	6.42E-02	[3]	(µg/g DW plant)/ (µg/g soil)
226-36-8	Dibenz[a,h]acridine	1.83E-02	(µg/g DW plant)/ (µg/g soil)	[5]	1.83E-02	[10]	1.83E-02	[5]	(µg/g DW plant)/ (µg/g soil)
22967-92-6	Methyl mercury	0.00E+00	(µg/g DW plant)/ (µg/g soil)	[4]	0.00E+00	[8]	0.00E+00	[4]	(µg/g DW plant)/ (µg/g soil)
23950-58-5	Pronamide	4.03E-01	(µg/g DW plant)/ (µg/g soil)	[4]	4.03E-01	[8]	4.03E-01	[4]	(µg/g DW plant)/ (µg/g soil)
24959-67-9	Bromide	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.38E+00	[7]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
27154-33-2	Trichlorofluoroethane	1.39E+00	(µg/g DW plant)/ (µg/g soil)	[10]	1.39E+00	[6]	1.39E+00	[10]	(µg/g DW plant)/ (µg/g soil)
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	2.86E-03	(µg/g DW plant)/ (µg/g soil)	[5]	2.86E-03	[10]	2.86E-03	[5]	(µg/g DW plant)/ (µg/g soil)
319-84-6	alpha-BHC	2.46E-01	(µg/g DW plant)/ (µg/g soil)	[4]	2.46E-01	[8]	2.46E-01	[4]	(µg/g DW plant)/ (µg/g soil)
319-85-7	beta-BHC	2.46E-01	(µg/g DW plant)/ (µg/g soil)	[4]	2.46E-01	[8]	2.46E-01	[4]	(µg/g DW plant)/ (µg/g soil)
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	5.50E-03	(µg/g DW plant)/ (µg/g soil)	[5]	5.50E-03	[10]	5.50E-03	[5]	(µg/g DW plant)/ (µg/g soil)
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	4.44E-03	(µg/g DW plant)/ (µg/g soil)	[5]	4.44E-03	[10]	4.44E-03	[5]	(µg/g DW plant)/ (µg/g soil)

Table 3-3 Plant-Soil Bioconcentration Factors for Aboveground Silage and Forage

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Forage from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Forage	Reference	Plant-Soil Bioconcentration Factor in Silage (Br_{silage})	Reference	Plant-Soil Bioconcentration Factor in Forage (Br_{forage})	Reference	Units for Plant-Soil Bioconcentration Factor in Silage and Forage
3268-87-9	Octachlorodibenzo(p)dioxin	7.05E-04	(µg/g DW plant)/(µg/g soil)	[4]	7.05E-04	[8]	7.05E-04	[4]	(µg/g DW plant)/(µg/g soil)
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	1.94E-03	(µg/g DW plant)/(µg/g soil)	[5]	1.94E-03	[10]	1.94E-03	[5]	(µg/g DW plant)/(µg/g soil)
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	9.20E-04	(µg/g DW plant)/(µg/g soil)	[4]	9.20E-04	[8]	9.20E-04	[4]	(µg/g DW plant)/(µg/g soil)
3697-24-3	5-Methylchrysene	1.16E-02	(µg/g DW plant)/(µg/g soil)	[5]	1.16E-02	[10]	1.16E-02	[5]	(µg/g DW plant)/(µg/g soil)
378253-40-8	Barium-137m	1.50E-01	(µg/g DW plant)/(µg/g soil)	[1]	1.50E-01	[1]	1.50E-01	[1]	(µg/g DW plant)/(µg/g soil)
378253-44-2	Cadmium-113m	5.50E-01	(µg/g DW plant)/(µg/g soil)	[1]	5.50E-01	[1]	5.50E-01	[1]	(µg/g DW plant)/(µg/g soil)
378782-82-2	Niobium-93m	2.00E-02	(µg/g DW plant)/(µg/g soil)	[1]	2.00E-02	[1]	2.00E-02	[1]	(µg/g DW plant)/(µg/g soil)
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	1.50E-03	(µg/g DW plant)/(µg/g soil)	[5]	1.50E-03	[10]	1.50E-03	[5]	(µg/g DW plant)/(µg/g soil)
39001-02-0	Octachlorodibenzofuran	9.20E-04	(µg/g DW plant)/(µg/g soil)	[4]	9.20E-04	[8]	9.20E-04	[4]	(µg/g DW plant)/(µg/g soil)
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	1.20E-03	(µg/g DW plant)/(µg/g soil)	[4]	1.20E-03	[8]	1.20E-03	[4]	(µg/g DW plant)/(µg/g soil)
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	6.15E-04	(µg/g DW plant)/(µg/g soil)	[5]	6.15E-04	[10]	6.15E-04	[5]	(µg/g DW plant)/(µg/g soil)
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	5.62E-03	(µg/g DW plant)/(µg/g soil)	[4]	5.62E-03	[8]	5.62E-03	[4]	(µg/g DW plant)/(µg/g soil)
4170-30-3	Crotonaldehyde (Propylene aldehyde)	1.73E+01	(µg/g DW plant)/(µg/g soil)	[5]	8.13E+00	[9]	1.73E+01	[5]	(µg/g DW plant)/(µg/g soil)
41851-50-7	Chlorocyclopentadiene	1.50E+00	(µg/g DW plant)/(µg/g soil)	[5]	1.50E+00	[10]	1.50E+00	[5]	(µg/g DW plant)/(µg/g soil)
460-19-5	Cyanogen (oxalonitrile)	3.46E+01	(µg/g DW plant)/(µg/g soil)	[5]	8.13E+00	[9]	3.46E+01	[5]	(µg/g DW plant)/(µg/g soil)

Table 3-3 Plant-Soil Bioconcentration Factors for Aboveground Silage and Forage

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Forage from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Forage	Reference	Plant-Soil Bioconcentration Factor in Silage (Br_{silage})	Reference	Plant-Soil Bioconcentration Factor in Forage (Br_{forage})	Reference	Units for Plant-Soil Bioconcentration Factor in Silage and Forage
4786-20-3	2-Butenenitrile	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.13E+00	[9]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
50-00-0	Formaldehyde	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[4]	8.13E+00	[9]	8.38E+00	[4]	(µg/g DW plant)/ (µg/g soil)
50-32-8	Benzo(a)pyrene	1.32E-02	(µg/g DW plant)/ (µg/g soil)	[4]	1.32E-02	[8]	1.32E-02	[4]	(µg/g DW plant)/ (µg/g soil)
506-68-3	Cyanogen bromide (bromocyanide)	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.13E+00	[9]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
506-77-4	Cyanogen chloride	2.91E+01	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	2.91E+01	[5]	(µg/g DW plant)/ (µg/g soil)
51-28-5	2,4-Dinitrophenol	4.99E+00	(µg/g DW plant)/ (µg/g soil)	[4]	4.99E+00	[8]	4.99E+00	[4]	(µg/g DW plant)/ (µg/g soil)
51-79-6	Ethyl carbamate (urethane)	4.70E+01	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	4.70E+01	[5]	(µg/g DW plant)/ (µg/g soil)
510-15-6	Chlorobenzilate	1.17E-01	(µg/g DW plant)/ (µg/g soil)	[4]	1.17E-01	[8]	1.17E-01	[4]	(µg/g DW plant)/ (µg/g soil)
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	1.15E-02	(µg/g DW plant)/ (µg/g soil)	[4]	1.15E-02	[8]	1.15E-02	[4]	(µg/g DW plant)/ (µg/g soil)
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	1.72E-03	(µg/g DW plant)/ (µg/g soil)	[5]	1.72E-03	[10]	1.72E-03	[5]	(µg/g DW plant)/ (µg/g soil)
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	4.03E+00	(µg/g DW plant)/ (µg/g soil)	[5]	4.03E+00	[10]	4.03E+00	[5]	(µg/g DW plant)/ (µg/g soil)
53-70-3	Dibenz[a,h]anthracene	6.78E-03	(µg/g DW plant)/ (µg/g soil)	[4]	6.78E-03	[8]	6.78E-03	[4]	(µg/g DW plant)/ (µg/g soil)
532-27-4	2-Chloroacetophenone	2.92E+00	(µg/g DW plant)/ (µg/g soil)	[5]	2.92E+00	[10]	2.92E+00	[5]	(µg/g DW plant)/ (µg/g soil)
534-52-1	4,6-Dinitro-o-cresol	2.24E+00	(µg/g DW plant)/ (µg/g soil)	[5]	2.24E+00	[10]	2.24E+00	[5]	(µg/g DW plant)/ (µg/g soil)
5385-75-1	Dibenzo(a,e)fluoranthene	2.31E-03	(µg/g DW plant)/ (µg/g soil)	[9]	2.31E-03	[5]	2.31E-03	[9]	(µg/g DW plant)/ (µg/g soil)
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	2.36E+00	(µg/g DW plant)/ (µg/g soil)	[5]	2.36E+00	[10]	2.36E+00	[5]	(µg/g DW plant)/ (µg/g soil)

Table 3-3 Plant-Soil Bioconcentration Factors for Aboveground Silage and Forage

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Forage from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Forage	Reference	Plant-Soil Bioconcentration Factor in Silage (Br_{silage})	Reference	Plant-Soil Bioconcentration Factor in Forage (Br_{forage})	Reference	Units for Plant-Soil Bioconcentration Factor in Silage and Forage
540-73-8	1,2-Dimethylhydrazine	7.92E+01	(µg/g DW plant)/(µg/g soil)	[5]	8.13E+00	[9]	7.92E+01	[5]	(µg/g DW plant)/(µg/g soil)
540-84-1	2,2,4-Trimethylpentane	1.63E-01	(µg/g DW plant)/(µg/g soil)	[5]	1.63E-01	[10]	1.63E-01	[5]	(µg/g DW plant)/(µg/g soil)
541-73-1	1,3-Dichlorobenzene	3.22E-01	(µg/g DW plant)/(µg/g soil)	[4]	3.22E-01	[8]	3.22E-01	[4]	(µg/g DW plant)/(µg/g soil)
542-75-6	1,3-Dichloropropene	4.60E+00	(µg/g DW plant)/(µg/g soil)	[4]	4.60E+00	[8]	4.60E+00	[4]	(µg/g DW plant)/(µg/g soil)
542-88-1	Bis(chloromethyl)ether	1.80E+01	(µg/g DW plant)/(µg/g soil)	[5]	8.13E+00	[9]	1.80E+01	[5]	(µg/g DW plant)/(µg/g soil)
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	2.05E-03	(µg/g DW plant)/(µg/g soil)	[4]	2.05E-03	[8]	2.05E-03	[4]	(µg/g DW plant)/(µg/g soil)
56-23-5	Carbon tetrachloride	9.32E-01	(µg/g DW plant)/(µg/g soil)	[4]	9.32E-01	[8]	9.32E-01	[4]	(µg/g DW plant)/(µg/g soil)
56-49-5	3-Methylcholanthrene	7.28E-03	(µg/g DW plant)/(µg/g soil)	[5]	7.28E-03	[10]	7.28E-03	[5]	(µg/g DW plant)/(µg/g soil)
56-55-3	Benzo(a)anthracene	1.97E-02	(µg/g DW plant)/(µg/g soil)	[4]	1.97E-02	[8]	1.97E-02	[4]	(µg/g DW plant)/(µg/g soil)
57-12-5	Cyanide	8.38E+00	(µg/g DW plant)/(µg/g soil)	[4]	8.38E+00	[8]	8.38E+00	[4]	(µg/g DW plant)/(µg/g soil)
57-24-9	Strychnine	2.97E+00	(µg/g DW plant)/(µg/g soil)	[4]	2.97E+00	[8]	2.97E+00	[4]	(µg/g DW plant)/(µg/g soil)
57-74-9	Chlordane	2.56E-02	(µg/g DW plant)/(µg/g soil)	[4]	2.56E-02	[8]	2.56E-02	[4]	(µg/g DW plant)/(µg/g soil)
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	6.78E-03	(µg/g DW plant)/(µg/g soil)	[4]	6.78E-03	[8]	6.78E-03	[4]	(µg/g DW plant)/(µg/g soil)
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	4.61E-03	(µg/g DW plant)/(µg/g soil)	[4]	4.61E-03	[8]	4.61E-03	[4]	(µg/g DW plant)/(µg/g soil)
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	3.48E-03	(µg/g DW plant)/(µg/g soil)	[4]	3.48E-03	[8]	3.48E-03	[4]	(µg/g DW plant)/(µg/g soil)

Table 3-3 Plant-Soil Bioconcentration Factors for Aboveground Silage and Forage

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Forage from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Forage	Reference	Plant-Soil Bioconcentration Factor in Silage (Br_{silage})	Reference	Plant-Soil Bioconcentration Factor in Forage (Br_{forage})	Reference	Units for Plant-Soil Bioconcentration Factor in Silage and Forage
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	3.44E-03	(µg/g DW plant)/(µg/g soil)	[5]	3.44E-03	[10]	3.44E-03	[5]	(µg/g DW plant)/(µg/g soil)
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	2.33E-03	(µg/g DW plant)/(µg/g soil)	[4]	2.33E-03	[8]	2.33E-03	[4]	(µg/g DW plant)/(µg/g soil)
58-89-9	gamma-BHC (Lindane)	2.68E-01	(µg/g DW plant)/(µg/g soil)	[5]	2.68E-01	[10]	2.68E-01	[5]	(µg/g DW plant)/(µg/g soil)
58-90-2	2,3,4,6-Tetrachlorophenol	1.04E-01	(µg/g DW plant)/(µg/g soil)	[4]	1.04E-01	[8]	1.04E-01	[4]	(µg/g DW plant)/(µg/g soil)
581-42-0	2,6-Dimethylnaphthalene	1.25E-01	(µg/g DW plant)/(µg/g soil)	[3]	1.25E-01	[2]	1.25E-01	[3]	(µg/g DW plant)/(µg/g soil)
584-84-9	2,4-Toluene diisocyanate	2.78E+00	(µg/g DW plant)/(µg/g soil)	[7]	2.78E+00	[3]	2.78E+00	[7]	(µg/g DW plant)/(µg/g soil)
589-38-8	3-Hexanone	7.43E+00	(µg/g DW plant)/(µg/g soil)	[3]	7.43E+00	[2]	7.43E+00	[3]	(µg/g DW plant)/(µg/g soil)
59-50-7	4-Chloro-3-methylphenol	6.25E-01	(µg/g DW plant)/(µg/g soil)	[4]	6.25E-01	[8]	6.25E-01	[4]	(µg/g DW plant)/(µg/g soil)
59-89-2	N-Nitrosomorpholine	6.93E+01	(µg/g DW plant)/(µg/g soil)	[5]	8.13E+00	[9]	6.93E+01	[5]	(µg/g DW plant)/(µg/g soil)
591-50-4	Benzene, iodo-	5.12E-01	(µg/g DW plant)/(µg/g soil)	[3]	5.12E-01	[2]	5.12E-01	[3]	(µg/g DW plant)/(µg/g soil)
591-78-6	2-Hexanone	6.10E+00	(µg/g DW plant)/(µg/g soil)	[5]	6.10E+00	[10]	6.10E+00	[5]	(µg/g DW plant)/(µg/g soil)
593-60-2	Bromoethene (Vinyl bromide)	4.73E+00	(µg/g DW plant)/(µg/g soil)	[5]	4.73E+00	[10]	4.73E+00	[5]	(µg/g DW plant)/(µg/g soil)
593-74-8	Dimethyl Mercury	1.21E+00	(µg/g DW plant)/(µg/g soil)	[5]	1.21E+00	[10]	1.21E+00	[5]	(µg/g DW plant)/(µg/g soil)
60-11-7	Dimethyl aminoazobenzene	8.49E-02	(µg/g DW plant)/(µg/g soil)	[5]	8.49E-02	[10]	8.49E-02	[5]	(µg/g DW plant)/(µg/g soil)
60-29-7	Ethyl ether	1.17E+01	(µg/g DW plant)/(µg/g soil)	[5]	8.13E+00	[9]	1.17E+01	[5]	(µg/g DW plant)/(µg/g soil)
60-35-5	Acetamide	2.07E+02	(µg/g DW plant)/(µg/g soil)	[5]	8.13E+00	[9]	2.07E+02	[5]	(µg/g DW plant)/(µg/g soil)
602-87-9	5-Nitroacenaphthene	2.25E-01	(µg/g DW plant)/(µg/g soil)	[5]	2.25E-01	[10]	2.25E-01	[5]	(µg/g DW plant)/(µg/g soil)

Table 3-3 Plant-Soil Bioconcentration Factors for Aboveground Silage and Forage

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Forage from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Forage	Reference	Plant-Soil Bioconcentration Factor in Silage (Br_{silage})	Reference	Plant-Soil Bioconcentration Factor in Forage (Br_{forage})	Reference	Units for Plant-Soil Bioconcentration Factor in Silage and Forage
606-20-2	2,6-Dinitrotoluene	3.93E+00	(µg/g DW plant)/ (µg/g soil)	[4]	3.93E+00	[8]	3.93E+00	[4]	(µg/g DW plant)/ (µg/g soil)
608-93-5	Pentachlorobenzene	3.98E-02	(µg/g DW plant)/ (µg/g soil)	[4]	3.98E-02	[8]	3.98E-02	[4]	(µg/g DW plant)/ (µg/g soil)
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	3.48E-03	(µg/g DW plant)/ (µg/g soil)	[4]	3.48E-03	[8]	3.48E-03	[4]	(µg/g DW plant)/ (µg/g soil)
61626-71-9	Dichloropentadiene	1.50E+00	(µg/g DW plant)/ (µg/g soil)	[8]	1.50E+00	[4]	1.50E+00	[8]	(µg/g DW plant)/ (µg/g soil)
62-50-0	Ethyl methanesulfonate	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[4]	8.13E+00	[9]	8.38E+00	[4]	(µg/g DW plant)/ (µg/g soil)
62-53-3	Aniline	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[4]	8.13E+00	[9]	8.38E+00	[4]	(µg/g DW plant)/ (µg/g soil)
62-75-9	N-Nitroso-N,N-dimethylamine	8.24E+01	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	8.24E+01	[5]	(µg/g DW plant)/ (µg/g soil)
621-64-7	N-Nitroso-di-n-propylamine	6.34E+00	(µg/g DW plant)/ (µg/g soil)	[4]	6.34E+00	[8]	6.34E+00	[4]	(µg/g DW plant)/ (µg/g soil)
624-83-9	Methyl isocyanate	1.34E+01	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	1.34E+01	[5]	(µg/g DW plant)/ (µg/g soil)
628-73-9	Hexanenitrile	4.25E+00	(µg/g DW plant)/ (µg/g soil)	[3]	4.25E+00	[2]	4.25E+00	[3]	(µg/g DW plant)/ (µg/g soil)
630-08-0	Carbon monoxide	2.26E+01	(µg/g DW plant)/ (µg/g soil)	[5]	2.26E+01	[10]	2.26E+01	[5]	(µg/g DW plant)/ (µg/g soil)
630-20-6	1,1,1,2-Tetrachloroethane	6.87E-01	(µg/g DW plant)/ (µg/g soil)	[4]	6.87E-01	[8]	6.87E-01	[4]	(µg/g DW plant)/ (µg/g soil)
64-18-6	Formic acid (methanoic acid)	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[4]	8.13E+00	[9]	8.38E+00	[4]	(µg/g DW plant)/ (µg/g soil)
65-85-0	Benzoic acid	3.21E+00	(µg/g DW plant)/ (µg/g soil)	[4]	3.21E+00	[8]	3.21E+00	[4]	(µg/g DW plant)/ (µg/g soil)
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	3.44E-03	(µg/g DW plant)/ (µg/g soil)	[5]	3.44E-03	[10]	3.44E-03	[5]	(µg/g DW plant)/ (µg/g soil)
67-56-1	Methyl alcohol	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[4]	8.13E+00	[9]	8.38E+00	[4]	(µg/g DW plant)/ (µg/g soil)
67-63-0	2-Propyl alcohol	3.60E+01	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	3.60E+01	[5]	(µg/g DW plant)/ (µg/g soil)

Table 3-3 Plant-Soil Bioconcentration Factors for Aboveground Silage and Forage

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Forage from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Forage	Reference	Plant-Soil Bioconcentration Factor in Silage (Br_{silage})	Reference	Plant-Soil Bioconcentration Factor in Forage (Br_{forage})	Reference	Units for Plant-Soil Bioconcentration Factor in Silage and Forage
67-64-1	2-Propanone (Acetone)	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[4]	8.13E+00	[9]	8.38E+00	[4]	(µg/g DW plant)/ (µg/g soil)
67-66-3	Chloroform	2.70E+00	(µg/g DW plant)/ (µg/g soil)	[4]	2.70E+00	[8]	2.70E+00	[4]	(µg/g DW plant)/ (µg/g soil)
67-72-1	Hexachloroethane	2.07E-01	(µg/g DW plant)/ (µg/g soil)	[4]	2.07E-01	[8]	2.07E-01	[4]	(µg/g DW plant)/ (µg/g soil)
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	2.05E-03	(µg/g DW plant)/ (µg/g soil)	[4]	2.05E-03	[8]	2.05E-03	[4]	(µg/g DW plant)/ (µg/g soil)
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	1.50E-03	(µg/g DW plant)/ (µg/g soil)	[5]	1.50E-03	[10]	1.50E-03	[5]	(µg/g DW plant)/ (µg/g soil)
70-30-4	Hexachlorophene	1.70E-03	(µg/g DW plant)/ (µg/g soil)	[4]	1.70E-03	[8]	1.70E-03	[4]	(µg/g DW plant)/ (µg/g soil)
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	8.10E-03	(µg/g DW plant)/ (µg/g soil)	[5]	8.10E-03	[10]	8.10E-03	[5]	(µg/g DW plant)/ (µg/g soil)
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	3.48E-03	(µg/g DW plant)/ (µg/g soil)	[4]	3.48E-03	[8]	3.48E-03	[4]	(µg/g DW plant)/ (µg/g soil)
71-36-3	n-Butyl alcohol	1.19E+01	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	1.19E+01	[5]	(µg/g DW plant)/ (µg/g soil)
71-43-2	Benzene	2.37E+00	(µg/g DW plant)/ (µg/g soil)	[4]	2.37E+00	[8]	2.37E+00	[4]	(µg/g DW plant)/ (µg/g soil)
71-55-6	1,1,1-Trichloroethane	1.39E+00	(µg/g DW plant)/ (µg/g soil)	[4]	1.39E+00	[8]	1.39E+00	[4]	(µg/g DW plant)/ (µg/g soil)
72-43-5	Methoxychlor	6.51E-02	(µg/g DW plant)/ (µg/g soil)	[4]	6.51E-02	[8]	6.51E-02	[4]	(µg/g DW plant)/ (µg/g soil)
72-55-9	4,4-DDE	1.97E-02	(µg/g DW plant)/ (µg/g soil)	[4]	1.97E-02	[8]	1.97E-02	[4]	(µg/g DW plant)/ (µg/g soil)
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	3.48E-03	(µg/g DW plant)/ (µg/g soil)	[4]	3.48E-03	[8]	3.48E-03	[4]	(µg/g DW plant)/ (µg/g soil)
74-83-9	Bromomethane	7.95E+00	(µg/g DW plant)/ (µg/g soil)	[4]	7.95E+00	[8]	7.95E+00	[4]	(µg/g DW plant)/ (µg/g soil)

Table 3-3 Plant-Soil Bioconcentration Factors for Aboveground Silage and Forage

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Forage from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Forage	Reference	Plant-Soil Bioconcentration Factor in Silage (Br_{silage})	Reference	Plant-Soil Bioconcentration Factor in Forage (Br_{forage})	Reference	Units for Plant-Soil Bioconcentration Factor in Silage and Forage
74-87-3	Chloromethane	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[4]	8.13E+00	[9]	8.38E+00	[4]	(µg/g DW plant)/ (µg/g soil)
74-88-4	Iodomethane	5.12E+00	(µg/g DW plant)/ (µg/g soil)	[5]	5.12E+00	[10]	5.12E+00	[5]	(µg/g DW plant)/ (µg/g soil)
74-95-3	Methylene bromide	5.06E+00	(µg/g DW plant)/ (µg/g soil)	[4]	5.06E+00	[8]	5.06E+00	[4]	(µg/g DW plant)/ (µg/g soil)
74-97-5	Bromochloromethane	5.86E+00	(µg/g DW plant)/ (µg/g soil)	[5]	5.86E+00	[10]	5.86E+00	[5]	(µg/g DW plant)/ (µg/g soil)
7429-90-5	Aluminum	4.00E-03	(µg/g DW plant)/ (µg/g soil)	[1]	4.00E-03	[1]	4.00E-03	[1]	(µg/g DW plant)/ (µg/g soil)
7439-89-6	Iron	4.00E-03	(µg/g DW plant)/ (µg/g soil)	[1]	4.00E-03	[1]	4.00E-03	[1]	(µg/g DW plant)/ (µg/g soil)
7439-92-1	Lead	4.50E-02	(µg/g DW plant)/ (µg/g soil)	[1]	4.50E-02	[1]	4.50E-02	[1]	(µg/g DW plant)/ (µg/g soil)
7439-93-2	Lithium	2.50E-02	(µg/g DW plant)/ (µg/g soil)	[1]	2.50E-02	[1]	2.50E-02	[1]	(µg/g DW plant)/ (µg/g soil)
7439-95-4	Magnesium	1.00E+00	(µg/g DW plant)/ (µg/g soil)	[1]	1.00E+00	[1]	1.00E+00	[1]	(µg/g DW plant)/ (µg/g soil)
7439-96-5	Manganese	2.50E-01	(µg/g DW plant)/ (µg/g soil)	[1]	2.50E-01	[1]	2.50E-01	[1]	(µg/g DW plant)/ (µg/g soil)
7439-97-6	Mercury	9.00E-01	(µg/g DW plant)/ (µg/g soil)	[1]	9.00E-01	[1]	9.00E-01	[1]	(µg/g DW plant)/ (µg/g soil)
7439-98-7	Molybdenum	2.50E-01	(µg/g DW plant)/ (µg/g soil)	[1]	2.50E-01	[1]	2.50E-01	[1]	(µg/g DW plant)/ (µg/g soil)
7440-02-0	Nickel	3.20E-02	(µg/g DW plant)/ (µg/g soil)	[4]	3.20E-02	[8]	3.20E-02	[4]	(µg/g DW plant)/ (µg/g soil)
7440-16-6	Rhodium	1.50E-01	(µg/g DW plant)/ (µg/g soil)	[1]	1.50E-01	[1]	1.50E-01	[1]	(µg/g DW plant)/ (µg/g soil)
7440-22-4	Silver	4.00E-01	(µg/g DW plant)/ (µg/g soil)	[1]	4.00E-01	[1]	4.00E-01	[1]	(µg/g DW plant)/ (µg/g soil)
7440-23-5	Sodium	7.50E-02	(µg/g DW plant)/ (µg/g soil)	[1]	7.50E-02	[1]	7.50E-02	[1]	(µg/g DW plant)/ (µg/g soil)
7440-24-6	Strontium (total)	2.50E+00	(µg/g DW plant)/ (µg/g soil)	[1]	2.50E+00	[1]	2.50E+00	[1]	(µg/g DW plant)/ (µg/g soil)

Table 3-3 Plant-Soil Bioconcentration Factors for Aboveground Silage and Forage

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Forage from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Forage	Reference	Plant-Soil Bioconcentration Factor in Silage (Br_{silage})	Reference	Plant-Soil Bioconcentration Factor in Forage (Br_{forage})	Reference	Units for Plant-Soil Bioconcentration Factor in Silage and Forage
7440-25-7	Tantalum	1.00E-02	(µg/g DW plant)/ (µg/g soil)	[1]	1.00E-02	[1]	1.00E-02	[1]	(µg/g DW plant)/ (µg/g soil)
7440-28-0	Thallium	4.00E-03	(µg/g DW plant)/ (µg/g soil)	[1]	4.00E-03	[1]	4.00E-03	[1]	(µg/g DW plant)/ (µg/g soil)
7440-29-1	Thorium-232	8.50E-04	(µg/g DW plant)/ (µg/g soil)	[1]	8.50E-04	[1]	8.50E-04	[1]	(µg/g DW plant)/ (µg/g soil)
7440-31-5	Tin	3.00E-02	(µg/g DW plant)/ (µg/g soil)	[1]	3.00E-02	[1]	3.00E-02	[1]	(µg/g DW plant)/ (µg/g soil)
7440-33-7	Tungsten	4.50E-02	(µg/g DW plant)/ (µg/g soil)	[1]	4.50E-02	[1]	4.50E-02	[1]	(µg/g DW plant)/ (µg/g soil)
7440-36-0	Antimony	2.00E-01	(µg/g DW plant)/ (µg/g soil)	[1]	2.00E-01	[1]	2.00E-01	[1]	(µg/g DW plant)/ (µg/g soil)
7440-38-2	Arsenic	3.60E-02	(µg/g DW plant)/ (µg/g soil)	[4]	3.60E-02	[8]	3.60E-02	[4]	(µg/g DW plant)/ (µg/g soil)
7440-39-3	Barium	1.50E-01	(µg/g DW plant)/ (µg/g soil)	[1]	1.50E-01	[1]	1.50E-01	[1]	(µg/g DW plant)/ (µg/g soil)
7440-41-7	Beryllium	1.00E-02	(µg/g DW plant)/ (µg/g soil)	[1]	1.00E-02	[1]	1.00E-02	[1]	(µg/g DW plant)/ (µg/g soil)
7440-43-9	Cadmium	3.64E-01	(µg/g DW plant)/ (µg/g soil)	[4]	3.64E-01	[8]	3.64E-01	[4]	(µg/g DW plant)/ (µg/g soil)
7440-47-3	Chromium	7.50E-03	(µg/g DW plant)/ (µg/g soil)	[1]	7.50E-03	[1]	7.50E-03	[1]	(µg/g DW plant)/ (µg/g soil)
7440-48-4	Cobalt	2.00E-02	(µg/g DW plant)/ (µg/g soil)	[1]	2.00E-02	[1]	2.00E-02	[1]	(µg/g DW plant)/ (µg/g soil)
7440-50-8	Copper	4.00E-01	(µg/g DW plant)/ (µg/g soil)	[1]	4.00E-01	[1]	4.00E-01	[1]	(µg/g DW plant)/ (µg/g soil)
7440-61-1	Uranium	8.50E-03	(µg/g DW plant)/ (µg/g soil)	[1]	8.50E-03	[1]	8.50E-03	[1]	(µg/g DW plant)/ (µg/g soil)
7440-61-1R	Uranium-238	8.50E-03	(µg/g DW plant)/ (µg/g soil)	[1]	8.50E-03	[1]	8.50E-03	[1]	(µg/g DW plant)/ (µg/g soil)
7440-62-2	Vanadium	5.50E-03	(µg/g DW plant)/ (µg/g soil)	[1]	5.50E-03	[1]	5.50E-03	[1]	(µg/g DW plant)/ (µg/g soil)
7440-65-5	Yttrium	1.50E-02	(µg/g DW plant)/ (µg/g soil)	[1]	1.50E-02	[1]	1.50E-02	[1]	(µg/g DW plant)/ (µg/g soil)

Table 3-3 Plant-Soil Bioconcentration Factors for Aboveground Silage and Forage

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Forage from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Forage	Reference	Plant-Soil Bioconcentration Factor in Silage (Br_{silage})	Reference	Plant-Soil Bioconcentration Factor in Forage (Br_{forage})	Reference	Units for Plant-Soil Bioconcentration Factor in Silage and Forage
7440-66-6	Zinc	2.50E-01	(µg/g DW plant)/ (µg/g soil)	[4]	2.50E-01	[8]	2.50E-01	[4]	(µg/g DW plant)/ (µg/g soil)
7440-67-7	Zirconium	2.00E-03	(µg/g DW plant)/ (µg/g soil)	[1]	2.00E-03	[1]	2.00E-03	[1]	(µg/g DW plant)/ (µg/g soil)
7446-09-5	Sulfur dioxide	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.38E+00	[7]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	3.44E-03	(µg/g DW plant)/ (µg/g soil)	[5]	3.44E-03	[10]	3.44E-03	[5]	(µg/g DW plant)/ (µg/g soil)
7487-94-7	Mercuric chloride (HgCl2)	0.00E+00	(µg/g DW plant)/ (µg/g soil)	[4]	0.00E+00	[8]	0.00E+00	[4]	(µg/g DW plant)/ (µg/g soil)
75-00-3	Chloroethane	6.01E+00	(µg/g DW plant)/ (µg/g soil)	[4]	6.01E+00	[8]	6.01E+00	[4]	(µg/g DW plant)/ (µg/g soil)
75-01-4	1-Chloroethene	6.01E+00	(µg/g DW plant)/ (µg/g soil)	[4]	6.01E+00	[8]	6.01E+00	[4]	(µg/g DW plant)/ (µg/g soil)
75-02-5	Fluoroethene (vinyl fluoride)	7.95E+00	(µg/g DW plant)/ (µg/g soil)	[3]	7.95E+00	[2]	7.95E+00	[3]	(µg/g DW plant)/ (µg/g soil)
75-05-8	Acetonitrile	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[4]	8.13E+00	[9]	8.38E+00	[4]	(µg/g DW plant)/ (µg/g soil)
75-07-0	Acetaldehyde	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[4]	8.13E+00	[9]	8.38E+00	[4]	(µg/g DW plant)/ (µg/g soil)
75-09-2	Dichloromethane (Methylene Chloride)	6.86E+00	(µg/g DW plant)/ (µg/g soil)	[4]	6.86E+00	[8]	6.86E+00	[4]	(µg/g DW plant)/ (µg/g soil)
75-15-0	Carbon disulfide	2.07E+00	(µg/g DW plant)/ (µg/g soil)	[4]	2.07E+00	[8]	2.07E+00	[4]	(µg/g DW plant)/ (µg/g soil)
75-21-8	Ethylene oxide (Oxirane)	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[4]	8.13E+00	[9]	8.38E+00	[4]	(µg/g DW plant)/ (µg/g soil)
75-25-2	Bromoform	1.65E+00	(µg/g DW plant)/ (µg/g soil)	[4]	1.65E+00	[8]	1.65E+00	[4]	(µg/g DW plant)/ (µg/g soil)
75-27-4	Bromodichlorometha ne	2.37E+00	(µg/g DW plant)/ (µg/g soil)	[4]	2.37E+00	[8]	2.37E+00	[4]	(µg/g DW plant)/ (µg/g soil)
75-29-6	2-Chloropropane	3.04E+00	(µg/g DW plant)/ (µg/g soil)	[5]	3.04E+00	[10]	3.04E+00	[5]	(µg/g DW plant)/ (µg/g soil)
75-34-3	1,1-Dichloroethane	3.53E+00	(µg/g DW plant)/ (µg/g soil)	[4]	3.53E+00	[8]	3.53E+00	[4]	(µg/g DW plant)/ (µg/g soil)

Table 3-3 Plant-Soil Bioconcentration Factors for Aboveground Silage and Forage

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Forage from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Forage	Reference	Plant-Soil Bioconcentration Factor in Silage (Br_{silage})	Reference	Plant-Soil Bioconcentration Factor in Forage (Br_{forage})	Reference	Units for Plant-Soil Bioconcentration Factor in Silage and Forage
75-35-4	1,1-Dichloroethene	2.37E+00	(µg/g DW plant)/ (µg/g soil)	[4]	2.37E+00	[8]	2.37E+00	[4]	(µg/g DW plant)/ (µg/g soil)
75-44-5	Phosgene (hydrogen phosphide)	9.94E+01	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	9.94E+01	[5]	(µg/g DW plant)/ (µg/g soil)
75-45-6	Chlorodifluoromethane	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[4]	8.13E+00	[9]	8.38E+00	[4]	(µg/g DW plant)/ (µg/g soil)
75-50-3	Trimethylamine	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.13E+00	[9]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
75-69-4	Trichlorofluoromethane	1.39E+00	(µg/g DW plant)/ (µg/g soil)	[4]	1.39E+00	[8]	1.39E+00	[4]	(µg/g DW plant)/ (µg/g soil)
75-71-8	Dichlorodifluoromethane	2.19E+00	(µg/g DW plant)/ (µg/g soil)	[4]	2.19E+00	[8]	2.19E+00	[4]	(µg/g DW plant)/ (µg/g soil)
76-01-7	Pentachloroethane	5.22E-01	(µg/g DW plant)/ (µg/g soil)	[5]	5.22E-01	[10]	5.22E-01	[5]	(µg/g DW plant)/ (µg/g soil)
76-13-1	1,2,2-Trichlorotrifluoroethane	5.66E-01	(µg/g DW plant)/ (µg/g soil)	[5]	5.66E-01	[10]	5.66E-01	[5]	(µg/g DW plant)/ (µg/g soil)
76-44-8	Heptachlor	1.27E-01	(µg/g DW plant)/ (µg/g soil)	[4]	1.27E-01	[8]	1.27E-01	[4]	(µg/g DW plant)/ (µg/g soil)
764-41-0	1,4-Dichloro-2-butene	1.20E+00	(µg/g DW plant)/ (µg/g soil)	[5]	1.20E+00	[10]	1.20E+00	[5]	(µg/g DW plant)/ (µg/g soil)
7647-01-0	Hydrogen chloride								
765-34-4	Glycidylaldehyde	4.52E+01	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	4.52E+01	[5]	(µg/g DW plant)/ (µg/g soil)
7664-39-3	Hydrogen Fluoride	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.38E+00	[7]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
7664-41-7	Ammonia/Ammonium	3.80E+01	(µg/g DW plant)/ (µg/g soil)	[5]	3.80E+01	[10]	3.80E+01	[5]	(µg/g DW plant)/ (µg/g soil)
77-47-4	Hexachlorocyclopentadiene	4.73E-02	(µg/g DW plant)/ (µg/g soil)	[4]	4.73E-02	[8]	4.73E-02	[4]	(µg/g DW plant)/ (µg/g soil)
77-78-1	Dimethyl sulfate	8.18E+00	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	8.18E+00	[5]	(µg/g DW plant)/ (µg/g soil)
7704-34-9	Total Sulfur (thermodynamically stable)	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.38E+00	[7]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)

Table 3-3 Plant-Soil Bioconcentration Factors for Aboveground Silage and Forage

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Forage from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Forage	Reference	Plant-Soil Bioconcentration Factor in Silage (Br_{silage})	Reference	Plant-Soil Bioconcentration Factor in Forage (Br_{forage})	Reference	Units for Plant-Soil Bioconcentration Factor in Silage and Forage
7723-14-0	Phosphorus	3.50E+00	(µg/g DW plant)/ (µg/g soil)	[1]	3.50E+00	[1]	3.50E+00	[1]	(µg/g DW plant)/ (µg/g soil)
7782-41-4	Fluorine gas F2	6.00E-02	(µg/g DW plant)/ (µg/g soil)	[5]	6.00E-02	[10]	6.00E-02	[5]	(µg/g DW plant)/ (µg/g soil)
7782-49-2	Selenium	1.60E-02	(µg/g DW plant)/ (µg/g soil)	[4]	1.60E-02	[8]	1.60E-02	[4]	(µg/g DW plant)/ (µg/g soil)
7782-50-5	Chlorine	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[4]	8.38E+00	[8]	8.38E+00	[4]	(µg/g DW plant)/ (µg/g soil)
78-83-1	2-Methylpropyl alcohol	1.40E+01	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	1.40E+01	[5]	(µg/g DW plant)/ (µg/g soil)
78-87-5	1,2-Dichloropropane	2.70E+00	(µg/g DW plant)/ (µg/g soil)	[4]	2.70E+00	[8]	2.70E+00	[4]	(µg/g DW plant)/ (µg/g soil)
78-93-3	2-Butanone	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[4]	8.13E+00	[9]	8.38E+00	[4]	(µg/g DW plant)/ (µg/g soil)
79-00-5	1,1,2-Trichloroethane	2.70E+00	(µg/g DW plant)/ (µg/g soil)	[4]	2.70E+00	[8]	2.70E+00	[4]	(µg/g DW plant)/ (µg/g soil)
79-01-6	1,1,2-Trichloroethylene	1.59E+00	(µg/g DW plant)/ (µg/g soil)	[4]	1.59E+00	[8]	1.59E+00	[4]	(µg/g DW plant)/ (µg/g soil)
79-10-7	2-Propenoic acid	2.41E+01	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	2.41E+01	[5]	(µg/g DW plant)/ (µg/g soil)
79-34-5	1,1,2,2-Tetrachloroethane	1.59E+00	(µg/g DW plant)/ (µg/g soil)	[4]	1.59E+00	[8]	1.59E+00	[4]	(µg/g DW plant)/ (µg/g soil)
79-46-9	2-Nitropropane	1.11E+01	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	1.11E+01	[5]	(µg/g DW plant)/ (µg/g soil)
80-62-6	Methyl methacrylate	6.10E+00	(µg/g DW plant)/ (µg/g soil)	[5]	6.10E+00	[10]	6.10E+00	[5]	(µg/g DW plant)/ (µg/g soil)
82-68-8	Pentachloronitrobenzene (PCNB)	8.06E-02	(µg/g DW plant)/ (µg/g soil)	[4]	8.06E-02	[8]	8.06E-02	[4]	(µg/g DW plant)/ (µg/g soil)
822-06-0	Hexamethylene-1,5-diisocyanate	5.36E-01	(µg/g DW plant)/ (µg/g soil)	[5]	5.36E-01	[10]	5.36E-01	[5]	(µg/g DW plant)/ (µg/g soil)
823-40-5	Toluene-2,6-diamine	3.11E+01	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	3.11E+01	[5]	(µg/g DW plant)/ (µg/g soil)
83-32-9	Acenaphthene	2.16E-01	(µg/g DW plant)/ (µg/g soil)	[4]	2.16E-01	[8]	2.16E-01	[4]	(µg/g DW plant)/ (µg/g soil)

Table 3-3 Plant-Soil Bioconcentration Factors for Aboveground Silage and Forage

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Forage from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Forage	Reference	Plant-Soil Bioconcentration Factor in Silage (Br_{silage})	Reference	Plant-Soil Bioconcentration Factor in Forage (Br_{forage})	Reference	Units for Plant-Soil Bioconcentration Factor in Silage and Forage
832-69-9	1-Methylphenanthrene	4.48E-02	(µg/g DW plant)/(µg/g soil)	[3]	4.48E-02	[2]	4.48E-02	[3]	(µg/g DW plant)/(µg/g soil)
84-66-2	Diethyl phthalate	1.39E+00	(µg/g DW plant)/(µg/g soil)	[4]	1.39E+00	[8]	1.39E+00	[4]	(µg/g DW plant)/(µg/g soil)
84-74-2	Di-n-butylphthalate	7.44E-02	(µg/g DW plant)/(µg/g soil)	[4]	7.44E-02	[8]	7.44E-02	[4]	(µg/g DW plant)/(µg/g soil)
85-01-8	Phenanthrene	9.71E-02	(µg/g DW plant)/(µg/g soil)	[4]	9.71E-02	[8]	9.71E-02	[4]	(µg/g DW plant)/(µg/g soil)
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	8.38E+00	(µg/g DW plant)/(µg/g soil)	[4]	8.13E+00	[9]	8.38E+00	[4]	(µg/g DW plant)/(µg/g soil)
85-68-7	Butylbenzylphthalate	5.70E-02	(µg/g DW plant)/(µg/g soil)	[4]	5.70E-02	[8]	5.70E-02	[4]	(µg/g DW plant)/(µg/g soil)
86-73-7	Fluorene	1.45E-01	(µg/g DW plant)/(µg/g soil)	[4]	1.45E-01	[8]	1.45E-01	[4]	(µg/g DW plant)/(µg/g soil)
87-61-6	1,2,3-Trichlorobenzene	1.77E-01	(µg/g DW plant)/(µg/g soil)	[4]	1.77E-01	[8]	1.77E-01	[4]	(µg/g DW plant)/(µg/g soil)
87-68-3	Hexachlorobutadiene	6.51E-02	(µg/g DW plant)/(µg/g soil)	[4]	6.51E-02	[8]	6.51E-02	[4]	(µg/g DW plant)/(µg/g soil)
87-86-5	Pentachlorophenol	4.37E-02	(µg/g DW plant)/(µg/g soil)	[4]	4.37E-02	[8]	4.37E-02	[4]	(µg/g DW plant)/(µg/g soil)
88-06-2	2,4,6-Trichlorophenol	2.81E-01	(µg/g DW plant)/(µg/g soil)	[4]	2.81E-01	[8]	2.81E-01	[4]	(µg/g DW plant)/(µg/g soil)
88-74-4	o-Nitroaniline (2-nitroaniline)	3.30E+00	(µg/g DW plant)/(µg/g soil)	[4]	3.30E+00	[8]	3.30E+00	[4]	(µg/g DW plant)/(µg/g soil)
88-75-5	2-Nitrophenol	3.58E+00	(µg/g DW plant)/(µg/g soil)	[4]	3.58E+00	[8]	3.58E+00	[4]	(µg/g DW plant)/(µg/g soil)
90-04-0	o-Anisidine	7.96E+00	(µg/g DW plant)/(µg/g soil)	[5]	7.96E+00	[10]	7.96E+00	[5]	(µg/g DW plant)/(µg/g soil)
90-12-0	1-Methylnaphthalene	2.19E-01	(µg/g DW plant)/(µg/g soil)	[5]	2.19E-01	[10]	2.19E-01	[5]	(µg/g DW plant)/(µg/g soil)
91-20-3	Naphthalene	4.79E-01	(µg/g DW plant)/(µg/g soil)	[4]	4.79E-01	[8]	4.79E-01	[4]	(µg/g DW plant)/(µg/g soil)
91-22-5	Quinoline	2.56E+00	(µg/g DW plant)/(µg/g soil)	[5]	2.56E+00	[10]	2.56E+00	[5]	(µg/g DW plant)/(µg/g soil)

Table 3-3 Plant-Soil Bioconcentration Factors for Aboveground Silage and Forage

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Forage from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Forage	Reference	Plant-Soil Bioconcentration Factor in Silage (Br_{silage})	Reference	Plant-Soil Bioconcentration Factor in Forage (Br_{forage})	Reference	Units for Plant-Soil Bioconcentration Factor in Silage and Forage
91-57-6	2-Methylnaphthalene	2.22E-01	(µg/g DW plant)/ (µg/g soil)	[5]	2.22E-01	[10]	2.22E-01	[5]	(µg/g DW plant)/ (µg/g soil)
91-58-7	2-Chloronaphthalene	4.31E-01	(µg/g DW plant)/ (µg/g soil)	[4]	4.31E-01	[8]	4.31E-01	[4]	(µg/g DW plant)/ (µg/g soil)
91-94-1	3,3'-Dichlorobenzidine	3.62E-01	(µg/g DW plant)/ (µg/g soil)	[4]	3.62E-01	[8]	3.62E-01	[4]	(µg/g DW plant)/ (µg/g soil)
92-52-4	1,1`-Biphenyl	1.89E-01	(µg/g DW plant)/ (µg/g soil)	[5]	1.89E-01	[10]	1.89E-01	[5]	(µg/g DW plant)/ (µg/g soil)
924-16-3	N-Nitroso-di-n-Buetylamine	3.01E+00	(µg/g DW plant)/ (µg/g soil)	[4]	3.01E+00	[8]	3.01E+00	[4]	(µg/g DW plant)/ (µg/g soil)
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	1.12E+00	(µg/g DW plant)/ (µg/g soil)	[4]	1.12E+00	[8]	1.12E+00	[4]	(µg/g DW plant)/ (µg/g soil)
94-75-7	2,4-D	9.03E-01	(µg/g DW plant)/ (µg/g soil)	[5]	9.03E-01	[10]	9.03E-01	[5]	(µg/g DW plant)/ (µg/g soil)
95-48-7	o-Cresol	2.89E+00	(µg/g DW plant)/ (µg/g soil)	[4]	2.89E+00	[8]	2.89E+00	[4]	(µg/g DW plant)/ (µg/g soil)
95-49-8	o-Chlorotoluene	4.00E-01	(µg/g DW plant)/ (µg/g soil)	[5]	4.00E-01	[10]	4.00E-01	[5]	(µg/g DW plant)/ (µg/g soil)
95-50-1	1,2-Dichlorobenzene	4.31E-01	(µg/g DW plant)/ (µg/g soil)	[4]	4.31E-01	[8]	4.31E-01	[4]	(µg/g DW plant)/ (µg/g soil)
95-53-4	o-Toluidine	6.68E+00	(µg/g DW plant)/ (µg/g soil)	[4]	6.68E+00	[8]	6.68E+00	[4]	(µg/g DW plant)/ (µg/g soil)
95-57-8	2-Chlorophenol	2.21E+00	(µg/g DW plant)/ (µg/g soil)	[4]	2.21E+00	[8]	2.21E+00	[4]	(µg/g DW plant)/ (µg/g soil)
95-63-6	1,2,4-Trimethyl benzene	3.02E-01	(µg/g DW plant)/ (µg/g soil)	[5]	3.02E-01	[10]	3.02E-01	[5]	(µg/g DW plant)/ (µg/g soil)
95-94-3	1,2,4,5-Tetrachlorobenzene	6.51E-02	(µg/g DW plant)/ (µg/g soil)	[4]	6.51E-02	[8]	6.51E-02	[4]	(µg/g DW plant)/ (µg/g soil)
95-95-4	2,4,5-Trichlorophenol	2.74E-01	(µg/g DW plant)/ (µg/g soil)	[4]	2.74E-01	[8]	2.74E-01	[4]	(µg/g DW plant)/ (µg/g soil)
96-12-8	1,2-Dibromo-3-chloropropane	1.81E+00	(µg/g DW plant)/ (µg/g soil)	[4]	1.81E+00	[8]	1.81E+00	[4]	(µg/g DW plant)/ (µg/g soil)
96-18-4	1,2,3-Trichloropropane	2.70E+00	(µg/g DW plant)/ (µg/g soil)	[4]	2.70E+00	[8]	2.70E+00	[4]	(µg/g DW plant)/ (µg/g soil)

Table 3-3 Plant-Soil Bioconcentration Factors for Aboveground Silage and Forage

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration Factor for Forage from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Forage	Reference	Plant-Soil Bioconcentration Factor in Silage (Br_{silage})	Reference	Plant-Soil Bioconcentration Factor in Forage (Br_{forage})	Reference	Units for Plant-Soil Bioconcentration Factor in Silage and Forage
96-45-7	Ethylene thiourea	9.30E+01	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	9.30E+01	[5]	(µg/g DW plant)/ (µg/g soil)
97-63-2	Ethyl methacrylate	2.93E+00	(µg/g DW plant)/ (µg/g soil)	[4]	2.93E+00	[8]	2.93E+00	[4]	(µg/g DW plant)/ (µg/g soil)
98-01-1	Furfural	2.23E+01	(µg/g DW plant)/ (µg/g soil)	[5]	8.13E+00	[9]	2.23E+01	[5]	(µg/g DW plant)/ (µg/g soil)
98-06-6	tert-Butyl benzene	1.59E-01	(µg/g DW plant)/ (µg/g soil)	[5]	1.59E-01	[10]	1.59E-01	[5]	(µg/g DW plant)/ (µg/g soil)
98-07-7	Benzotrichloride	2.11E-01	(µg/g DW plant)/ (µg/g soil)	[5]	2.11E-01	[10]	2.11E-01	[5]	(µg/g DW plant)/ (µg/g soil)
98-82-8	Cumene	2.81E-01	(µg/g DW plant)/ (µg/g soil)	[4]	2.81E-01	[8]	2.81E-01	[4]	(µg/g DW plant)/ (µg/g soil)
98-83-9	Methyl styrene (mixed isomers)	3.89E-01	(µg/g DW plant)/ (µg/g soil)	[5]	3.89E-01	[10]	3.89E-01	[5]	(µg/g DW plant)/ (µg/g soil)
98-86-2	Acetophenone	4.73E+00	(µg/g DW plant)/ (µg/g soil)	[4]	4.73E+00	[8]	4.73E+00	[4]	(µg/g DW plant)/ (µg/g soil)
98-95-3	Nitrobenzene	3.30E+00	(µg/g DW plant)/ (µg/g soil)	[4]	3.30E+00	[8]	3.30E+00	[4]	(µg/g DW plant)/ (µg/g soil)
99-35-4	1,3,5-Trinitrobenzene	7.84E+00	(µg/g DW plant)/ (µg/g soil)	[4]	7.84E+00	[8]	7.84E+00	[4]	(µg/g DW plant)/ (µg/g soil)
99-65-0	1,3-Dinitrobenzene	5.26E+00	(µg/g DW plant)/ (µg/g soil)	[4]	5.26E+00	[8]	5.26E+00	[4]	(µg/g DW plant)/ (µg/g soil)

Reference	Reference (source) for Plant-Soil Bioconcentration Factor for Forage (from literature, study, or database)
[1]	Baes CF, Sharp RD, Sjoreen AL, and Shor RW. 1984. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture*, ORNL-5786, Oak Ridge National Laboratory, Oak Ridge, TN (http://homer.ornl.gov/baes/documents/ornl5786.html)
[2]	Calculated value per Eq. A-2-18 (using log(K_{ow})=1.15) in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm)
[3]	Calculated value per Eq. A-2-18 in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm)

Reference	Reference (source) for Plant-Soil Bioconcentration Factor for Forage (from literature, study, or database)
[4]	EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013)
[5]	ORNL. *The Risk Assessment Information System (RAIS) Database*. Copyright © 2013 Oak Ridge National Laboratory and The University of Tennessee, Oak Ridge, TN (http://rais.ornl.gov, accessed April 2014)
[6]	Staven LH, Rhoads K, Napier BA, Strenge DL, *A Compendium of Transfer Factors for Agricultural and Animal Products*, PNNL-13421, Pacific Northwest National Laboratory, Richland, WA. June 2003. (average vegetable & fruit value) (value for produce)
[7]	Surrogate value from 2,4-Dinitrotoluene
[8]	Surrogate value from Chlorocyclopentadiene
[9]	Surrogate value from Dibenzo[a,i]pyrene
[10]	Surrogate value from Trichlorofluoromethane

Reference	Reference (source) for Plant-Soil Bioconcentration Factor in Silage
[1]	Baes CF, Sharp RD, Sjoreen AL, and Shor RW. 1984. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture*, ORNL-5786, Oak Ridge National Laboratory, Oak Ridge, TN (http://homer.ornl.gov/baes/documents/ornl5786.html)
[2]	Based on the plant-soil bioconcentration factor for forage. (Calculated value per Eq. A-2-18 in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm).)
[3]	Based on the plant-soil bioconcentration factor for forage. (Surrogate value from 2,4-Dinitrotoluene.)
[4]	Based on the plant-soil bioconcentration factor for forage. (Surrogate value from Chlorocyclopentadiene.)
[5]	Based on the plant-soil bioconcentration factor for forage. (Surrogate value from Dibenzo[a,i]pyrene.)
[6]	Based on the plant-soil bioconcentration factor for forage. (Surrogate value from Trichlorofluoromethane.)
[7]	Calculated value per Eq. A-2-18 (using $\log(K_{ow})$=1.15) in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm)
[8]	EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013)
[9]	Mass-limited plant-soil bioconcentration factor for silage (tilled soil)
[10]	ORNL. *The Risk Assessment Information System (RAIS) Database*. Copyright © 2013 Oak Ridge National Laboratory and The University of Tennessee, Oak Ridge, TN (http://rais.ornl.gov, accessed April 2014)
[11]	Staven LH, Rhoads K, Napier BA, Strenge DL, *A Compendium of Transfer Factors for Agricultural and Animal Products*, PNNL-13421, Pacific Northwest National Laboratory, Richland, WA. June 2003. (average vegetable & fruit value) (value for produce)

Reference	Reference (source) for Plant-Soil Bioconcentration Factor on Forage
[1]	Baes CF, Sharp RD, Sjoreen AL, and Shor RW. 1984. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture*, ORNL-5786, Oak Ridge National Laboratory, Oak Ridge, TN (http://homer.ornl.gov/baes/documents/ornl5786.html)

Reference	Reference (source) for Plant-Soil Bioconcentration Factor on Forage
[2]	Calculated value per Eq. A-2-18 (using log(K_{ow})=1.15) in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm)
[3]	Calculated value per Eq. A-2-18 in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm)
[4]	EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013)
[5]	ORNL. *The Risk Assessment Information System (RAIS) Database*. Copyright © 2013 Oak Ridge National Laboratory and The University of Tennessee, Oak Ridge, TN (http://rais.ornl.gov, accessed April 2014)
[6]	Staven LH, Rhoads K, Napier BA, Strenge DL, *A Compendium of Transfer Factors for Agricultural and Animal Products*, PNNL-13421, Pacific Northwest National Laboratory, Richland, WA. June 2003. (average vegetable & fruit value) (value for produce)
[7]	Surrogate value from 2,4-Dinitrotoluene
[8]	Surrogate value from Chlorocyclopentadiene
[9]	Surrogate value from Dibenzo[a,i]pyrene
[10]	Surrogate value from Trichlorofluoromethane

Table 3-4 provides data on aboveground bioconcentration factors for domestic and wild grain units of dry weight (DW) concentration of plant matter per unit of soil concentration. This constituent parameter accounts for the uptake from soil and the subsequent transport of contaminants through the roots to the aboveground plant parts. The data in the third column show values that were found in studies and published reports. The subsequent Br_{grain} values shown in the 7th and 8th columns are values used in the environmental risk assessment. The data are presented this way to distinguish mass-limited uptake values used in risk assessment from those values found in the literature (refer to the RAWP, Section 6.6.3.3). Blank entries in the table indicate where data are not available.

Table 3-4 Plant-Soil Bioconcentration Factors for Domestic and Wild Grain

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration factor for Grain from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Grain	Reference	Plant-Soil Bioconcentration Factor in Domestic Grain (Br_{grain})	Reference	Plant-Soil Bioconcentration Factor in Wild Grain (Br_{grain})	Reference	Units for Plant-Soil Bioconcentration Factor in Grain
100-02-7	p-Nitrophenol	3.05E+00	(µg/g DW plant)/ (µg/g soil)	[2]	3.05E+00	[2]	3.05E+00	[2]	(µg/g DW plant)/ (µg/g soil)
100-21-0	Phthalic acid	2.66E+00	(µg/g DW plant)/ (µg/g soil)	[3]	2.66E+00	[2]	2.66E+00	[2]	(µg/g DW plant)/ (µg/g soil)
100-25-4	1,4-Dinitrobenzene	5.48E+00	(µg/g DW plant)/ (µg/g soil)	[3]	5.48E+00	[2]	5.48E+00	[2]	(µg/g DW plant)/ (µg/g soil)
100-40-3	4-Ethenylcyclohexene				2.07E-01	[2]	2.07E-01	[2]	(µg/g DW plant)/ (µg/g soil)
100-41-4	Ethyl benzene	6.25E-01	(µg/g DW plant)/ (µg/g soil)	[2]	6.25E-01	[2]	6.25E-01	[2]	(µg/g DW plant)/ (µg/g soil)
100-42-5	Styrene	7.14E-01	(µg/g DW plant)/ (µg/g soil)	[2]	7.14E-01	[2]	7.14E-01	[2]	(µg/g DW plant)/ (µg/g soil)
100-44-7	Benzyl chloride	1.81E+00	(µg/g DW plant)/ (µg/g soil)	[2]	1.81E+00	[2]	1.81E+00	[2]	(µg/g DW plant)/ (µg/g soil)
100-47-0	Benzonitrile	4.86E+00	(µg/g DW plant)/ (µg/g soil)	[2]	4.86E+00	[2]	4.86E+00	[2]	(µg/g DW plant)/ (µg/g soil)
100-51-6	Benzyl alcohol	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
100-52-7	Benzaldehyde	5.40E+00	(µg/g DW plant)/ (µg/g soil)	[2]	5.40E+00	[2]	5.40E+00	[2]	(µg/g DW plant)/ (µg/g soil)
10028-15-6	Ozone				8.38E+00	[3]	8.38E+00	[3]	(µg/g DW plant)/ (µg/g soil)
10028-17-8	Tritium	2.40E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.40E+01	[6]	2.40E+01	[6]	(µg/g DW plant)/ (µg/g soil)

Table 3-4 Plant-Soil Bioconcentration Factors for Domestic and Wild Grain

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration factor for Grain from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Grain	Reference	Plant-Soil Bioconcentration Factor in Domestic Grain (Br_{grain})	Reference	Plant-Soil Bioconcentration Factor in Wild Grain (Br_{grain})	Reference	Units for Plant-Soil Bioconcentration Factor in Grain
10045-97-3	Cesium-137	2.60E-02	(µg/g DW plant)/ (µg/g soil)	[4]	2.60E-02	[7]	2.60E-02	[7]	(µg/g DW plant)/ (µg/g soil)
10061-01-5	cis-1,3-Dichloropropene	2.46E+00	(µg/g DW plant)/ (µg/g soil)	[3]	2.46E+00	[2]	2.46E+00	[2]	(µg/g DW plant)/ (µg/g soil)
10061-02-6	trans-1,3-Dichloropropene	2.56E+00	(µg/g DW plant)/ (µg/g soil)	[3]	2.56E+00	[2]	2.56E+00	[2]	(µg/g DW plant)/ (µg/g soil)
10098-91-6	Yttrium-90	1.00E-02	(µg/g DW plant)/ (µg/g soil)	[4]	1.00E-02	[7]	1.00E-02	[7]	(µg/g DW plant)/ (µg/g soil)
10098-97-2	Strontium-90	2.10E-01	(µg/g DW plant)/ (µg/g soil)	[4]	2.10E-01	[7]	2.10E-01	[7]	(µg/g DW plant)/ (µg/g soil)
101-55-3	4-Bromophenylphenyl ether	3.61E-02	(µg/g DW plant)/ (µg/g soil)	[2]	3.61E-02	[2]	3.61E-02	[2]	(µg/g DW plant)/ (µg/g soil)
101-77-9	4,4-Methylenedianiline	4.61E+00	(µg/g DW plant)/ (µg/g soil)	[3]	4.61E+00	[2]	4.61E+00	[2]	(µg/g DW plant)/ (µg/g soil)
10102-44-0	Nitrogen dioxide				8.38E+00	[3]	8.38E+00	[3]	(µg/g DW plant)/ (µg/g soil)
10198-40-0	Cobalt-60	3.70E-03	(µg/g DW plant)/ (µg/g soil)	[4]	3.70E-03	[7]	3.70E-03	[7]	(µg/g DW plant)/ (µg/g soil)
103-33-3	Azobenzene	2.34E-01	(µg/g DW plant)/ (µg/g soil)	[3]	2.34E-01	[2]	2.34E-01	[2]	(µg/g DW plant)/ (µg/g soil)
103-65-1	n-Propyl benzene (Isocumene)	2.79E-01	(µg/g DW plant)/ (µg/g soil)	[3]	2.79E-01	[2]	2.79E-01	[2]	(µg/g DW plant)/ (µg/g soil)
104-51-8	n-Butylbenzene	1.11E-01	(µg/g DW plant)/ (µg/g soil)	[3]	1.11E-01	[2]	1.11E-01	[2]	(µg/g DW plant)/ (µg/g soil)
104-76-7	2-Ethyl-1-hexanol				1.02E+00	[2]	1.02E+00	[2]	(µg/g DW plant)/ (µg/g soil)
105-67-9	2,4-Dimethylphenol	1.81E+00	(µg/g DW plant)/ (µg/g soil)	[2]	1.81E+00	[2]	1.81E+00	[2]	(µg/g DW plant)/ (µg/g soil)
10595-95-6	n-Nitrosomethylethylamine	3.65E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.60E+01	[5]	1.95E+01	[5]	(µg/g DW plant)/ (µg/g soil)

Table 3-4 Plant-Soil Bioconcentration Factors for Domestic and Wild Grain

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration factor for Grain from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Grain	Reference	Plant-Soil Bioconcentration Factor in Domestic Grain (Br_{grain})	Reference	Plant-Soil Bioconcentration Factor in Wild Grain (Br_{grain})	Reference	Units for Plant-Soil Bioconcentration Factor in Grain
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	4.51E-01	(µg/g DW plant)/ (µg/g soil)	[3]	4.51E-01	[2]	4.51E-01	[2]	(µg/g DW plant)/ (µg/g soil)
106-44-5	p-Cresol (4-methyl phenol)	3.09E+00	(µg/g DW plant)/ (µg/g soil)	[2]	3.09E+00	[2]	3.09E+00	[2]	(µg/g DW plant)/ (µg/g soil)
106-46-7	1,4-Dichlorobenzene	3.67E-01	(µg/g DW plant)/ (µg/g soil)	[2]	3.67E-01	[2]	3.67E-01	[2]	(µg/g DW plant)/ (µg/g soil)
106-47-8	p-Chloroaniline	3.39E+00	(µg/g DW plant)/ (µg/g soil)	[2]	3.39E+00	[2]	3.39E+00	[2]	(µg/g DW plant)/ (µg/g soil)
106-49-0	p-Toluidine	6.02E+00	(µg/g DW plant)/ (µg/g soil)	[3]	6.02E+00	[2]	6.02E+00	[2]	(µg/g DW plant)/ (µg/g soil)
106-51-4	Quinone				8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
106-88-7	1,2-Epoxybutane	1.22E+01	(µg/g DW plant)/ (µg/g soil)	[3]	1.22E+01	[2]	1.22E+01	[2]	(µg/g DW plant)/ (µg/g soil)
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
106-93-4	Ethylene dibromide	2.70E+00	(µg/g DW plant)/ (µg/g soil)	[2]	2.70E+00	[2]	2.70E+00	[2]	(µg/g DW plant)/ (µg/g soil)
106-99-0	1,3-Butadiene	2.70E+00	(µg/g DW plant)/ (µg/g soil)	[3]	2.70E+00	[2]	2.70E+00	[2]	(µg/g DW plant)/ (µg/g soil)
107-02-8	Acrolein	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
107-05-1	3-Chloropropene	2.92E+00	(µg/g DW plant)/ (µg/g soil)	[3]	2.92E+00	[2]	2.92E+00	[2]	(µg/g DW plant)/ (µg/g soil)
107-06-2	1,2-Dichloroethane	5.26E+00	(µg/g DW plant)/ (µg/g soil)	[2]	5.26E+00	[2]	5.26E+00	[2]	(µg/g DW plant)/ (µg/g soil)
107-12-0	Propionitrile	3.11E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.60E+01	[5]	1.95E+01	[5]	(µg/g DW plant)/ (µg/g soil)
107-13-1	Acrylonitrile	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
107-19-7	Propargyl alcohol	6.40E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.60E+01	[5]	1.95E+01	[5]	(µg/g DW plant)/ (µg/g soil)

Table 3-4 Plant-Soil Bioconcentration Factors for Domestic and Wild Grain

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration factor for Grain from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Grain	Reference	Plant-Soil Bioconcentration Factor in Domestic Grain (Br_{grain})	Reference	Plant-Soil Bioconcentration Factor in Wild Grain (Br_{grain})	Reference	Units for Plant-Soil Bioconcentration Factor in Grain
107-21-1	Ethylene glycol (1,2-ethanediol)	2.37E+02	(µg/g DW plant)/ (µg/g soil)	[3]	2.60E+01	[5]	1.95E+01	[5]	(µg/g DW plant)/ (µg/g soil)
107-98-2	Propylene glycol monomethyl ether	7.41E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.60E+01	[5]	1.95E+01	[5]	(µg/g DW plant)/ (µg/g soil)
108-05-4	Acetic acid vinyl ester	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
108-10-1	4-Methyl-2-pentanone	7.84E+00	(µg/g DW plant)/ (µg/g soil)	[2]	7.84E+00	[2]	7.84E+00	[2]	(µg/g DW plant)/ (µg/g soil)
108-39-4	m-Cresol	2.85E+00	(µg/g DW plant)/ (µg/g soil)	[2]	2.85E+00	[2]	2.85E+00	[2]	(µg/g DW plant)/ (µg/g soil)
108-60-1	bis (2-Chloroisopropyl)ether	1.40E+00	(µg/g DW plant)/ (µg/g soil)	[3]	1.40E+00	[2]	1.40E+00	[2]	(µg/g DW plant)/ (µg/g soil)
108-67-8	1,3,5-Trimethylbenzene	4.09E-01	(µg/g DW plant)/ (µg/g soil)	[2]	4.09E-01	[2]	4.09E-01	[2]	(µg/g DW plant)/ (µg/g soil)
108-86-1	Bromobenzene (Phenyl bromide)	7.10E-01	(µg/g DW plant)/ (µg/g soil)	[3]	7.10E-01	[2]	7.10E-01	[2]	(µg/g DW plant)/ (µg/g soil)
108-87-2	Methylcyclohexane	3.10E-01	(µg/g DW plant)/ (µg/g soil)	[3]	3.10E-01	[2]	3.10E-01	[2]	(µg/g DW plant)/ (µg/g soil)
108-88-3	Toluene	1.07E+00	(µg/g DW plant)/ (µg/g soil)	[2]	1.07E+00	[2]	1.07E+00	[2]	(µg/g DW plant)/ (µg/g soil)
108-90-7	Chlorobenzene	9.32E-01	(µg/g DW plant)/ (µg/g soil)	[2]	9.32E-01	[2]	9.32E-01	[2]	(µg/g DW plant)/ (µg/g soil)
108-94-1	Cyclohexanone	1.31E+01	(µg/g DW plant)/ (µg/g soil)	[3]	1.31E+01	[2]	1.31E+01	[2]	(µg/g DW plant)/ (µg/g soil)
108-95-2	Phenol	5.26E+00	(µg/g DW plant)/ (µg/g soil)	[2]	5.26E+00	[2]	5.26E+00	[2]	(µg/g DW plant)/ (µg/g soil)
109-74-0	n-Butanenitrile				8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
109-75-1	3-Butenenitrile				8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
109-77-3	Malononitrile	8.58E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.60E+01	[5]	1.95E+01	[5]	(µg/g DW plant)/ (µg/g soil)

Table 3-4 Plant-Soil Bioconcentration Factors for Domestic and Wild Grain

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration factor for Grain from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Grain	Reference	Plant-Soil Bioconcentration Factor in Domestic Grain (Br_{grain})	Reference	Plant-Soil Bioconcentration Factor in Wild Grain (Br_{grain})	Reference	Units for Plant-Soil Bioconcentration Factor in Grain
109-86-4	2-Methoxyethanol	1.08E+02	(µg/g DW plant)/ (µg/g soil)	[3]	2.60E+01	[5]	1.95E+01	[5]	(µg/g DW plant)/ (µg/g soil)
109-99-9	Tetrahydrofuran	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
110-00-9	Furan	6.43E+00	(µg/g DW plant)/ (µg/g soil)	[3]	6.43E+00	[2]	6.43E+00	[2]	(µg/g DW plant)/ (µg/g soil)
110-54-3	n-Hexane	2.10E-01	(µg/g DW plant)/ (µg/g soil)	[3]	2.10E-01	[2]	2.10E-01	[2]	(µg/g DW plant)/ (µg/g soil)
110-59-8	Pentanenitrile				8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
110-80-5	2-Ethoxyethanol	5.90E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.60E+01	[5]	1.95E+01	[5]	(µg/g DW plant)/ (µg/g soil)
110-82-7	Cyclohexane	3.89E-01	(µg/g DW plant)/ (µg/g soil)	[3]	3.89E-01	[2]	3.89E-01	[2]	(µg/g DW plant)/ (µg/g soil)
110-83-8	Cyclohexene	8.45E-01	(µg/g DW plant)/ (µg/g soil)	[3]	8.45E-01	[2]	8.45E-01	[2]	(µg/g DW plant)/ (µg/g soil)
110-86-1	Pyridine	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
111-15-9	Ethylene glycol monoethyl ether acetate	1.75E+01	(µg/g DW plant)/ (µg/g soil)	[3]	1.75E+01	[2]	1.75E+01	[2]	(µg/g DW plant)/ (µg/g soil)
111-44-4	Bis(2-chloroethyl)ether	6.96E+00	(µg/g DW plant)/ (µg/g soil)	[2]	6.96E+00	[2]	6.96E+00	[2]	(µg/g DW plant)/ (µg/g soil)
111-65-9	n-Octane				3.93E-02	[2]	3.93E-02	[2]	(µg/g DW plant)/ (µg/g soil)
111-76-2	2-Butoxyethanol	1.27E+01	(µg/g DW plant)/ (µg/g soil)	[3]	1.27E+01	[2]	1.27E+01	[2]	(µg/g DW plant)/ (µg/g soil)
111-84-2	n-Nonane	2.03E-02	(µg/g DW plant)/ (µg/g soil)	[3]	2.03E-02	[2]	2.03E-02	[2]	(µg/g DW plant)/ (µg/g soil)
111-91-1	Bis(2-chloroethoxy)methane	6.78E+00	(µg/g DW plant)/ (µg/g soil)	[3]	6.78E+00	[2]	6.78E+00	[2]	(µg/g DW plant)/ (µg/g soil)

Table 3-4 Plant-Soil Bioconcentration Factors for Domestic and Wild Grain

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration factor for Grain from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Grain	Reference	Plant-Soil Bioconcentration Factor in Domestic Grain (Br_{grain})	Reference	Plant-Soil Bioconcentration Factor in Wild Grain (Br_{grain})	Reference	Units for Plant-Soil Bioconcentration Factor in Grain
112-30-1	1-Decanol	8.61E-02	(µg/g DW plant)/ (µg/g soil)	[3]	8.61E-02	[2]	8.61E-02	[2]	(µg/g DW plant)/ (µg/g soil)
112-31-2	Decanal				2.60E-01	[2]	2.60E-01	[2]	(µg/g DW plant)/ (µg/g soil)
112-40-3	Dodecane				1.15E-02	[2]	1.15E-02	[2]	(µg/g DW plant)/ (µg/g soil)
1120-21-4	Undecane				1.86E-02	[2]	1.86E-02	[2]	(µg/g DW plant)/ (µg/g soil)
1120-71-4	1,3-Propane sultone	5.60E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.60E+01	[5]	1.95E+01	[5]	(µg/g DW plant)/ (µg/g soil)
117-81-7	Bis(2-ethylhexyl) phthalate	4.37E-02	(µg/g DW plant)/ (µg/g soil)	[2]	4.37E-02	[2]	4.37E-02	[2]	(µg/g DW plant)/ (µg/g soil)
117-84-0	Di-n-octylphthalate	8.06E-04	(µg/g DW plant)/ (µg/g soil)	[2]	8.06E-04	[2]	8.06E-04	[2]	(µg/g DW plant)/ (µg/g soil)
118-74-1	Hexachlorobenzene	3.35E-02	(µg/g DW plant)/ (µg/g soil)	[2]	3.30E-02	[2]	3.30E-02	[2]	(µg/g DW plant)/ (µg/g soil)
119-90-4	3,3'-Dimethoxybenzidine	3.48E+00	(µg/g DW plant)/ (µg/g soil)	[2]	3.48E+00	[2]	3.48E+00	[2]	(µg/g DW plant)/ (µg/g soil)
120-12-7	Anthracene	9.71E-02	(µg/g DW plant)/ (µg/g soil)	[2]	9.71E-02	[2]	9.71E-02	[2]	(µg/g DW plant)/ (µg/g soil)
120-82-1	1,2,4-Trichlorobenzene	1.89E-01	(µg/g DW plant)/ (µg/g soil)	[2]	1.89E-01	[2]	1.89E-01	[2]	(µg/g DW plant)/ (µg/g soil)
120-83-2	2,4-Dichlorophenol	8.16E-01	(µg/g DW plant)/ (µg/g soil)	[2]	8.16E-01	[2]	8.16E-01	[2]	(µg/g DW plant)/ (µg/g soil)
121-14-2	2,4-Dinitrotoluene	2.78E+00	(µg/g DW plant)/ (µg/g soil)	[2]	2.78E+00	[2]	2.78E+00	[2]	(µg/g DW plant)/ (µg/g soil)
122-39-4	N,N-Diphenylamine	3.59E-01	(µg/g DW plant)/ (µg/g soil)	[3]	3.59E-01	[2]	3.59E-01	[2]	(µg/g DW plant)/ (µg/g soil)
122-66-7	1,2-Diphenylhydrazine	8.16E-01	(µg/g DW plant)/ (µg/g soil)	[2]	8.16E-01	[2]	8.16E-01	[2]	(µg/g DW plant)/ (µg/g soil)
123-33-1	Maleic hydrazide	1.18E+02	(µg/g DW plant)/ (µg/g soil)	[3]	2.60E+01	[5]	1.95E+01	[5]	(µg/g DW plant)/ (µg/g soil)

Table 3-4 Plant-Soil Bioconcentration Factors for Domestic and Wild Grain

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration factor for Grain from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Grain	Reference	Plant-Soil Bioconcentration Factor in Domestic Grain (Br_{grain})	Reference	Plant-Soil Bioconcentration Factor in Wild Grain (Br_{grain})	Reference	Units for Plant-Soil Bioconcentration Factor in Grain
123-38-6	Propionaldehyde	1.75E+01	(µg/g DW plant)/ (µg/g soil)	[3]	1.75E+01	[2]	1.75E+01	[2]	(µg/g DW plant)/ (µg/g soil)
123-72-8	Butanal				8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
123-91-1	1,4-Dioxan	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
124-18-5	Decane	4.78E-02	(µg/g DW plant)/ (µg/g soil)	[3]	4.78E-02	[2]	4.78E-02	[2]	(µg/g DW plant)/ (µg/g soil)
124-38-9	Carbon dioxide				8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
124-48-1	Chlorodibromomethane	1.99E+00	(µg/g DW plant)/ (µg/g soil)	[2]	1.99E+00	[2]	1.99E+00	[2]	(µg/g DW plant)/ (µg/g soil)
126-73-8	Tributyl phosphate	1.84E-01	(µg/g DW plant)/ (µg/g soil)	[3]	1.84E-01	[2]	1.84E-01	[2]	(µg/g DW plant)/ (µg/g soil)
126-98-7	2-Methyl-2-propenenitrile	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
127-18-4	1,1,2,2-Tetrachloroethene	4.20E-01	(µg/g DW plant)/ (µg/g soil)	[2]	4.20E-01	[2]	4.20E-01	[2]	(µg/g DW plant)/ (µg/g soil)
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	4.24E-02	(µg/g DW plant)/ (µg/g soil)	[3]	4.24E-02	[2]	4.24E-02	[2]	(µg/g DW plant)/ (µg/g soil)
129-00-0	Pyrene	5.70E-02	(µg/g DW plant)/ (µg/g soil)	[2]	5.70E-02	[2]	5.70E-02	[2]	(µg/g DW plant)/ (µg/g soil)
131-11-3	Dimethyl Phthalate	4.86E+00	(µg/g DW plant)/ (µg/g soil)	[2]	4.86E+00	[2]	4.86E+00	[2]	(µg/g DW plant)/ (µg/g soil)
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	1.57E-01	(µg/g DW plant)/ (µg/g soil)	[3]	1.57E-01	[2]	1.57E-01	[2]	(µg/g DW plant)/ (µg/g soil)
132-64-9	Dibenzofuran	1.57E-01	(µg/g DW plant)/ (µg/g soil)	[3]	1.57E-01	[2]	1.57E-01	[2]	(µg/g DW plant)/ (µg/g soil)
133-06-2	Captan	9.15E-01	(µg/g DW plant)/ (µg/g soil)	[3]	9.15E-01	[2]	9.15E-01	[2]	(µg/g DW plant)/ (µg/g soil)
1330-20-7	Xylenes (mixed isomers)	5.66E-01	(µg/g DW plant)/ (µg/g soil)	[3]	5.66E-01	[2]	5.66E-01	[2]	(µg/g DW plant)/ (µg/g soil)

Table 3-4 Plant-Soil Bioconcentration Factors for Domestic and Wild Grain

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration factor for Grain from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Grain	Reference	Plant-Soil Bioconcentration Factor in Domestic Grain (Br_{grain})	Reference	Plant-Soil Bioconcentration Factor in Wild Grain (Br_{grain})	Reference	Units for Plant-Soil Bioconcentration Factor in Grain
1336-36-3	Polychlorinated biphenyls	2.93E-03	(µg/g DW plant)/ (µg/g soil)	[3]	2.93E-03	[2]	2.93E-03	[2]	(µg/g DW plant)/ (µg/g soil)
134-32-7	alpha-Naphthylamine	1.91E+00	(µg/g DW plant)/ (µg/g soil)	[3]	1.91E+00	[2]	1.91E+00	[2]	(µg/g DW plant)/ (µg/g soil)
135-98-8	sec-Butylbenzene	8.61E-02	(µg/g DW plant)/ (µg/g soil)	[3]	8.61E-02	[2]	8.61E-02	[2]	(µg/g DW plant)/ (µg/g soil)
13966-29-5	Uranium-234	1.30E-03	(µg/g DW plant)/ (µg/g soil)	[4]	1.30E-03	[7]	1.30E-03	[7]	(µg/g DW plant)/ (µg/g soil)
13967-48-1	Ruthenium-106	5.00E-03	(µg/g DW plant)/ (µg/g soil)	[4]	5.00E-03	[7]	5.00E-03	[7]	(µg/g DW plant)/ (µg/g soil)
13967-70-9	Cesium-134	2.60E-02	(µg/g DW plant)/ (µg/g soil)	[4]	2.60E-02	[7]	2.60E-02	[7]	(µg/g DW plant)/ (µg/g soil)
13968-55-3	Uranium-233	1.30E-03	(µg/g DW plant)/ (µg/g soil)	[4]	1.30E-03	[7]	1.30E-03	[7]	(µg/g DW plant)/ (µg/g soil)
13981-15-2	Curium-244	2.10E-05	(µg/g DW plant)/ (µg/g soil)	[4]	2.10E-05	[7]	2.10E-05	[7]	(µg/g DW plant)/ (µg/g soil)
13981-16-3	Plutonium-238	8.60E-06	(µg/g DW plant)/ (µg/g soil)	[4]	8.60E-06	[7]	8.60E-06	[7]	(µg/g DW plant)/ (µg/g soil)
13981-37-8	Nickel-63	3.00E-02	(µg/g DW plant)/ (µg/g soil)	[4]	3.00E-02	[7]	3.00E-02	[7]	(µg/g DW plant)/ (µg/g soil)
13982-10-0	Plutonium-242	8.60E-06	(µg/g DW plant)/ (µg/g soil)	[4]	8.60E-06	[7]	8.60E-06	[7]	(µg/g DW plant)/ (µg/g soil)
13982-63-3	Radium-226	1.20E-03	(µg/g DW plant)/ (µg/g soil)	[4]	1.20E-03	[7]	1.20E-03	[7]	(µg/g DW plant)/ (µg/g soil)
13982-70-2	Uranium-236	1.30E-03	(µg/g DW plant)/ (µg/g soil)	[4]	1.30E-03	[7]	1.30E-03	[7]	(µg/g DW plant)/ (µg/g soil)
13994-20-2	Neptunium-237	2.70E-03	(µg/g DW plant)/ (µg/g soil)	[4]	2.70E-03	[7]	2.70E-03	[7]	(µg/g DW plant)/ (µg/g soil)
141-78-6	Acetic acid ethyl ester	1.45E+01	(µg/g DW plant)/ (µg/g soil)	[3]	1.45E+01	[2]	1.45E+01	[2]	(µg/g DW plant)/ (µg/g soil)
14119-32-5	Plutonium-241	8.60E-06	(µg/g DW plant)/ (µg/g soil)	[4]	8.60E-06	[7]	8.60E-06	[7]	(µg/g DW plant)/ (µg/g soil)

Table 3-4 Plant-Soil Bioconcentration Factors for Domestic and Wild Grain

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration factor for Grain from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Grain	Reference	Plant-Soil Bioconcentration Factor in Domestic Grain (Br_{grain})	Reference	Plant-Soil Bioconcentration Factor in Wild Grain (Br_{grain})	Reference	Units for Plant-Soil Bioconcentration Factor in Grain
14119-33-6	Plutonium-240	8.60E-06	(µg/g DW plant)/ (µg/g soil)	[4]	8.60E-06	[7]	8.60E-06	[7]	(µg/g DW plant)/ (µg/g soil)
14133-76-7	Technetium-99	7.30E-01	(µg/g DW plant)/ (µg/g soil)	[4]	7.30E-01	[7]	7.30E-01	[7]	(µg/g DW plant)/ (µg/g soil)
14158-29-3	Uranium-232	1.30E-03	(µg/g DW plant)/ (µg/g soil)	[4]	1.30E-03	[7]	1.30E-03	[7]	(µg/g DW plant)/ (µg/g soil)
14234-35-6	Antimony-125	3.00E-02	(µg/g DW plant)/ (µg/g soil)	[4]	3.00E-02	[7]	3.00E-02	[7]	(µg/g DW plant)/ (µg/g soil)
14265-44-2	Phosphate								
14331-85-2	Protactinium-231	2.20E-05	(µg/g DW plant)/ (µg/g soil)	[4]	2.20E-05	[7]	2.20E-05	[7]	(µg/g DW plant)/ (µg/g soil)
14336-70-0	Nickel-59	3.00E-02	(µg/g DW plant)/ (µg/g soil)	[4]	3.00E-02	[7]	3.00E-02	[7]	(µg/g DW plant)/ (µg/g soil)
14391-16-3	Europium-155	2.00E-02	(µg/g DW plant)/ (µg/g soil)	[4]	2.00E-02	[7]	2.00E-02	[7]	(µg/g DW plant)/ (µg/g soil)
145-73-3	Endothall	3.00E+00	(µg/g DW plant)/ (µg/g soil)	[3]	3.00E+00	[2]	3.00E+00	[2]	(µg/g DW plant)/ (µg/g soil)
14596-10-2	Americium-241	2.20E-05	(µg/g DW plant)/ (µg/g soil)	[4]	2.20E-05	[7]	2.20E-05	[7]	(µg/g DW plant)/ (µg/g soil)
14683-23-9	Europium-152	2.00E-02	(µg/g DW plant)/ (µg/g soil)	[4]	2.00E-02	[7]	2.00E-02	[7]	(µg/g DW plant)/ (µg/g soil)
14762-75-5	Carbon-14	7.00E-01	(µg/g DW plant)/ (µg/g soil)	[4]	7.00E-01	[7]	7.00E-01	[7]	(µg/g DW plant)/ (µg/g soil)
14797-55-8	Nitrate				8.38E+00	[3]	8.38E+00	[3]	(µg/g DW plant)/ (µg/g soil)
14797-65-0	Nitrite								
14808-79-8	Sulfate								
14952-40-0	Actinium-227	2.20E-05	(µg/g DW plant)/ (µg/g soil)	[4]	2.20E-05	[7]	2.20E-05	[7]	(µg/g DW plant)/ (µg/g soil)
14993-75-0	Americium-243	2.20E-05	(µg/g DW plant)/ (µg/g soil)	[4]	2.20E-05	[7]	2.20E-05	[7]	(µg/g DW plant)/ (µg/g soil)
15046-84-1	Iodine-129	4.00E-02	(µg/g DW plant)/ (µg/g soil)	[4]	4.00E-02	[7]	4.00E-02	[7]	(µg/g DW plant)/ (µg/g soil)

Table 3-4 Plant-Soil Bioconcentration Factors for Domestic and Wild Grain

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration factor for Grain from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Grain	Reference	Plant-Soil Bioconcentration Factor in Domestic Grain (Br_{grain})	Reference	Plant-Soil Bioconcentration Factor in Wild Grain (Br_{grain})	Reference	Units for Plant-Soil Bioconcentration Factor in Grain
15117-48-3	Plutonium-239	8.60E-06	(µg/g DW plant)/ (µg/g soil)	[4]	8.60E-06	[7]	8.60E-06	[7]	(µg/g DW plant)/ (µg/g soil)
15117-96-1	Uranium-235	1.30E-03	(µg/g DW plant)/ (µg/g soil)	[4]	1.30E-03	[7]	1.30E-03	[7]	(µg/g DW plant)/ (µg/g soil)
15262-20-1	Radium-228	1.20E-03	(µg/g DW plant)/ (µg/g soil)	[4]	1.20E-03	[7]	1.20E-03	[7]	(µg/g DW plant)/ (µg/g soil)
15510-73-3	Curium-242	2.10E-05	(µg/g DW plant)/ (µg/g soil)	[4]	2.10E-05	[7]	2.10E-05	[7]	(µg/g DW plant)/ (µg/g soil)
15585-10-1	Europium-154	2.00E-02	(µg/g DW plant)/ (µg/g soil)	[4]	2.00E-02	[7]	2.00E-02	[7]	(µg/g DW plant)/ (µg/g soil)
15594-54-4	Thorium-229	3.40E-05	(µg/g DW plant)/ (µg/g soil)	[4]	3.40E-05	[7]	3.40E-05	[7]	(µg/g DW plant)/ (µg/g soil)
156-59-2	cis-1,2-Dichloroethene	3.09E+00	(µg/g DW plant)/ (µg/g soil)	[2]	3.09E+00	[2]	3.09E+00	[2]	(µg/g DW plant)/ (µg/g soil)
156-60-5	1,2-trans-Dichloroethene	2.37E+00	(µg/g DW plant)/ (µg/g soil)	[2]	2.37E+00	[2]	2.37E+00	[2]	(µg/g DW plant)/ (µg/g soil)
15715-94-3	Samarium-151	2.00E-02	(µg/g DW plant)/ (µg/g soil)	[4]	2.00E-02	[7]	2.00E-02	[7]	(µg/g DW plant)/ (µg/g soil)
15751-77-6	Zirconium-93	1.00E-03	(µg/g DW plant)/ (µg/g soil)	[4]	1.00E-03	[7]	1.00E-03	[7]	(µg/g DW plant)/ (µg/g soil)
15757-87-6	Curium-243	2.10E-05	(µg/g DW plant)/ (µg/g soil)	[4]	2.10E-05	[7]	2.10E-05	[7]	(µg/g DW plant)/ (µg/g soil)
15758-45-9	Selenium-79	2.50E-01	(µg/g DW plant)/ (µg/g soil)	[4]	2.50E-01	[7]	2.50E-01	[7]	(µg/g DW plant)/ (µg/g soil)
15832-50-5	Tin-126	6.00E-03	(µg/g DW plant)/ (µg/g soil)	[4]	6.00E-03	[7]	6.00E-03	[7]	(µg/g DW plant)/ (µg/g soil)
1634-04-4	Methyl tert-butyl ether	1.10E+01	(µg/g DW plant)/ (µg/g soil)	[3]	1.10E+01	[2]	1.10E+01	[2]	(µg/g DW plant)/ (µg/g soil)
16887-00-6	Chloride				8.38E+00	[3]	8.38E+00	[3]	(µg/g DW plant)/ (µg/g soil)
16984-48-8	Fluoride	6.00E-02	(µg/g DW plant)/ (µg/g soil)	[3]	6.00E-02	[6]	6.00E-02	[6]	(µg/g DW plant)/ (µg/g soil)

Table 3-4 Plant-Soil Bioconcentration Factors for Domestic and Wild Grain

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration factor for Grain from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Grain	Reference	Plant-Soil Bioconcentration Factor in Domestic Grain (Br_{grain})	Reference	Plant-Soil Bioconcentration Factor in Wild Grain (Br_{grain})	Reference	Units for Plant-Soil Bioconcentration Factor in Grain
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	4.55E-03	(µg/g DW plant)/(µg/g soil)	[2]	4.55E-03	[2]	4.55E-03	[2]	(µg/g DW plant)/(µg/g soil)
18540-29-9	Chromium(VI)	4.50E-03	(µg/g DW plant)/(µg/g soil)	[1]	4.50E-03	[1]	4.50E-03	[1]	(µg/g DW plant)/(µg/g soil)
189-55-9	Dibenzo[a,i]pyrene	2.31E-03	(µg/g DW plant)/(µg/g soil)	[3]	2.31E-03	[2]	2.31E-03	[2]	(µg/g DW plant)/(µg/g soil)
189-64-0	Dibenzo[a,h]pyrene	2.31E-03	(µg/g DW plant)/(µg/g soil)	[3]	2.31E-03	[2]	2.31E-03	[2]	(µg/g DW plant)/(µg/g soil)
191-24-2	Benzo(g,h,i)perylene	5.50E-03	(µg/g DW plant)/(µg/g soil)	[3]	5.50E-03	[2]	5.50E-03	[2]	(µg/g DW plant)/(µg/g soil)
191-30-0	Dibenzo(a,l)pyrene	1.30E-03	(µg/g DW plant)/(µg/g soil)	[3]	1.30E-03	[2]	1.30E-03	[2]	(µg/g DW plant)/(µg/g soil)
192-65-4	Dibenzo[a,e]pyrene	1.30E-03	(µg/g DW plant)/(µg/g soil)	[3]	1.30E-03	[2]	1.30E-03	[2]	(µg/g DW plant)/(µg/g soil)
192-97-2	Benzo(e)pyrene				7.34E-03	[2]	7.34E-03	[2]	(µg/g DW plant)/(µg/g soil)
193-39-5	Indeno(1,2,3-cd)pyrene	5.93E-03	(µg/g DW plant)/(µg/g soil)	[2]	5.93E-03	[2]	5.93E-03	[2]	(µg/g DW plant)/(µg/g soil)
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	2.34E-03	(µg/g DW plant)/(µg/g soil)	[2]	2.34E-03	[2]	2.34E-03	[2]	(µg/g DW plant)/(µg/g soil)
205-82-3	Benzo[j]fluoranthene	1.10E-02	(µg/g DW plant)/(µg/g soil)	[3]	1.10E-02	[2]	1.10E-02	[2]	(µg/g DW plant)/(µg/g soil)
205-99-2	Benzo(b)fluoranthene	1.12E-02	(µg/g DW plant)/(µg/g soil)	[2]	1.12E-02	[2]	1.12E-02	[2]	(µg/g DW plant)/(µg/g soil)
206-44-0	Fluoranthene	4.99E-02	(µg/g DW plant)/(µg/g soil)	[2]	4.99E-02	[2]	4.99E-02	[2]	(µg/g DW plant)/(µg/g soil)
207-08-9	Benzo(k)fluoranthene	1.15E-02	(µg/g DW plant)/(µg/g soil)	[2]	1.15E-02	[2]	1.15E-02	[2]	(µg/g DW plant)/(µg/g soil)
208-96-8	Acenaphthylene	2.00E-01	(µg/g DW plant)/(µg/g soil)	[3]	2.00E-01	[2]	2.00E-01	[2]	(µg/g DW plant)/(µg/g soil)

Table 3-4 Plant-Soil Bioconcentration Factors for Domestic and Wild Grain

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration factor for Grain from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Grain	Reference	Plant-Soil Bioconcentration Factor in Domestic Grain (Br_{grain})	Reference	Plant-Soil Bioconcentration Factor in Wild Grain (Br_{grain})	Reference	Units for Plant-Soil Bioconcentration Factor in Grain
218-01-9	Chrysene	1.97E-02	(µg/g DW plant)/ (µg/g soil)	[2]	1.97E-02	[2]	1.97E-02	[2]	(µg/g DW plant)/ (µg/g soil)
224-42-0	Dibenz[a,j]acridine	2.09E-02	(µg/g DW plant)/ (µg/g soil)	[3]	2.09E-02	[2]	2.09E-02	[2]	(µg/g DW plant)/ (µg/g soil)
2245-38-7	2,3,5-Trimethylnaphthalene				6.42E-02	[2]	6.42E-02	[2]	(µg/g DW plant)/ (µg/g soil)
226-36-8	Dibenz[a,h]acridine	1.83E-02	(µg/g DW plant)/ (µg/g soil)	[3]	1.83E-02	[2]	1.83E-02	[2]	(µg/g DW plant)/ (µg/g soil)
22967-92-6	Methyl mercury	1.90E-02	(µg/g DW plant)/ (µg/g soil)	[2]	1.90E-02	[4]	1.90E-02	[4]	(µg/g DW plant)/ (µg/g soil)
23950-58-5	Pronamide	4.03E-01	(µg/g DW plant)/ (µg/g soil)	[2]	4.03E-01	[2]	4.03E-01	[2]	(µg/g DW plant)/ (µg/g soil)
24959-67-9	Bromide				8.38E+00	[3]	8.38E+00	[3]	(µg/g DW plant)/ (µg/g soil)
27154-33-2	Trichlorofluoroethane	1.39E+00	(µg/g DW plant)/ (µg/g soil)	[8]	1.39E+00	[2]	1.39E+00	[2]	(µg/g DW plant)/ (µg/g soil)
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	2.86E-03	(µg/g DW plant)/ (µg/g soil)	[3]	2.86E-03	[2]	2.86E-03	[2]	(µg/g DW plant)/ (µg/g soil)
319-84-6	alpha-BHC	2.46E-01	(µg/g DW plant)/ (µg/g soil)	[2]	2.46E-01	[2]	2.46E-01	[2]	(µg/g DW plant)/ (µg/g soil)
319-85-7	beta-BHC	2.46E-01	(µg/g DW plant)/ (µg/g soil)	[2]	2.46E-01	[2]	2.46E-01	[2]	(µg/g DW plant)/ (µg/g soil)
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	5.50E-03	(µg/g DW plant)/ (µg/g soil)	[3]	5.50E-03	[2]	5.50E-03	[2]	(µg/g DW plant)/ (µg/g soil)
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	4.44E-03	(µg/g DW plant)/ (µg/g soil)	[3]	4.44E-03	[2]	4.44E-03	[2]	(µg/g DW plant)/ (µg/g soil)
3268-87-9	Octachlorodibenzo(p)dioxin	7.05E-04	(µg/g DW plant)/ (µg/g soil)	[2]	7.05E-04	[2]	7.05E-04	[2]	(µg/g DW plant)/ (µg/g soil)

Table 3-4 Plant-Soil Bioconcentration Factors for Domestic and Wild Grain

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration factor for Grain from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Grain	Reference	Plant-Soil Bioconcentration Factor in Domestic Grain (Br_{grain})	Reference	Plant-Soil Bioconcentration Factor in Wild Grain (Br_{grain})	Reference	Units for Plant-Soil Bioconcentration Factor in Grain
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	1.94E-03	(µg/g DW plant)/ (µg/g soil)	[3]	1.94E-03	[2]	1.94E-03	[2]	(µg/g DW plant)/ (µg/g soil)
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	9.20E-04	(µg/g DW plant)/ (µg/g soil)	[2]	9.20E-04	[2]	9.20E-04	[2]	(µg/g DW plant)/ (µg/g soil)
3697-24-3	5-Methylchrysene	1.16E-02	(µg/g DW plant)/ (µg/g soil)	[3]	1.16E-02	[2]	1.16E-02	[2]	(µg/g DW plant)/ (µg/g soil)
378253-40-8	Barium-137m	1.50E-02	(µg/g DW plant)/ (µg/g soil)	[4]	1.50E-02	[7]	1.50E-02	[7]	(µg/g DW plant)/ (µg/g soil)
378253-44-2	Cadmium-113m	1.50E-01	(µg/g DW plant)/ (µg/g soil)	[4]	1.50E-01	[7]	1.50E-01	[7]	(µg/g DW plant)/ (µg/g soil)
378782-82-2	Niobium-93m	2.50E-02	(µg/g DW plant)/ (µg/g soil)	[4]	2.50E-02	[7]	2.50E-02	[7]	(µg/g DW plant)/ (µg/g soil)
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	1.50E-03	(µg/g DW plant)/ (µg/g soil)	[3]	1.50E-03	[2]	1.50E-03	[2]	(µg/g DW plant)/ (µg/g soil)
39001-02-0	Octachlorodibenzofuran	9.20E-04	(µg/g DW plant)/ (µg/g soil)	[2]	9.20E-04	[2]	9.20E-04	[2]	(µg/g DW plant)/ (µg/g soil)
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	1.20E-03	(µg/g DW plant)/ (µg/g soil)	[2]	1.20E-03	[2]	1.20E-03	[2]	(µg/g DW plant)/ (µg/g soil)
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	6.15E-04	(µg/g DW plant)/ (µg/g soil)	[3]	6.15E-04	[2]	6.15E-04	[2]	(µg/g DW plant)/ (µg/g soil)
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	5.62E-03	(µg/g DW plant)/ (µg/g soil)	[2]	5.62E-03	[2]	5.62E-03	[2]	(µg/g DW plant)/ (µg/g soil)
4170-30-3	Crotonaldehyde (Propylene aldehyde)	1.73E+01	(µg/g DW plant)/ (µg/g soil)	[3]	1.73E+01	[2]	1.73E+01	[2]	(µg/g DW plant)/ (µg/g soil)
41851-50-7	Chlorocyclopentadiene	1.50E+00	(µg/g DW plant)/ (µg/g soil)	[3]	1.50E+00	[2]	1.50E+00	[2]	(µg/g DW plant)/ (µg/g soil)
460-19-5	Cyanogen (oxalonitrile)	3.46E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.60E+01	[5]	1.95E+01	[5]	(µg/g DW plant)/ (µg/g soil)

Table 3-4 Plant-Soil Bioconcentration Factors for Domestic and Wild Grain

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration factor for Grain from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Grain	Reference	Plant-Soil Bioconcentration Factor in Domestic Grain (Br_{grain})	Reference	Plant-Soil Bioconcentration Factor in Wild Grain (Br_{grain})	Reference	Units for Plant-Soil Bioconcentration Factor in Grain
4786-20-3	2-Butenenitrile				8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
50-00-0	Formaldehyde	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
50-32-8	Benzo(a)pyrene	1.32E-02	(µg/g DW plant)/ (µg/g soil)	[2]	1.32E-02	[2]	1.32E-02	[2]	(µg/g DW plant)/ (µg/g soil)
506-68-3	Cyanogen bromide (bromocyanide)				8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
506-77-4	Cyanogen chloride	2.91E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.60E+01	[5]	1.95E+01	[5]	(µg/g DW plant)/ (µg/g soil)
51-28-5	2,4-Dinitrophenol	4.99E+00	(µg/g DW plant)/ (µg/g soil)	[2]	4.99E+00	[2]	4.99E+00	[2]	(µg/g DW plant)/ (µg/g soil)
51-79-6	Ethyl carbamate (urethane)	4.70E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.60E+01	[5]	1.95E+01	[5]	(µg/g DW plant)/ (µg/g soil)
510-15-6	Chlorobenzilate	1.17E-01	(µg/g DW plant)/ (µg/g soil)	[2]	1.17E-01	[2]	1.17E-01	[2]	(µg/g DW plant)/ (µg/g soil)
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	1.15E-02	(µg/g DW plant)/ (µg/g soil)	[2]	1.15E-02	[2]	1.15E-02	[2]	(µg/g DW plant)/ (µg/g soil)
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	1.72E-03	(µg/g DW plant)/ (µg/g soil)	[3]	1.72E-03	[2]	1.72E-03	[2]	(µg/g DW plant)/ (µg/g soil)
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	4.03E+00	(µg/g DW plant)/ (µg/g soil)	[3]	4.03E+00	[2]	4.03E+00	[2]	(µg/g DW plant)/ (µg/g soil)
53-70-3	Dibenz[a,h]anthracene	6.78E-03	(µg/g DW plant)/ (µg/g soil)	[2]	6.78E-03	[2]	6.78E-03	[2]	(µg/g DW plant)/ (µg/g soil)
532-27-4	2-Chloroacetophenone	2.92E+00	(µg/g DW plant)/ (µg/g soil)	[3]	2.92E+00	[2]	2.92E+00	[2]	(µg/g DW plant)/ (µg/g soil)
534-52-1	4,6-Dinitro-o-cresol	2.24E+00	(µg/g DW plant)/ (µg/g soil)	[3]	2.24E+00	[2]	2.24E+00	[2]	(µg/g DW plant)/ (µg/g soil)
5385-75-1	Dibenzo(a,e)fluoranthene	2.31E-03	(µg/g DW plant)/ (µg/g soil)	[7]	2.31E-03	[2]	2.31E-03	[2]	(µg/g DW plant)/ (µg/g soil)

Table 3-4 Plant-Soil Bioconcentration Factors for Domestic and Wild Grain

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration factor for Grain from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Grain	Reference	Plant-Soil Bioconcentration Factor in Domestic Grain (Br_{grain})	Reference	Plant-Soil Bioconcentration Factor in Wild Grain (Br_{grain})	Reference	Units for Plant-Soil Bioconcentration Factor in Grain
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	2.36E+00	(µg/g DW plant)/ (µg/g soil)	[3]	2.36E+00	[2]	2.36E+00	[2]	(µg/g DW plant)/ (µg/g soil)
540-73-8	1,2-Dimethylhydrazine	7.92E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.60E+01	[5]	1.95E+01	[5]	(µg/g DW plant)/ (µg/g soil)
540-84-1	2,2,4-Trimethylpentane	1.63E-01	(µg/g DW plant)/ (µg/g soil)	[3]	1.63E-01	[2]	1.63E-01	[2]	(µg/g DW plant)/ (µg/g soil)
541-73-1	1,3-Dichlorobenzene	3.22E-01	(µg/g DW plant)/ (µg/g soil)	[2]	3.22E-01	[2]	3.22E-01	[2]	(µg/g DW plant)/ (µg/g soil)
542-75-6	1,3-Dichloropropene	4.60E+00	(µg/g DW plant)/ (µg/g soil)	[2]	4.60E+00	[2]	4.60E+00	[2]	(µg/g DW plant)/ (µg/g soil)
542-88-1	Bis(chloromethyl)ether	1.80E+01	(µg/g DW plant)/ (µg/g soil)	[3]	1.80E+01	[2]	1.80E+01	[2]	(µg/g DW plant)/ (µg/g soil)
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	2.05E-03	(µg/g DW plant)/ (µg/g soil)	[2]	2.05E-03	[2]	2.05E-03	[2]	(µg/g DW plant)/ (µg/g soil)
56-23-5	Carbon tetrachloride	9.32E-01	(µg/g DW plant)/ (µg/g soil)	[2]	9.32E-01	[2]	9.32E-01	[2]	(µg/g DW plant)/ (µg/g soil)
56-49-5	3-Methylcholanthrene	7.28E-03	(µg/g DW plant)/ (µg/g soil)	[3]	7.28E-03	[2]	7.28E-03	[2]	(µg/g DW plant)/ (µg/g soil)
56-55-3	Benzo(a)anthracene	1.97E-02	(µg/g DW plant)/ (µg/g soil)	[2]	1.97E-02	[2]	1.97E-02	[2]	(µg/g DW plant)/ (µg/g soil)
57-12-5	Cyanide	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.38E+00	[4]	8.38E+00	[4]	(µg/g DW plant)/ (µg/g soil)
57-24-9	Strychnine	2.97E+00	(µg/g DW plant)/ (µg/g soil)	[2]	2.97E+00	[2]	2.97E+00	[2]	(µg/g DW plant)/ (µg/g soil)
57-74-9	Chlordane	2.56E-02	(µg/g DW plant)/ (µg/g soil)	[2]	2.56E-02	[2]	2.56E-02	[2]	(µg/g DW plant)/ (µg/g soil)
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	6.78E-03	(µg/g DW plant)/ (µg/g soil)	[2]	6.78E-03	[2]	6.78E-03	[2]	(µg/g DW plant)/ (µg/g soil)
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	4.61E-03	(µg/g DW plant)/ (µg/g soil)	[2]	4.61E-03	[2]	4.61E-03	[2]	(µg/g DW plant)/ (µg/g soil)

Table 3-4 Plant-Soil Bioconcentration Factors for Domestic and Wild Grain

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration factor for Grain from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Grain	Reference	Plant-Soil Bioconcentration Factor in Domestic Grain (Br_{grain})	Reference	Plant-Soil Bioconcentration Factor in Wild Grain (Br_{grain})	Reference	Units for Plant-Soil Bioconcentration Factor in Grain
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	3.48E-03	(µg/g DW plant)/(µg/g soil)	[2]	3.48E-03	[2]	3.48E-03	[2]	(µg/g DW plant)/(µg/g soil)
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	3.44E-03	(µg/g DW plant)/(µg/g soil)	[3]	3.44E-03	[2]	3.44E-03	[2]	(µg/g DW plant)/(µg/g soil)
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	2.34E-03	(µg/g DW plant)/(µg/g soil)	[2]	2.33E-03	[2]	2.33E-03	[2]	(µg/g DW plant)/(µg/g soil)
58-89-9	gamma-BHC (Lindane)	2.68E-01	(µg/g DW plant)/(µg/g soil)	[3]	2.68E-01	[2]	2.68E-01	[2]	(µg/g DW plant)/(µg/g soil)
58-90-2	2,3,4,6-Tetrachlorophenol	1.04E-01	(µg/g DW plant)/(µg/g soil)	[2]	1.04E-01	[2]	1.04E-01	[2]	(µg/g DW plant)/(µg/g soil)
581-42-0	2,6-Dimethylnaphthalene				1.25E-01	[2]	1.25E-01	[2]	(µg/g DW plant)/(µg/g soil)
584-84-9	2,4-Toluene diisocyanate	2.78E+00	(µg/g DW plant)/(µg/g soil)	[5]	2.78E+00	[2]	2.78E+00	[2]	(µg/g DW plant)/(µg/g soil)
589-38-8	3-Hexanone				7.43E+00	[2]	7.43E+00	[2]	(µg/g DW plant)/(µg/g soil)
59-50-7	4-Chloro-3-methylphenol	6.25E-01	(µg/g DW plant)/(µg/g soil)	[2]	6.25E-01	[2]	6.25E-01	[2]	(µg/g DW plant)/(µg/g soil)
59-89-2	N-Nitrosomorpholine	6.93E+01	(µg/g DW plant)/(µg/g soil)	[3]	2.60E+01	[5]	1.95E+01	[5]	(µg/g DW plant)/(µg/g soil)
591-50-4	Benzene, iodo-				5.12E-01	[2]	5.12E-01	[2]	(µg/g DW plant)/(µg/g soil)
591-78-6	2-Hexanone	6.10E+00	(µg/g DW plant)/(µg/g soil)	[3]	6.10E+00	[2]	6.10E+00	[2]	(µg/g DW plant)/(µg/g soil)
593-60-2	Bromoethene (Vinyl bromide)	4.73E+00	(µg/g DW plant)/(µg/g soil)	[3]	4.73E+00	[2]	4.73E+00	[2]	(µg/g DW plant)/(µg/g soil)
593-74-8	Dimethyl Mercury	1.21E+00	(µg/g DW plant)/(µg/g soil)	[3]	1.21E+00	[6]	1.21E+00	[6]	(µg/g DW plant)/(µg/g soil)
60-11-7	Dimethyl aminoazobenzene	8.49E-02	(µg/g DW plant)/(µg/g soil)	[3]	8.49E-02	[2]	8.49E-02	[2]	(µg/g DW plant)/(µg/g soil)

Table 3-4 Plant-Soil Bioconcentration Factors for Domestic and Wild Grain

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration factor for Grain from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Grain	Reference	Plant-Soil Bioconcentration Factor in Domestic Grain (Br_{grain})	Reference	Plant-Soil Bioconcentration Factor in Wild Grain (Br_{grain})	Reference	Units for Plant-Soil Bioconcentration Factor in Grain
60-29-7	Ethyl ether	1.17E+01	(µg/g DW plant)/ (µg/g soil)	[3]	1.17E+01	[2]	1.17E+01	[2]	(µg/g DW plant)/ (µg/g soil)
60-35-5	Acetamide	2.07E+02	(µg/g DW plant)/ (µg/g soil)	[3]	2.60E+01	[5]	1.95E+01	[5]	(µg/g DW plant)/ (µg/g soil)
602-87-9	5-Nitroacenaphthene	2.25E-01	(µg/g DW plant)/ (µg/g soil)	[3]	2.25E-01	[2]	2.25E-01	[2]	(µg/g DW plant)/ (µg/g soil)
606-20-2	2,6-Dinitrotoluene	3.93E+00	(µg/g DW plant)/ (µg/g soil)	[2]	3.93E+00	[2]	3.93E+00	[2]	(µg/g DW plant)/ (µg/g soil)
608-93-5	Pentachlorobenzene	3.98E-02	(µg/g DW plant)/ (µg/g soil)	[2]	3.98E-02	[2]	3.98E-02	[2]	(µg/g DW plant)/ (µg/g soil)
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	3.48E-03	(µg/g DW plant)/ (µg/g soil)	[2]	3.48E-03	[2]	3.48E-03	[2]	(µg/g DW plant)/ (µg/g soil)
61626-71-9	Dichloropentadiene	1.50E+00	(µg/g DW plant)/ (µg/g soil)	[6]	1.50E+00	[2]	1.50E+00	[2]	(µg/g DW plant)/ (µg/g soil)
62-50-0	Ethyl methanesulfonate	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
62-53-3	Aniline	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
62-75-9	N-Nitroso-N,N-dimethylamine	8.24E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.60E+01	[5]	1.95E+01	[5]	(µg/g DW plant)/ (µg/g soil)
621-64-7	N-Nitroso-di-n-propylamine	6.34E+00	(µg/g DW plant)/ (µg/g soil)	[2]	6.34E+00	[2]	6.34E+00	[2]	(µg/g DW plant)/ (µg/g soil)
624-83-9	Methyl isocyanate	1.34E+01	(µg/g DW plant)/ (µg/g soil)	[3]	1.34E+01	[2]	1.34E+01	[2]	(µg/g DW plant)/ (µg/g soil)
628-73-9	Hexanenitrile				4.25E+00	[2]	4.25E+00	[2]	(µg/g DW plant)/ (µg/g soil)
630-08-0	Carbon monoxide	2.26E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.26E+01	[6]	2.26E+01	[6]	(µg/g DW plant)/ (µg/g soil)
630-20-6	1,1,1,2-Tetrachloroethane	6.87E-01	(µg/g DW plant)/ (µg/g soil)	[2]	6.87E-01	[2]	6.87E-01	[2]	(µg/g DW plant)/ (µg/g soil)
64-18-6	Formic acid (methanoic acid)	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)

Table 3-4 Plant-Soil Bioconcentration Factors for Domestic and Wild Grain

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration factor for Grain from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Grain	Reference	Plant-Soil Bioconcentration Factor in Domestic Grain (Br_{grain})	Reference	Plant-Soil Bioconcentration Factor in Wild Grain (Br_{grain})	Reference	Units for Plant-Soil Bioconcentration Factor in Grain
65-85-0	Benzoic acid	3.21E+00	(µg/g DW plant)/ (µg/g soil)	[2]	3.21E+00	[2]	3.21E+00	[2]	(µg/g DW plant)/ (µg/g soil)
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	3.44E-03	(µg/g DW plant)/ (µg/g soil)	[3]	3.44E-03	[2]	3.44E-03	[2]	(µg/g DW plant)/ (µg/g soil)
67-56-1	Methyl alcohol	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
67-63-0	2-Propyl alcohol	3.60E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.60E+01	[5]	1.95E+01	[5]	(µg/g DW plant)/ (µg/g soil)
67-64-1	2-Propanone (Acetone)	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
67-66-3	Chloroform	2.70E+00	(µg/g DW plant)/ (µg/g soil)	[2]	2.70E+00	[2]	2.70E+00	[2]	(µg/g DW plant)/ (µg/g soil)
67-72-1	Hexachloroethane	2.07E-01	(µg/g DW plant)/ (µg/g soil)	[2]	2.07E-01	[2]	2.07E-01	[2]	(µg/g DW plant)/ (µg/g soil)
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	2.05E-03	(µg/g DW plant)/ (µg/g soil)	[2]	2.05E-03	[2]	2.05E-03	[2]	(µg/g DW plant)/ (µg/g soil)
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	1.50E-03	(µg/g DW plant)/ (µg/g soil)	[3]	1.50E-03	[2]	1.50E-03	[2]	(µg/g DW plant)/ (µg/g soil)
70-30-4	Hexachlorophene	1.70E-03	(µg/g DW plant)/ (µg/g soil)	[2]	1.70E-03	[2]	1.70E-03	[2]	(µg/g DW plant)/ (µg/g soil)
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	8.10E-03	(µg/g DW plant)/ (µg/g soil)	[3]	8.10E-03	[2]	8.10E-03	[2]	(µg/g DW plant)/ (µg/g soil)
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	3.48E-03	(µg/g DW plant)/ (µg/g soil)	[2]	3.48E-03	[2]	3.48E-03	[2]	(µg/g DW plant)/ (µg/g soil)
71-36-3	n-Butyl alcohol	1.19E+01	(µg/g DW plant)/ (µg/g soil)	[3]	1.19E+01	[2]	1.19E+01	[2]	(µg/g DW plant)/ (µg/g soil)
71-43-2	Benzene	2.37E+00	(µg/g DW plant)/ (µg/g soil)	[2]	2.37E+00	[2]	2.37E+00	[2]	(µg/g DW plant)/ (µg/g soil)

Table 3-4 Plant-Soil Bioconcentration Factors for Domestic and Wild Grain

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration factor for Grain from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Grain	Reference	Plant-Soil Bioconcentration Factor in Domestic Grain (Br_{grain})	Reference	Plant-Soil Bioconcentration Factor in Wild Grain (Br_{grain})	Reference	Units for Plant-Soil Bioconcentration Factor in Grain
71-55-6	1,1,1-Trichloroethane	1.39E+00	(µg/g DW plant)/(µg/g soil)	[2]	1.39E+00	[2]	1.39E+00	[2]	(µg/g DW plant)/(µg/g soil)
72-43-5	Methoxychlor	6.51E-02	(µg/g DW plant)/(µg/g soil)	[2]	6.51E-02	[2]	6.51E-02	[2]	(µg/g DW plant)/(µg/g soil)
72-55-9	4,4-DDE	1.97E-02	(µg/g DW plant)/(µg/g soil)	[2]	1.97E-02	[2]	1.97E-02	[2]	(µg/g DW plant)/(µg/g soil)
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	3.48E-03	(µg/g DW plant)/(µg/g soil)	[2]	3.48E-03	[2]	3.48E-03	[2]	(µg/g DW plant)/(µg/g soil)
74-83-9	Bromomethane	7.95E+00	(µg/g DW plant)/(µg/g soil)	[2]	7.95E+00	[2]	7.95E+00	[2]	(µg/g DW plant)/(µg/g soil)
74-87-3	Chloromethane	8.38E+00	(µg/g DW plant)/(µg/g soil)	[2]	8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/(µg/g soil)
74-88-4	Iodomethane	5.12E+00	(µg/g DW plant)/(µg/g soil)	[3]	5.12E+00	[2]	5.12E+00	[2]	(µg/g DW plant)/(µg/g soil)
74-95-3	Methylene bromide	5.06E+00	(µg/g DW plant)/(µg/g soil)	[2]	5.06E+00	[2]	5.06E+00	[2]	(µg/g DW plant)/(µg/g soil)
74-97-5	Bromochloromethane	5.86E+00	(µg/g DW plant)/(µg/g soil)	[3]	5.86E+00	[2]	5.86E+00	[2]	(µg/g DW plant)/(µg/g soil)
7429-90-5	Aluminum	4.00E-03	(µg/g DW plant)/(µg/g soil)	[3]	4.00E-03	[6]	4.00E-03	[6]	(µg/g DW plant)/(µg/g soil)
7439-89-6	Iron	5.00E-02	(µg/g DW plant)/(µg/g soil)	[4]	5.00E-02	[7]	5.00E-02	[7]	(µg/g DW plant)/(µg/g soil)
7439-92-1	Lead	9.00E-03	(µg/g DW plant)/(µg/g soil)	[1]	9.00E-03	[1]	9.00E-03	[1]	(µg/g DW plant)/(µg/g soil)
7439-93-2	Lithium	2.50E-02	(µg/g DW plant)/(µg/g soil)	[3]	2.50E-02	[6]	2.50E-02	[6]	(µg/g DW plant)/(µg/g soil)
7439-95-4	Magnesium	5.50E-01	(µg/g DW plant)/(µg/g soil)	[4]	5.50E-01	[7]	5.50E-01	[7]	(µg/g DW plant)/(µg/g soil)
7439-96-5	Manganese	3.00E-01	(µg/g DW plant)/(µg/g soil)	[4]	3.00E-01	[7]	3.00E-01	[7]	(µg/g DW plant)/(µg/g soil)
7439-97-6	Mercury	4.90E-01	(µg/g DW plant)/(µg/g soil)	[4]	4.90E-01	[7]	4.90E-01	[7]	(µg/g DW plant)/(µg/g soil)

Table 3-4 Plant-Soil Bioconcentration Factors for Domestic and Wild Grain

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration factor for Grain from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Grain	Reference	Plant-Soil Bioconcentration Factor in Domestic Grain (Br_{grain})	Reference	Plant-Soil Bioconcentration Factor in Wild Grain (Br_{grain})	Reference	Units for Plant-Soil Bioconcentration Factor in Grain
7439-98-7	Molybdenum	8.00E-01	(µg/g DW plant)/ (µg/g soil)	[4]	8.00E-01	[7]	8.00E-01	[7]	(µg/g DW plant)/ (µg/g soil)
7440-02-0	Nickel	6.00E-03	(µg/g DW plant)/ (µg/g soil)	[2]	6.00E-03	[4]	6.00E-03	[4]	(µg/g DW plant)/ (µg/g soil)
7440-16-6	Rhodium	4.00E-02	(µg/g DW plant)/ (µg/g soil)	[4]	4.00E-02	[7]	4.00E-02	[7]	(µg/g DW plant)/ (µg/g soil)
7440-22-4	Silver	1.00E-01	(µg/g DW plant)/ (µg/g soil)	[1]	1.00E-01	[1]	1.00E-01	[1]	(µg/g DW plant)/ (µg/g soil)
7440-23-5	Sodium	3.00E-01	(µg/g DW plant)/ (µg/g soil)	[4]	3.00E-01	[7]	3.00E-01	[7]	(µg/g DW plant)/ (µg/g soil)
7440-24-6	Strontium (total)	2.10E-01	(µg/g DW plant)/ (µg/g soil)	[4]	2.10E-01	[7]	2.10E-01	[7]	(µg/g DW plant)/ (µg/g soil)
7440-25-7	Tantalum	2.50E-02	(µg/g DW plant)/ (µg/g soil)	[4]	2.50E-02	[7]	2.50E-02	[7]	(µg/g DW plant)/ (µg/g soil)
7440-28-0	Thallium	4.00E-04	(µg/g DW plant)/ (µg/g soil)	[1]	4.00E-04	[1]	4.00E-04	[1]	(µg/g DW plant)/ (µg/g soil)
7440-29-1	Thorium-232	3.40E-05	(µg/g DW plant)/ (µg/g soil)	[4]	3.40E-05	[7]	3.40E-05	[7]	(µg/g DW plant)/ (µg/g soil)
7440-31-5	Tin	6.00E-03	(µg/g DW plant)/ (µg/g soil)	[4]	6.00E-03	[7]	6.00E-03	[7]	(µg/g DW plant)/ (µg/g soil)
7440-33-7	Tungsten	3.00E+00	(µg/g DW plant)/ (µg/g soil)	[4]	3.00E+00	[7]	3.00E+00	[7]	(µg/g DW plant)/ (µg/g soil)
7440-36-0	Antimony	3.00E-02	(µg/g DW plant)/ (µg/g soil)	[1]	3.00E-02	[1]	3.00E-02	[1]	(µg/g DW plant)/ (µg/g soil)
7440-38-2	Arsenic	4.00E-03	(µg/g DW plant)/ (µg/g soil)	[2]	4.00E-03	[4]	4.00E-03	[4]	(µg/g DW plant)/ (µg/g soil)
7440-39-3	Barium	1.50E-02	(µg/g DW plant)/ (µg/g soil)	[1]	1.50E-02	[1]	1.50E-02	[1]	(µg/g DW plant)/ (µg/g soil)
7440-41-7	Beryllium	1.50E-03	(µg/g DW plant)/ (µg/g soil)	[1]	1.50E-03	[1]	1.50E-03	[1]	(µg/g DW plant)/ (µg/g soil)
7440-43-9	Cadmium	6.20E-02	(µg/g DW plant)/ (µg/g soil)	[2]	6.20E-02	[4]	6.20E-02	[4]	(µg/g DW plant)/ (µg/g soil)

Table 3-4 Plant-Soil Bioconcentration Factors for Domestic and Wild Grain

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration factor for Grain from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Grain	Reference	Plant-Soil Bioconcentration Factor in Domestic Grain (Br_{grain})	Reference	Plant-Soil Bioconcentration Factor in Wild Grain (Br_{grain})	Reference	Units for Plant-Soil Bioconcentration Factor in Grain
7440-47-3	Chromium	4.50E-03	(µg/g DW plant)/ (µg/g soil)	[1]	4.50E-03	[1]	4.50E-03	[1]	(µg/g DW plant)/ (µg/g soil)
7440-48-4	Cobalt	3.70E-03	(µg/g DW plant)/ (µg/g soil)	[4]	3.70E-03	[7]	3.70E-03	[7]	(µg/g DW plant)/ (µg/g soil)
7440-50-8	Copper	2.50E-01	(µg/g DW plant)/ (µg/g soil)	[4]	2.50E-01	[7]	2.50E-01	[7]	(µg/g DW plant)/ (µg/g soil)
7440-61-1	Uranium	1.30E-03	(µg/g DW plant)/ (µg/g soil)	[4]	1.30E-03	[7]	1.30E-03	[7]	(µg/g DW plant)/ (µg/g soil)
7440-61-1R	Uranium-238	1.25E-02	(µg/g DW plant)/ (µg/g soil)	[3]	1.25E-02	[6]	1.25E-02	[6]	(µg/g DW plant)/ (µg/g soil)
7440-62-2	Vanadium	5.50E-03	(µg/g DW plant)/ (µg/g soil)	[3]	5.50E-03	[6]	5.50E-03	[6]	(µg/g DW plant)/ (µg/g soil)
7440-65-5	Yttrium	1.00E-02	(µg/g DW plant)/ (µg/g soil)	[4]	1.00E-02	[7]	1.00E-02	[7]	(µg/g DW plant)/ (µg/g soil)
7440-66-6	Zinc	5.40E-02	(µg/g DW plant)/ (µg/g soil)	[2]	5.40E-02	[4]	5.40E-02	[4]	(µg/g DW plant)/ (µg/g soil)
7440-67-7	Zirconium	1.00E-03	(µg/g DW plant)/ (µg/g soil)	[4]	1.00E-03	[7]	1.00E-03	[7]	(µg/g DW plant)/ (µg/g soil)
7446-09-5	Sulfur dioxide				8.38E+00	[3]	8.38E+00	[3]	(µg/g DW plant)/ (µg/g soil)
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	3.44E-03	(µg/g DW plant)/ (µg/g soil)	[3]	3.44E-03	[2]	3.44E-03	[2]	(µg/g DW plant)/ (µg/g soil)
7487-94-7	Mercuric chloride (HgCl2)	9.30E-03	(µg/g DW plant)/ (µg/g soil)	[2]	9.30E-03	[4]	9.30E-03	[4]	(µg/g DW plant)/ (µg/g soil)
75-00-3	Chloroethane	6.01E+00	(µg/g DW plant)/ (µg/g soil)	[2]	6.01E+00	[2]	6.01E+00	[2]	(µg/g DW plant)/ (µg/g soil)
75-01-4	1-Chloroethene	6.01E+00	(µg/g DW plant)/ (µg/g soil)	[2]	6.01E+00	[2]	6.01E+00	[2]	(µg/g DW plant)/ (µg/g soil)
75-02-5	Fluoroethene (vinyl fluoride)				7.95E+00	[2]	7.95E+00	[2]	(µg/g DW plant)/ (µg/g soil)
75-05-8	Acetonitrile	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)

Table 3-4 Plant-Soil Bioconcentration Factors for Domestic and Wild Grain

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration factor for Grain from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Grain	Reference	Plant-Soil Bioconcentration Factor in Domestic Grain (Br_{grain})	Reference	Plant-Soil Bioconcentration Factor in Wild Grain (Br_{grain})	Reference	Units for Plant-Soil Bioconcentration Factor in Grain
75-07-0	Acetaldehyde	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
75-09-2	Dichloromethane (Methylene Chloride)	6.86E+00	(µg/g DW plant)/ (µg/g soil)	[2]	6.86E+00	[2]	6.86E+00	[2]	(µg/g DW plant)/ (µg/g soil)
75-15-0	Carbon disulfide	2.07E+00	(µg/g DW plant)/ (µg/g soil)	[2]	2.07E+00	[2]	2.07E+00	[2]	(µg/g DW plant)/ (µg/g soil)
75-21-8	Ethylene oxide (Oxirane)	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
75-25-2	Bromoform	1.65E+00	(µg/g DW plant)/ (µg/g soil)	[2]	1.65E+00	[2]	1.65E+00	[2]	(µg/g DW plant)/ (µg/g soil)
75-27-4	Bromodichloromethane	2.37E+00	(µg/g DW plant)/ (µg/g soil)	[2]	2.37E+00	[2]	2.37E+00	[2]	(µg/g DW plant)/ (µg/g soil)
75-29-6	2-Chloropropane	3.04E+00	(µg/g DW plant)/ (µg/g soil)	[3]	3.04E+00	[2]	3.04E+00	[2]	(µg/g DW plant)/ (µg/g soil)
75-34-3	1,1-Dichloroethane	3.53E+00	(µg/g DW plant)/ (µg/g soil)	[2]	3.53E+00	[2]	3.53E+00	[2]	(µg/g DW plant)/ (µg/g soil)
75-35-4	1,1-Dichloroethene	2.37E+00	(µg/g DW plant)/ (µg/g soil)	[2]	2.37E+00	[2]	2.37E+00	[2]	(µg/g DW plant)/ (µg/g soil)
75-44-5	Phosgene (hydrogen phosphide)	9.94E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.60E+01	[5]	1.95E+01	[5]	(µg/g DW plant)/ (µg/g soil)
75-45-6	Chlorodifluoromethane	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
75-50-3	Trimethylamine				8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
75-69-4	Trichlorofluoromethane	1.39E+00	(µg/g DW plant)/ (µg/g soil)	[2]	1.39E+00	[2]	1.39E+00	[2]	(µg/g DW plant)/ (µg/g soil)
75-71-8	Dichlorodifluoromethane	2.19E+00	(µg/g DW plant)/ (µg/g soil)	[2]	2.19E+00	[2]	2.19E+00	[2]	(µg/g DW plant)/ (µg/g soil)
76-01-7	Pentachloroethane	5.22E-01	(µg/g DW plant)/ (µg/g soil)	[3]	5.22E-01	[2]	5.22E-01	[2]	(µg/g DW plant)/ (µg/g soil)

Table 3-4 Plant-Soil Bioconcentration Factors for Domestic and Wild Grain

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration factor for Grain from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Grain	Reference	Plant-Soil Bioconcentration Factor in Domestic Grain (Br_{grain})	Reference	Plant-Soil Bioconcentration Factor in Wild Grain (Br_{grain})	Reference	Units for Plant-Soil Bioconcentration Factor in Grain
76-13-1	1,2,2-Trichlorotrifluoroethane	5.66E-01	(µg/g DW plant)/(µg/g soil)	[3]	5.66E-01	[2]	5.66E-01	[2]	(µg/g DW plant)/(µg/g soil)
76-44-8	Heptachlor	1.27E-01	(µg/g DW plant)/(µg/g soil)	[2]	1.27E-01	[2]	1.27E-01	[2]	(µg/g DW plant)/(µg/g soil)
764-41-0	1,4-Dichloro-2-butene	1.20E+00	(µg/g DW plant)/(µg/g soil)	[3]	1.20E+00	[2]	1.20E+00	[2]	(µg/g DW plant)/(µg/g soil)
7647-01-0	Hydrogen chloride								
765-34-4	Glycidylaldehyde	4.52E+01	(µg/g DW plant)/(µg/g soil)	[3]	2.60E+01	[5]	1.95E+01	[5]	(µg/g DW plant)/(µg/g soil)
7664-39-3	Hydrogen Fluoride				8.38E+00	[3]	8.38E+00	[3]	(µg/g DW plant)/(µg/g soil)
7664-41-7	Ammonia/Ammonium	3.80E+01	(µg/g DW plant)/(µg/g soil)	[3]	3.80E+01	[6]	3.80E+01	[6]	(µg/g DW plant)/(µg/g soil)
77-47-4	Hexachlorocyclopentadiene	4.73E-02	(µg/g DW plant)/(µg/g soil)	[2]	4.73E-02	[2]	4.73E-02	[2]	(µg/g DW plant)/(µg/g soil)
77-78-1	Dimethyl sulfate	8.18E+00	(µg/g DW plant)/(µg/g soil)	[3]	8.18E+00	[2]	8.18E+00	[2]	(µg/g DW plant)/(µg/g soil)
7704-34-9	Total Sulfur (thermodynamically stable)				8.38E+00	[3]	8.38E+00	[3]	(µg/g DW plant)/(µg/g soil)
7723-14-0	Phosphorus	3.50E+00	(µg/g DW plant)/(µg/g soil)	[4]	3.50E+00	[7]	3.50E+00	[7]	(µg/g DW plant)/(µg/g soil)
7782-41-4	Fluorine gas F2	6.00E-02	(µg/g DW plant)/(µg/g soil)	[3]	6.00E-02	[6]	6.00E-02	[6]	(µg/g DW plant)/(µg/g soil)
7782-49-2	Selenium	2.00E-03	(µg/g DW plant)/(µg/g soil)	[2]	2.00E-03	[4]	2.00E-03	[4]	(µg/g DW plant)/(µg/g soil)
7782-50-5	Chlorine	8.38E+00	(µg/g DW plant)/(µg/g soil)	[2]	8.38E+00	[4]	8.38E+00	[4]	(µg/g DW plant)/(µg/g soil)
78-83-1	2-Methylpropyl alcohol	1.40E+01	(µg/g DW plant)/(µg/g soil)	[3]	1.40E+01	[2]	1.40E+01	[2]	(µg/g DW plant)/(µg/g soil)
78-87-5	1,2-Dichloropropane	2.70E+00	(µg/g DW plant)/(µg/g soil)	[2]	2.70E+00	[2]	2.70E+00	[2]	(µg/g DW plant)/(µg/g soil)

Table 3-4 Plant-Soil Bioconcentration Factors for Domestic and Wild Grain

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration factor for Grain from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Grain	Reference	Plant-Soil Bioconcentration Factor in Domestic Grain (Br_{grain})	Reference	Plant-Soil Bioconcentration Factor in Wild Grain (Br_{grain})	Reference	Units for Plant-Soil Bioconcentration Factor in Grain
78-93-3	2-Butanone	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
79-00-5	1,1,2-Trichloroethane	2.70E+00	(µg/g DW plant)/ (µg/g soil)	[2]	2.70E+00	[2]	2.70E+00	[2]	(µg/g DW plant)/ (µg/g soil)
79-01-6	1,1,2-Trichloroethylene	1.59E+00	(µg/g DW plant)/ (µg/g soil)	[2]	1.59E+00	[2]	1.59E+00	[2]	(µg/g DW plant)/ (µg/g soil)
79-10-7	2-Propenoic acid	2.41E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.41E+01	[2]	1.95E+01	[5]	(µg/g DW plant)/ (µg/g soil)
79-34-5	1,1,2,2-Tetrachloroethane	1.59E+00	(µg/g DW plant)/ (µg/g soil)	[2]	1.59E+00	[2]	1.59E+00	[2]	(µg/g DW plant)/ (µg/g soil)
79-46-9	2-Nitropropane	1.11E+01	(µg/g DW plant)/ (µg/g soil)	[3]	1.11E+01	[2]	1.11E+01	[2]	(µg/g DW plant)/ (µg/g soil)
80-62-6	Methyl methacrylate	6.10E+00	(µg/g DW plant)/ (µg/g soil)	[3]	6.10E+00	[2]	6.10E+00	[2]	(µg/g DW plant)/ (µg/g soil)
82-68-8	Pentachloronitrobenzene (PCNB)	8.06E-02	(µg/g DW plant)/ (µg/g soil)	[2]	8.06E-02	[2]	8.06E-02	[2]	(µg/g DW plant)/ (µg/g soil)
822-06-0	Hexamethylene-1,5-diisocyanate	5.36E-01	(µg/g DW plant)/ (µg/g soil)	[3]	5.36E-01	[2]	5.36E-01	[2]	(µg/g DW plant)/ (µg/g soil)
823-40-5	Toluene-2,6-diamine	3.11E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.60E+01	[5]	1.95E+01	[5]	(µg/g DW plant)/ (µg/g soil)
83-32-9	Acenaphthene	2.16E-01	(µg/g DW plant)/ (µg/g soil)	[2]	2.16E-01	[2]	2.16E-01	[2]	(µg/g DW plant)/ (µg/g soil)
832-69-9	1-Methylphenanthrene				4.48E-02	[2]	4.48E-02	[2]	(µg/g DW plant)/ (µg/g soil)
84-66-2	Diethyl phthalate	1.39E+00	(µg/g DW plant)/ (µg/g soil)	[2]	1.39E+00	[2]	1.39E+00	[2]	(µg/g DW plant)/ (µg/g soil)
84-74-2	Di-n-butylphthalate	7.44E-02	(µg/g DW plant)/ (µg/g soil)	[2]	7.44E-02	[2]	7.44E-02	[2]	(µg/g DW plant)/ (µg/g soil)
85-01-8	Phenanthrene	9.71E-02	(µg/g DW plant)/ (µg/g soil)	[2]	9.71E-02	[2]	9.71E-02	[2]	(µg/g DW plant)/ (µg/g soil)

Table 3-4 Plant-Soil Bioconcentration Factors for Domestic and Wild Grain

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration factor for Grain from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Grain	Reference	Plant-Soil Bioconcentration Factor in Domestic Grain (Br_{grain})	Reference	Plant-Soil Bioconcentration Factor in Wild Grain (Br_{grain})	Reference	Units for Plant-Soil Bioconcentration Factor in Grain
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	8.38E+00	(µg/g DW plant)/ (µg/g soil)	[2]	8.38E+00	[2]	8.38E+00	[2]	(µg/g DW plant)/ (µg/g soil)
85-68-7	Butylbenzylphthalate	5.70E-02	(µg/g DW plant)/ (µg/g soil)	[2]	5.70E-02	[2]	5.70E-02	[2]	(µg/g DW plant)/ (µg/g soil)
86-73-7	Fluorene	1.45E-01	(µg/g DW plant)/ (µg/g soil)	[2]	1.45E-01	[2]	1.45E-01	[2]	(µg/g DW plant)/ (µg/g soil)
87-61-6	1,2,3-Trichlorobenzene	1.77E-01	(µg/g DW plant)/ (µg/g soil)	[2]	1.77E-01	[2]	1.77E-01	[2]	(µg/g DW plant)/ (µg/g soil)
87-68-3	Hexachlorobutadiene	6.50E-02	(µg/g DW plant)/ (µg/g soil)	[2]	6.51E-02	[2]	6.51E-02	[2]	(µg/g DW plant)/ (µg/g soil)
87-86-5	Pentachlorophenol	4.37E-02	(µg/g DW plant)/ (µg/g soil)	[2]	4.37E-02	[2]	4.37E-02	[2]	(µg/g DW plant)/ (µg/g soil)
88-06-2	2,4,6-Trichlorophenol	2.81E-01	(µg/g DW plant)/ (µg/g soil)	[2]	2.81E-01	[2]	2.81E-01	[2]	(µg/g DW plant)/ (µg/g soil)
88-74-4	o-Nitroaniline (2-nitroaniline)	3.30E+00	(µg/g DW plant)/ (µg/g soil)	[2]	3.30E+00	[2]	3.30E+00	[2]	(µg/g DW plant)/ (µg/g soil)
88-75-5	2-Nitrophenol	3.58E+00	(µg/g DW plant)/ (µg/g soil)	[2]	3.58E+00	[2]	3.58E+00	[2]	(µg/g DW plant)/ (µg/g soil)
90-04-0	o-Anisidine	7.96E+00	(µg/g DW plant)/ (µg/g soil)	[3]	7.96E+00	[2]	7.96E+00	[2]	(µg/g DW plant)/ (µg/g soil)
90-12-0	1-Methylnaphthalene	2.19E-01	(µg/g DW plant)/ (µg/g soil)	[3]	2.19E-01	[2]	2.19E-01	[2]	(µg/g DW plant)/ (µg/g soil)
91-20-3	Naphthalene	4.79E-01	(µg/g DW plant)/ (µg/g soil)	[2]	4.79E-01	[2]	4.79E-01	[2]	(µg/g DW plant)/ (µg/g soil)
91-22-5	Quinoline	2.56E+00	(µg/g DW plant)/ (µg/g soil)	[3]	2.56E+00	[2]	2.56E+00	[2]	(µg/g DW plant)/ (µg/g soil)
91-57-6	2-Methylnaphthalene	2.22E-01	(µg/g DW plant)/ (µg/g soil)	[3]	2.22E-01	[2]	2.22E-01	[2]	(µg/g DW plant)/ (µg/g soil)
91-58-7	2-Chloronaphthalene	4.31E-01	(µg/g DW plant)/ (µg/g soil)	[2]	4.31E-01	[2]	4.31E-01	[2]	(µg/g DW plant)/ (µg/g soil)

Table 3-4 Plant-Soil Bioconcentration Factors for Domestic and Wild Grain

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration factor for Grain from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Grain	Reference	Plant-Soil Bioconcentration Factor in Domestic Grain (Br_{grain})	Reference	Plant-Soil Bioconcentration Factor in Wild Grain (Br_{grain})	Reference	Units for Plant-Soil Bioconcentration Factor in Grain
91-94-1	3,3'-Dichlorobenzidine	3.62E-01	(µg/g DW plant)/(µg/g soil)	[2]	3.62E-01	[2]	3.62E-01	[2]	(µg/g DW plant)/(µg/g soil)
92-52-4	1,1`-Biphenyl	1.89E-01	(µg/g DW plant)/(µg/g soil)	[3]	1.89E-01	[2]	1.89E-01	[2]	(µg/g DW plant)/(µg/g soil)
924-16-3	N-Nitroso-di-n-Buetylamine	3.01E+00	(µg/g DW plant)/(µg/g soil)	[2]	3.01E+00	[2]	3.01E+00	[2]	(µg/g DW plant)/(µg/g soil)
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	1.12E+00	(µg/g DW plant)/(µg/g soil)	[2]	1.12E+00	[2]	1.12E+00	[2]	(µg/g DW plant)/(µg/g soil)
94-75-7	2,4-D	9.03E-01	(µg/g DW plant)/(µg/g soil)	[3]	9.03E-01	[2]	9.03E-01	[2]	(µg/g DW plant)/(µg/g soil)
95-48-7	o-Cresol	2.89E+00	(µg/g DW plant)/(µg/g soil)	[2]	2.89E+00	[2]	2.89E+00	[2]	(µg/g DW plant)/(µg/g soil)
95-49-8	o-Chlorotoluene	4.00E-01	(µg/g DW plant)/(µg/g soil)	[3]	4.00E-01	[2]	4.00E-01	[2]	(µg/g DW plant)/(µg/g soil)
95-50-1	1,2-Dichlorobenzene	4.31E-01	(µg/g DW plant)/(µg/g soil)	[2]	4.31E-01	[2]	4.31E-01	[2]	(µg/g DW plant)/(µg/g soil)
95-53-4	o-Toluidine	6.68E+00	(µg/g DW plant)/(µg/g soil)	[2]	6.68E+00	[2]	6.68E+00	[2]	(µg/g DW plant)/(µg/g soil)
95-57-8	2-Chlorophenol	2.21E+00	(µg/g DW plant)/(µg/g soil)	[2]	2.21E+00	[2]	2.21E+00	[2]	(µg/g DW plant)/(µg/g soil)
95-63-6	1,2,4-Trimethyl benzene	3.02E-01	(µg/g DW plant)/(µg/g soil)	[3]	3.02E-01	[2]	3.02E-01	[2]	(µg/g DW plant)/(µg/g soil)
95-94-3	1,2,4,5-Tetrachlorobenzene	6.51E-02	(µg/g DW plant)/(µg/g soil)	[2]	6.51E-02	[2]	6.51E-02	[2]	(µg/g DW plant)/(µg/g soil)
95-95-4	2,4,5-Trichlorophenol	2.74E-01	(µg/g DW plant)/(µg/g soil)	[2]	2.74E-01	[2]	2.74E-01	[2]	(µg/g DW plant)/(µg/g soil)
96-12-8	1,2-Dibromo-3-chloropropane	1.81E+00	(µg/g DW plant)/(µg/g soil)	[2]	1.81E+00	[2]	1.81E+00	[2]	(µg/g DW plant)/(µg/g soil)
96-18-4	1,2,3-Trichloropropane	2.70E+00	(µg/g DW plant)/(µg/g soil)	[2]	2.70E+00	[2]	2.70E+00	[2]	(µg/g DW plant)/(µg/g soil)
96-45-7	Ethylene thiourea	9.30E+01	(µg/g DW plant)/(µg/g soil)	[3]	2.60E+01	[5]	1.95E+01	[5]	(µg/g DW plant)/(µg/g soil)

Table 3-4 Plant-Soil Bioconcentration Factors for Domestic and Wild Grain

CAS Registry Number	Constituent Name	Plant-Soil Bioconcentration factor for Grain from Literature, Database, or Study	Units for Plant-Soil Bioconcentration Factor for Grain	Reference	Plant-Soil Bioconcentration Factor in Domestic Grain (Br_{grain})	Reference	Plant-Soil Bioconcentration Factor in Wild Grain (Br_{grain})	Reference	Units for Plant-Soil Bioconcentration Factor in Grain
97-63-2	Ethyl methacrylate	2.93E+00	(µg/g DW plant)/ (µg/g soil)	[2]	2.93E+00	[2]	2.93E+00	[2]	(µg/g DW plant)/ (µg/g soil)
98-01-1	Furfural	2.23E+01	(µg/g DW plant)/ (µg/g soil)	[3]	2.23E+01	[2]	1.95E+01	[5]	(µg/g DW plant)/ (µg/g soil)
98-06-6	tert-Butyl benzene	1.59E-01	(µg/g DW plant)/ (µg/g soil)	[3]	1.59E-01	[2]	1.59E-01	[2]	(µg/g DW plant)/ (µg/g soil)
98-07-7	Benzotrichloride	2.11E-01	(µg/g DW plant)/ (µg/g soil)	[3]	2.11E-01	[2]	2.11E-01	[2]	(µg/g DW plant)/ (µg/g soil)
98-82-8	Cumene	2.81E-01	(µg/g DW plant)/ (µg/g soil)	[2]	2.81E-01	[2]	2.81E-01	[2]	(µg/g DW plant)/ (µg/g soil)
98-83-9	Methyl styrene (mixed isomers)	3.89E-01	(µg/g DW plant)/ (µg/g soil)	[3]	3.89E-01	[2]	3.89E-01	[2]	(µg/g DW plant)/ (µg/g soil)
98-86-2	Acetophenone	4.73E+00	(µg/g DW plant)/ (µg/g soil)	[2]	4.73E+00	[2]	4.73E+00	[2]	(µg/g DW plant)/ (µg/g soil)
98-95-3	Nitrobenzene	3.30E+00	(µg/g DW plant)/ (µg/g soil)	[2]	3.30E+00	[2]	3.30E+00	[2]	(µg/g DW plant)/ (µg/g soil)
99-35-4	1,3,5-Trinitrobenzene	7.84E+00	(µg/g DW plant)/ (µg/g soil)	[2]	7.84E+00	[2]	7.84E+00	[2]	(µg/g DW plant)/ (µg/g soil)
99-65-0	1,3-Dinitrobenzene	5.26E+00	(µg/g DW plant)/ (µg/g soil)	[2]	5.26E+00	[2]	5.26E+00	[2]	(µg/g DW plant)/ (µg/g soil)
99-87-6	p-Cymene	1.61E-01	(µg/g DW plant)/ (µg/g soil)	[3]	1.61E-01	[2]	1.61E-01	[2]	(µg/g DW plant)/ (µg/g soil)

Reference	Reference (source) for Plant-Soil Bioconcentration Factor for Grain (from literature, study, or database)
[1]	Baes CF, Sharp RD, Sjoreen AL, and Shor RW. 1984. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture*, ORNL-5786, Oak Ridge National Laboratory, Oak Ridge, TN (http://homer.ornl.gov/baes/documents/ornl5786.html).
[2]	EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013).
[3]	ORNL. *The Risk Assessment Information System (RAIS) Database*. Copyright © 2013 Oak Ridge National Laboratory and The University of Tennessee, Oak Ridge, TN (http://rais.ornl.gov, accessed April 2014).

Reference	Reference (source) for Plant-Soil Bioconcentration Factor for Grain (from literature, study, or database)
[4]	Staven LH, Rhoads K, Napier BA, Strenge DL, *A Compendium of Transfer Factors for Agricultural and Animal Products*, PNNL-13421, Pacific Northwest National Laboratory, Richland, WA. June 2003.
[5]	Surrogate value from 2,4-Dinitrotoluene.
[6]	Surrogate value from Chlorocyclopentadiene.
[7]	Surrogate value from Dibenzo[a,i]pyrene.
[8]	Surrogate value from Trichlorofluoromethane.

Reference	Reference (source) for Plant-Soil Bioconcentration Factor in Domestic Grain
[1]	Baes CF, Sharp RD, Sjoreen AL, and Shor RW. 1984. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture*, ORNL-5786, Oak Ridge National Laboratory, Oak Ridge, TN (http://homer.ornl.gov/baes/documents/ornl5786.html).
[2]	Based on the plant-soil bioconcentration factor for forage.
[3]	Calculated value per Eq. A-2-18 (using log(K_{ow})=1.15) in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm).
[4]	EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013).
[5]	Mass-limited plant-soil bioconcentration factor for domestic grain (tilled soil)
[6]	ORNL. *The Risk Assessment Information System (RAIS) Database*. Copyright © 2013 Oak Ridge National Laboratory and The University of Tennessee, Oak Ridge, TN (http://rais.ornl.gov, accessed April 2014).
[7]	Staven LH, Rhoads K, Napier BA, Strenge DL, *A Compendium of Transfer Factors for Agricultural and Animal Products*, PNNL-13421, Pacific Northwest National Laboratory, Richland, WA. June 2003.

Reference	Reference (source) for Plant-Soil Bioconcentration Factor in Wild Grain
[1]	Baes CF, Sharp RD, Sjoreen AL, and Shor RW. 1984. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture*, ORNL-5786, Oak Ridge National Laboratory, Oak Ridge, TN (http://homer.ornl.gov/baes/documents/ornl5786.html).
[2]	Based on the plant-soil bioconcentration factor for forage.
[3]	Calculated value per Eq. A-2-18 (using log(K_{ow})=1.15) in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm).
[4]	EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013).
[5]	Mass-limited plant-soil bioconcentration factor for wild grain (root zone soil)
[6]	ORNL. *The Risk Assessment Information System (RAIS) Database*. Copyright © 2013 Oak Ridge National Laboratory and The University of Tennessee, Oak Ridge, TN (http://rais.ornl.gov, accessed April 2014).
[7]	Staven LH, Rhoads K, Napier BA, Strenge DL, *A Compendium of Transfer Factors for Agricultural and Animal Products*, PNNL-13421, Pacific Northwest National Laboratory, Richland, WA. June 2003.

The values in Table 3-5 are the air-to-plant biotransfer factors for aboveground produce (and forage) units of dry weight (DW) concentration of plant matter per unit of air concentration. These values represent the ratio of contaminant concentration in aboveground plant parts to the contaminant concentration in air. Blank entries in the table indicate where data are not available.

Table 3-5 Air-to-Plant Biotransfer Factors for Aboveground Produce

CAS Registry Number	Constituent Name	Air-to-Plant Biotransfer for Aboveground Produce (Bv_{ag})	Units for Air-To-Plant Biotransfer for Aboveground Produce	Reference
100-02-7	p-Nitrophenol	1.46E+04	(µg/g DW plant)/ (µg/g air)	[3]
100-21-0	Phthalic acid	1.94E+07	(µg/g DW plant)/ (µg/g air)	[1]
100-25-4	1,4-Dinitrobenzene	5.43E+00	(µg/g DW plant)/ (µg/g air)	[1]
100-40-3	4-Ethenylcyclohexene	1.91E-02	(µg/g DW plant)/ (µg/g air)	[1]
100-41-4	Ethyl benzene	1.42E-02	(µg/g DW plant)/ (µg/g air)	[3]
100-42-5	Styrene	3.24E-02	(µg/g DW plant)/ (µg/g air)	[3]
100-44-7	Benzyl chloride	3.79E-02	(µg/g DW plant)/ (µg/g air)	[3]
100-47-0	Benzonitrile	4.92E-02	(µg/g DW plant)/ (µg/g air)	[3]
100-51-6	Benzyl alcohol	2.46E+00	(µg/g DW plant)/ (µg/g air)	[3]
100-52-7	Benzaldehyde	7.89E-02	(µg/g DW plant)/ (µg/g air)	[3]
10028-15-6	Ozone			
10028-17-8	Tritium			
10045-97-3	Cesium-137	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
10061-01-5	cis-1,3-Dichloropropene	1.44E-03	(µg/g DW plant)/ (µg/g air)	[11]
10061-02-6	trans-1,3-Dichloropropene	9.32E-03	(µg/g DW plant)/ (µg/g air)	[1]
10098-91-6	Yttrium-90	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
10098-97-2	Strontium-90	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
101-55-3	4-Bromophenylphenyl ether	1.83E+02	(µg/g DW plant)/ (µg/g air)	[3]
101-77-9	4,4-Methylenedianiline	1.75E+05	(µg/g DW plant)/ (µg/g air)	[1]
10102-44-0	Nitrogen dioxide			
10198-40-0	Cobalt-60	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
103-33-3	Azobenzene	4.84E+01	(µg/g DW plant)/ (µg/g air)	[1]
103-65-1	n-Propyl benzene (Isocumene)	4.53E-02	(µg/g DW plant)/ (µg/g air)	[1]
104-51-8	n-Butylbenzene	1.62E-01	(µg/g DW plant)/ (µg/g air)	[1]
104-76-7	2-Ethyl-1-hexanol	1.70E+00	(µg/g DW plant)/ (µg/g air)	[1]
105-67-9	2,4-Dimethylphenol	7.87E+00	(µg/g DW plant)/ (µg/g air)	[3]
10595-95-6	n-Nitrosomethylethylamine	4.28E-02	(µg/g DW plant)/ (µg/g air)	[1]
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	4.49E-02	(µg/g DW plant)/ (µg/g air)	[1]
106-44-5	p-Cresol (4-methyl phenol)	7.47E+00	(µg/g DW plant)/ (µg/g air)	[3]

Table 3-5 Air-to-Plant Biotransfer Factors for Aboveground Produce

CAS Registry Number	Constituent Name	Air-to-Plant Biotransfer for Aboveground Produce (Bv_{ag})	Units for Air-To-Plant Biotransfer for Aboveground Produce	Reference
106-46-7	1,4-Dichlorobenzene	1.24E-01	(µg/g DW plant)/ (µg/g air)	[3]
106-47-8	p-Chloroaniline	4.28E+00	(µg/g DW plant)/ (µg/g air)	[3]
106-49-0	p-Toluidine	8.36E-01	(µg/g DW plant)/ (µg/g air)	[1]
106-51-4	Quinone	1.91E-04	(µg/g DW plant)/ (µg/g air)	[1]
106-88-7	1,2-Epoxybutane	2.56E-03	(µg/g DW plant)/ (µg/g air)	[1]
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	1.10E-03	(µg/g DW plant)/ (µg/g air)	[3]
106-93-4	Ethylene dibromide	1.02E-02	(µg/g DW plant)/ (µg/g air)	[3]
106-99-0	1,3-Butadiene	9.99E-05	(µg/g DW plant)/ (µg/g air)	[1]
107-02-8	Acrolein	4.55E-04	(µg/g DW plant)/ (µg/g air)	[3]
107-05-1	3-Chloropropene	5.77E-04	(µg/g DW plant)/ (µg/g air)	[1]
107-06-2	1,2-Dichloroethane	2.26E-03	(µg/g DW plant)/ (µg/g air)	[3]
107-12-0	Propionitrile	2.24E-03	(µg/g DW plant)/ (µg/g air)	[1]
107-13-1	Acrylonitrile	1.00E-03	(µg/g DW plant)/ (µg/g air)	[3]
107-19-7	Propargyl alcohol	1.91E-02	(µg/g DW plant)/ (µg/g air)	[1]
107-21-1	Ethylene glycol (1,2-ethanediol)	3.32E-02	(µg/g DW plant)/ (µg/g air)	[1]
107-98-2	Propylene glycol monomethyl ether	1.83E-02	(µg/g DW plant)/ (µg/g air)	[1]
108-05-4	Acetic acid vinyl ester	6.57E-04	(µg/g DW plant)/ (µg/g air)	[3]
108-10-1	4-Methyl-2-pentanone	7.57E-03	(µg/g DW plant)/ (µg/g air)	[3]
108-39-4	m-Cresol	7.90E+00	(µg/g DW plant)/ (µg/g air)	[3]
108-60-1	bis (2-Chloroisopropyl)ether	3.30E-01	(µg/g DW plant)/ (µg/g air)	[1]
108-67-8	1,3,5-Trimethylbenzene	2.80E-02	(µg/g DW plant)/ (µg/g air)	[3]
108-86-1	Bromobenzene (Phenyl bromide)	3.46E-02	(µg/g DW plant)/ (µg/g air)	[1]
108-87-2	Methylcyclohexane	9.08E-04	(µg/g DW plant)/ (µg/g air)	[1]
108-88-3	Toluene	6.36E-03	(µg/g DW plant)/ (µg/g air)	[3]
108-90-7	Chlorobenzene	1.45E-02	(µg/g DW plant)/ (µg/g air)	[3]
108-94-1	Cyclohexanone	4.53E-02	(µg/g DW plant)/ (µg/g air)	[1]
108-95-2	Phenol	5.53E+00	(µg/g DW plant)/ (µg/g air)	[3]
109-74-0	n-Butanenitrile	3.92E-03	(µg/g DW plant)/ (µg/g air)	[1]
109-75-1	3-Butenenitrile	3.72E-03	(µg/g DW plant)/ (µg/g air)	[1]
109-77-3	Malononitrile	9.79E-02	(µg/g DW plant)/ (µg/g air)	[1]
109-86-4	2-Methoxyethanol	2.56E-02	(µg/g DW plant)/ (µg/g air)	[1]
109-99-9	Tetrahydrofuran	2.45E-03	(µg/g DW plant)/ (µg/g air)	[3]

Table 3-5 Air-to-Plant Biotransfer Factors for Aboveground Produce

CAS Registry Number	Constituent Name	Air-to-Plant Biotransfer for Aboveground Produce (Bv_{ag})	Units for Air-To-Plant Biotransfer for Aboveground Produce	Reference
110-00-9	Furan	2.76E-04	(µg/g DW plant)/ (µg/g air)	[1]
110-54-3	n-Hexane	4.42E-04	(µg/g DW plant)/ (µg/g air)	[1]
110-59-8	Pentanenitrile	1.22E-02	(µg/g DW plant)/ (µg/g air)	[1]
110-80-5	2-Ethoxyethanol	5.43E-02	(µg/g DW plant)/ (µg/g air)	[1]
110-82-7	Cyclohexane	1.72E-03	(µg/g DW plant)/ (µg/g air)	[1]
110-83-8	Cyclohexene	1.37E-03	(µg/g DW plant)/ (µg/g air)	[1]
110-86-1	Pyridine	3.10E-02	(µg/g DW plant)/ (µg/g air)	[3]
111-15-9	Ethylene glycol monoethyl ether acetate	7.41E-02	(µg/g DW plant)/ (µg/g air)	[1]
111-44-4	Bis(2-chloroethyl)ether	7.34E-02	(µg/g DW plant)/ (µg/g air)	[3]
111-65-9	n-Octane	5.72E-03	(µg/g DW plant)/ (µg/g air)	[1]
111-76-2	2-Butoxyethanol	2.67E-01	(µg/g DW plant)/ (µg/g air)	[1]
111-84-2	n-Nonane	1.71E-02	(µg/g DW plant)/ (µg/g air)	[1]
111-91-1	Bis(2-chloroethoxy)methane	3.53E-01	(µg/g DW plant)/ (µg/g air)	[1]
112-30-1	1-Decanol	1.29E+02	(µg/g DW plant)/ (µg/g air)	[1]
112-31-2	Decanal	3.14E-01	(µg/g DW plant)/ (µg/g air)	[1]
112-40-3	Dodecane	2.14E-02	(µg/g DW plant)/ (µg/g air)	[1]
1120-21-4	Undecane	3.76E-02	(µg/g DW plant)/ (µg/g air)	[1]
1120-71-4	1,3-Propane sultone	1.19E-02	(µg/g DW plant)/ (µg/g air)	[1]
117-81-7	Bis(2-ethylhexyl) phthalate	1.51E+05	(µg/g DW plant)/ (µg/g air)	[3]
117-84-0	Di-n-octylphthalate	3.53E+05	(µg/g DW plant)/ (µg/g air)	[3]
118-74-1	Hexachlorobenzene	1.90E+01	(µg/g DW plant)/ (µg/g air)	[3]
119-90-4	3,3'-Dimethoxybenzidine	2.61E+07	(µg/g DW plant)/ (µg/g air)	[3]
120-12-7	Anthracene	5.33E+01	(µg/g DW plant)/ (µg/g air)	[3]
120-82-1	1,2,4-Trichlorobenzene	7.27E-01	(µg/g DW plant)/ (µg/g air)	[3]
120-83-2	2,4-Dichlorophenol	2.14E+01	(µg/g DW plant)/ (µg/g air)	[3]
121-14-2	2,4-Dinitrotoluene	7.75E+01	(µg/g DW plant)/ (µg/g air)	[3]
122-39-4	N,N-Diphenylamine	1.11E+02	(µg/g DW plant)/ (µg/g air)	[1]
122-66-7	1,2-Diphenylhydrazine	4.57E+01	(µg/g DW plant)/ (µg/g air)	[3]
123-33-1	Maleic hydrazide	2.70E+02	(µg/g DW plant)/ (µg/g air)	[1]
123-38-6	Propionaldehyde	3.24E-03	(µg/g DW plant)/ (µg/g air)	[1]
123-72-8	Butanal	4.21E-03	(µg/g DW plant)/ (µg/g air)	[1]
123-91-1	1,4-Dioxan	6.01E-03	(µg/g DW plant)/ (µg/g air)	[3]
124-18-5	Decane	2.35E-03	(µg/g DW plant)/ (µg/g air)	[1]

Table 3-5 Air-to-Plant Biotransfer Factors for Aboveground Produce

CAS Registry Number	Constituent Name	Air-to-Plant Biotransfer for Aboveground Produce (Bv_{ag})	Units for Air-To-Plant Biotransfer for Aboveground Produce	Reference
124-38-9	Carbon dioxide	2.26E-07	(µg/g DW plant)/ (µg/g air)	[1]
124-48-1	Chlorodibromomethane	1.69E-02	(µg/g DW plant)/ (µg/g air)	[3]
126-73-8	Tributyl phosphate	7.22E+02	(µg/g DW plant)/ (µg/g air)	[1]
126-98-7	2-Methyl-2-propenenitrile	8.51E-04	(µg/g DW plant)/ (µg/g air)	[3]
127-18-4	1,1,2,2-Tetrachloroethene	1.30E-02	(µg/g DW plant)/ (µg/g air)	[3]
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	3.66E+03	(µg/g DW plant)/ (µg/g air)	[1]
129-00-0	Pyrene	8.40E+02	(µg/g DW plant)/ (µg/g air)	[3]
131-11-3	Dimethyl Phthalate	2.44E+01	(µg/g DW plant)/ (µg/g air)	[3]
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	4.04E+07	(µg/g DW plant)/ (µg/g air)	[1]
132-64-9	Dibenzofuran	6.41E+00	(µg/g DW plant)/ (µg/g air)	[1]
133-06-2	Captan	7.67E+03	(µg/g DW plant)/ (µg/g air)	[1]
1330-20-7	Xylenes (mixed isomers)	2.50E-02	(µg/g DW plant)/ (µg/g air)	[1]
1336-36-3	Polychlorinated biphenyls	1.47E+03	(µg/g DW plant)/ (µg/g air)	[1]
134-32-7	alpha-Naphthylamine	1.25E+02	(µg/g DW plant)/ (µg/g air)	[1]
135-98-8	sec-Butylbenzene	2.34E-01	(µg/g DW plant)/ (µg/g air)	[1]
13966-29-5	Uranium-234	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
13967-48-1	Ruthenium-106	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
13967-70-9	Cesium-134	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
13968-55-3	Uranium-233	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
13981-15-2	Curium-244	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
13981-16-3	Plutonium-238	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
13981-37-8	Nickel-63	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
13982-10-0	Plutonium-242	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
13982-63-3	Radium-226	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
13982-70-2	Uranium-236	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
13994-20-2	Neptunium-237	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
141-78-6	Acetic acid ethyl ester	2.50E-03	(µg/g DW plant)/ (µg/g air)	[1]
14119-32-5	Plutonium-241	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
14119-33-6	Plutonium-240	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
14133-76-7	Technetium-99	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
14158-29-3	Uranium-232	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
14234-35-6	Antimony-125	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
14265-44-2	Phosphate			

Table 3-5 Air-to-Plant Biotransfer Factors for Aboveground Produce

CAS Registry Number	Constituent Name	Air-to-Plant Biotransfer for Aboveground Produce (Bv_{ag})	Units for Air-To-Plant Biotransfer for Aboveground Produce	Reference
14331-85-2	Protactinium-231	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
14336-70-0	Nickel-59	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
14391-16-3	Europium-155	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
145-73-3	Endothall	1.57E+10	(µg/g DW plant)/ (µg/g air)	[1]
14596-10-2	Americium-241	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
14683-23-9	Europium-152	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
14762-75-5	Carbon-14			
14797-55-8	Nitrate			
14797-65-0	Nitrite			
14808-79-8	Sulfate			
14952-40-0	Actinium-227	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
14993-75-0	Americium-243	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
15046-84-1	Iodine-129			
15117-48-3	Plutonium-239	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
15117-96-1	Uranium-235	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
15262-20-1	Radium-228	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
15510-73-3	Curium-242	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
15585-10-1	Europium-154	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
15594-54-4	Thorium-229	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
156-59-2	cis-1,2-Dichloroethene	1.44E-03	(µg/g DW plant)/ (µg/g air)	[3]
156-60-5	1,2-trans-Dichloroethene	1.03E-03	(µg/g DW plant)/ (µg/g air)	[3]
15715-94-3	Samarium-151	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
15751-77-6	Zirconium-93	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
15757-87-6	Curium-243	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
15758-45-9	Selenium-79	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
15832-50-5	Tin-126	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
1634-04-4	Methyl tert-butyl ether	9.55E-04	(µg/g DW plant)/ (µg/g air)	[1]
16887-00-6	Chloride			
16984-48-8	Fluoride			
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	6.55E+04	(µg/g DW plant)/ (µg/g air)	[3]
18540-29-9	Chromium(VI)	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
189-55-9	Dibenzo[a,i]pyrene	1.25E+05	(µg/g DW plant)/ (µg/g air)	[7]

Table 3-5 Air-to-Plant Biotransfer Factors for Aboveground Produce

CAS Registry Number	Constituent Name	Air-to-Plant Biotransfer for Aboveground Produce (Bv_{ag})	Units for Air-To-Plant Biotransfer for Aboveground Produce	Reference
189-64-0	Dibenzo[a,h]pyrene	2.25E+08	(µg/g DW plant)/ (µg/g air)	[1]
191-24-2	Benzo(g,h,i)perylene	1.95E+06	(µg/g DW plant)/ (µg/g air)	[1]
191-30-0	Dibenzo(a,l)pyrene	6.45E+08	(µg/g DW plant)/ (µg/g air)	[1]
192-65-4	Dibenzo[a,e]pyrene	2.25E+08	(µg/g DW plant)/ (µg/g air)	[1]
192-97-2	Benzo(e)pyrene	1.35E+06	(µg/g DW plant)/ (µg/g air)	[1]
193-39-5	Indeno(1,2,3-cd)pyrene	3.73E+05	(µg/g DW plant)/ (µg/g air)	[3]
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	5.20E+05	(µg/g DW plant)/ (µg/g air)	[3]
205-82-3	Benzo[j]fluoranthene	8.85E+05	(µg/g DW plant)/ (µg/g air)	[1]
205-99-2	Benzo(b)fluoranthene	1.68E+03	(µg/g DW plant)/ (µg/g air)	[3]
206-44-0	Fluoranthene	7.38E+02	(µg/g DW plant)/ (µg/g air)	[3]
207-08-9	Benzo(k)fluoranthene	2.11E+05	(µg/g DW plant)/ (µg/g air)	[3]
208-96-8	Acenaphthylene	7.70E+00	(µg/g DW plant)/ (µg/g air)	[1]
218-01-9	Chrysene	6.92E+02	(µg/g DW plant)/ (µg/g air)	[3]
224-42-0	Dibenz[a,j]acridine	3.12E+07	(µg/g DW plant)/ (µg/g air)	[9]
2245-38-7	2,3,5-Trimethylnaphthalene	1.05E+01	(µg/g DW plant)/ (µg/g air)	[1]
226-36-8	Dibenz[a,h]acridine	3.12E+07	(µg/g DW plant)/ (µg/g air)	[9]
22967-92-6	Methyl mercury	0.00E+00	(µg/g DW plant)/ (µg/g air)	[3]
23950-58-5	Pronamide	2.57E+04	(µg/g DW plant)/ (µg/g air)	[3]
24959-67-9	Bromide			
27154-33-2	Trichlorofluoroethane	2.65E-04	(µg/g DW plant)/ (µg/g air)	[10]
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	7.43E+03	(µg/g DW plant)/ (µg/g air)	[1]
319-84-6	alpha-BHC	5.66E+01	(µg/g DW plant)/ (µg/g air)	[3]
319-85-7	beta-BHC	8.42E+02	(µg/g DW plant)/ (µg/g air)	[3]
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	6.84E+04	(µg/g DW plant)/ (µg/g air)	[1]
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	1.15E+03	(µg/g DW plant)/ (µg/g air)	[1]
3268-87-9	Octachlorodibenzo(p)dioxin	2.36E+06	(µg/g DW plant)/ (µg/g air)	[3]
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	6.36E+04	(µg/g DW plant)/ (µg/g air)	[1]
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	9.10E+05	(µg/g DW plant)/ (µg/g air)	[3]
3697-24-3	5-Methylchrysene	6.92E+02	(µg/g DW plant)/ (µg/g air)	[8]
378253-40-8	Barium-137m	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]

Table 3-5 Air-to-Plant Biotransfer Factors for Aboveground Produce

CAS Registry Number	Constituent Name	Air-to-Plant Biotransfer for Aboveground Produce (Bv_{ag})	Units for Air-To-Plant Biotransfer for Aboveground Produce	Reference
378253-44-2	Cadmium-113m	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
378782-82-2	Niobium-93m	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	4.85E+04	(µg/g DW plant)/ (µg/g air)	[1]
39001-02-0	Octachlorodibenzofuran	2.28E+06	(µg/g DW plant)/ (µg/g air)	[3]
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	5.20E+05	(µg/g DW plant)/ (µg/g air)	[3]
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	7.08E+05	(µg/g DW plant)/ (µg/g air)	[1]
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	2.39E+05	(µg/g DW plant)/ (µg/g air)	[3]
4170-30-3	Crotonaldehyde (Propylene aldehyde)	2.52E-02	(µg/g DW plant)/ (µg/g air)	[1]
41851-50-7	Chlorocyclopentadiene	9.66E-04	(µg/g DW plant)/ (µg/g air)	[1]
460-19-5	Cyanogen (oxalonitrile)	1.23E-05	(µg/g DW plant)/ (µg/g air)	[1]
4786-20-3	2-Butenenitrile	2.28E-03	(µg/g DW plant)/ (µg/g air)	[1]
50-00-0	Formaldehyde	3.92E-01	(µg/g DW plant)/ (µg/g air)	[3]
50-32-8	Benzo(a)pyrene	1.25E+05	(µg/g DW plant)/ (µg/g air)	[3]
506-68-3	Cyanogen bromide (bromocyanide)	1.76E-04	(µg/g DW plant)/ (µg/g air)	[1]
506-77-4	Cyanogen chloride	8.99E-07	(µg/g DW plant)/ (µg/g air)	[1]
51-28-5	2,4-Dinitrophenol	5.51E+00	(µg/g DW plant)/ (µg/g air)	[3]
51-79-6	Ethyl carbamate (urethane)	6.02E-01	(µg/g DW plant)/ (µg/g air)	[1]
510-15-6	Chlorobenzilate	3.40E+04	(µg/g DW plant)/ (µg/g air)	[3]
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	4.57E+04	(µg/g DW plant)/ (µg/g air)	[3]
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	7.93E+04	(µg/g DW plant)/ (µg/g air)	[1]
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	6.61E+01	(µg/g DW plant)/ (µg/g air)	[1]
53-70-3	Dibenz[a,h]anthracene	3.12E+07	(µg/g DW plant)/ (µg/g air)	[3]
532-27-4	2-Chloroacetophenone	1.92E+00	(µg/g DW plant)/ (µg/g air)	[1]
534-52-1	4,6-Dinitro-o-cresol	7.41E+00	(µg/g DW plant)/ (µg/g air)	[1]
5385-75-1	Dibenzo(a,e)fluoranthene	4.00E+07	(µg/g DW plant)/ (µg/g air)	[1]
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	1.85E-03	(µg/g DW plant)/ (µg/g air)	[1]
540-73-8	1,2-Dimethylhydrazine	2.14E-01	(µg/g DW plant)/ (µg/g air)	[1]
540-84-1	2,2,4-Trimethylpentane	4.17E-04	(µg/g DW plant)/ (µg/g air)	[1]
541-73-1	1,3-Dichlorobenzene	1.23E-01	(µg/g DW plant)/ (µg/g air)	[3]
542-75-6	1,3-Dichloropropene	1.57E-04	(µg/g DW plant)/ (µg/g air)	[3]

Table 3-5 Air-to-Plant Biotransfer Factors for Aboveground Produce

CAS Registry Number	Constituent Name	Air-to-Plant Biotransfer for Aboveground Produce (Bv_{ag})	Units for Air-To-Plant Biotransfer for Aboveground Produce	Reference
542-88-1	Bis(chloromethyl)ether	5.19E-05	(µg/g DW plant)/ (µg/g air)	[1]
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	8.30E+05	(µg/g DW plant)/ (µg/g air)	[3]
56-23-5	Carbon tetrachloride	1.79E-03	(µg/g DW plant)/ (µg/g air)	[3]
56-49-5	3-Methylcholanthrene	7.34E+04	(µg/g DW plant)/ (µg/g air)	[1]
56-55-3	Benzo(a)anthracene	1.93E+04	(µg/g DW plant)/ (µg/g air)	[3]
57-12-5	Cyanide	4.29E-07	(µg/g DW plant)/ (µg/g air)	[3]
57-24-9	Strychnine	8.40E+07	(µg/g DW plant)/ (µg/g air)	[3]
57-74-9	Chlordane	8.22E+02	(µg/g DW plant)/ (µg/g air)	[3]
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	9.75E+04	(µg/g DW plant)/ (µg/g air)	[3]
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	9.75E+04	(µg/g DW plant)/ (µg/g air)	[3]
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	1.62E+05	(µg/g DW plant)/ (µg/g air)	[3]
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	2.25E+05	(µg/g DW plant)/ (µg/g air)	[1]
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	5.20E+05	(µg/g DW plant)/ (µg/g air)	[3]
58-89-9	gamma-BHC (Lindane)	2.79E+02	(µg/g DW plant)/ (µg/g air)	[1]
58-90-2	2,3,4,6-Tetrachlorophenol	6.99E+02	(µg/g DW plant)/ (µg/g air)	[3]
581-42-0	2,6-Dimethylnaphthalene	3.39E+00	(µg/g DW plant)/ (µg/g air)	[1]
584-84-9	2,4-Toluene diisocyanate	7.75E+01	(µg/g DW plant)/ (µg/g air)	[4]
589-38-8	3-Hexanone	9.36E-03	(µg/g DW plant)/ (µg/g air)	[1]
59-50-7	4-Chloro-3-methylphenol	4.57E+01	(µg/g DW plant)/ (µg/g air)	[3]
59-89-2	N-Nitrosomorpholine	7.76E-01	(µg/g DW plant)/ (µg/g air)	[1]
591-50-4	Benzene, iodo-	1.93E-01	(µg/g DW plant)/ (µg/g air)	[1]
591-78-6	2-Hexanone	1.77E-02	(µg/g DW plant)/ (µg/g air)	[1]
593-60-2	Bromoethene (Vinyl bromide)	2.13E-04	(µg/g DW plant)/ (µg/g air)	[1]
593-74-8	Dimethyl Mercury			
60-11-7	Dimethyl aminoazobenzene	1.05E+07	(µg/g DW plant)/ (µg/g air)	[1]
60-29-7	Ethyl ether	4.03E-04	(µg/g DW plant)/ (µg/g air)	[1]
60-35-5	Acetamide	5.77E-01	(µg/g DW plant)/ (µg/g air)	[1]
602-87-9	5-Nitroacenaphthene	4.97E+00	(µg/g DW plant)/ (µg/g air)	[5]
606-20-2	2,6-Dinitrotoluene	5.08E+00	(µg/g DW plant)/ (µg/g air)	[3]
608-93-5	Pentachlorobenzene	2.52E+01	(µg/g DW plant)/ (µg/g air)	[3]
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	1.62E+05	(µg/g DW plant)/ (µg/g air)	[3]
61626-71-9	Dichloropentadiene	6.78E+04	(µg/g DW plant)/ (µg/g air)	[1]

Table 3-5 Air-to-Plant Biotransfer Factors for Aboveground Produce

CAS Registry Number	Constituent Name	Air-to-Plant Biotransfer for Aboveground Produce (Bv_{ag})	Units for Air-To-Plant Biotransfer for Aboveground Produce	Reference
62-50-0	Ethyl methanesulfonate	1.18E-02	(µg/g DW plant)/ (µg/g air)	[3]
62-53-3	Aniline	2.67E-01	(µg/g DW plant)/ (µg/g air)	[3]
62-75-9	N-Nitroso-N,N-dimethylamine	7.59E-03	(µg/g DW plant)/ (µg/g air)	[1]
621-64-7	N-Nitroso-di-n-propylamine	6.98E-01	(µg/g DW plant)/ (µg/g air)	[3]
624-83-9	Methyl isocyanate	1.00E-03	(µg/g DW plant)/ (µg/g air)	[6]
628-73-9	Hexanenitrile	3.45E-02	(µg/g DW plant)/ (µg/g air)	[1]
630-08-0	Carbon monoxide			
630-20-6	1,1,1,2-Tetrachloroethane	3.90E-02	(µg/g DW plant)/ (µg/g air)	[3]
64-18-6	Formic acid (methanoic acid)	8.90E-02	(µg/g DW plant)/ (µg/g air)	[3]
65-85-0	Benzoic acid	1.91E+00	(µg/g DW plant)/ (µg/g air)	[3]
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	9.08E+04	(µg/g DW plant)/ (µg/g air)	[1]
67-56-1	Methyl alcohol	1.86E-03	(µg/g DW plant)/ (µg/g air)	[3]
67-63-0	2-Propyl alcohol	7.80E-03	(µg/g DW plant)/ (µg/g air)	[1]
67-64-1	2-Propanone (Acetone)	7.96E-04	(µg/g DW plant)/ (µg/g air)	[3]
67-66-3	Chloroform	2.04E-03	(µg/g DW plant)/ (µg/g air)	[3]
67-72-1	Hexachloroethane	2.20E-01	(µg/g DW plant)/ (µg/g air)	[3]
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	8.30E+05	(µg/g DW plant)/ (µg/g air)	[3]
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	1.36E+05	(µg/g DW plant)/ (µg/g air)	[1]
70-30-4	Hexachlorophene	1.09E+13	(µg/g DW plant)/ (µg/g air)	[3]
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	9.50E+04	(µg/g DW plant)/ (µg/g air)	[1]
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	1.62E+05	(µg/g DW plant)/ (µg/g air)	[3]
71-36-3	n-Butyl alcohol	5.49E-02	(µg/g DW plant)/ (µg/g air)	[1]
71-43-2	Benzene	1.72E-03	(µg/g DW plant)/ (µg/g air)	[3]
71-55-6	1,1,1-Trichloroethane	1.51E-03	(µg/g DW plant)/ (µg/g air)	[3]
72-43-5	Methoxychlor	4.52E+02	(µg/g DW plant)/ (µg/g air)	[3]
72-55-9	4,4-DDE	3.13E+03	(µg/g DW plant)/ (µg/g air)	[3]
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	1.62E+05	(µg/g DW plant)/ (µg/g air)	[3]
74-83-9	Bromomethane	1.66E-04	(µg/g DW plant)/ (µg/g air)	[3]
74-87-3	Chloromethane	5.90E-05	(µg/g DW plant)/ (µg/g air)	[3]
74-88-4	Iodomethane	4.31E-04	(µg/g DW plant)/ (µg/g air)	[1]
74-95-3	Methylene bromide	2.76E-03	(µg/g DW plant)/ (µg/g air)	[3]
74-97-5	Bromochloromethane	1.21E-03	(µg/g DW plant)/ (µg/g air)	[1]

Table 3-5 Air-to-Plant Biotransfer Factors for Aboveground Produce

CAS Registry Number	Constituent Name	Air-to-Plant Biotransfer for Aboveground Produce (Bv_{ag})	Units for Air-To-Plant Biotransfer for Aboveground Produce	Reference
7429-90-5	Aluminum	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7439-89-6	Iron	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7439-92-1	Lead			
7439-93-2	Lithium	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7439-95-4	Magnesium	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7439-96-5	Manganese	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7439-97-6	Mercury	0.00E+00	(µg/g DW plant)/ (µg/g air)	[3]
7439-98-7	Molybdenum	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7440-02-0	Nickel	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7440-16-6	Rhodium	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7440-22-4	Silver	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7440-23-5	Sodium	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7440-24-6	Strontium (total)	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7440-25-7	Tantalum	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7440-28-0	Thallium	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7440-29-1	Thorium-232	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7440-31-5	Tin	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7440-33-7	Tungsten	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7440-36-0	Antimony	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7440-38-2	Arsenic	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7440-39-3	Barium	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7440-41-7	Beryllium	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7440-43-9	Cadmium	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7440-47-3	Chromium	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7440-48-4	Cobalt	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7440-50-8	Copper	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7440-61-1	Uranium	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7440-61-1R	Uranium-238	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7440-62-2	Vanadium	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7440-65-5	Yttrium	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7440-66-6	Zinc	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7440-67-7	Zirconium	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7446-09-5	Sulfur dioxide			

Table 3-5 Air-to-Plant Biotransfer Factors for Aboveground Produce

CAS Registry Number	Constituent Name	Air-to-Plant Biotransfer for Aboveground Produce (Bv_{ag})	Units for Air-To-Plant Biotransfer for Aboveground Produce	Reference
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	1.64E+04	(µg/g DW plant)/ (µg/g air)	[1]
7487-94-7	Mercuric chloride (HgCl2)	1.80E+03	(µg/g DW plant)/ (µg/g air)	[3]
75-00-3	Chloroethane	1.97E-04	(µg/g DW plant)/ (µg/g air)	[3]
75-01-4	1-Chloroethene	6.41E-05	(µg/g DW plant)/ (µg/g air)	[3]
75-02-5	Fluoroethene (vinyl fluoride)	8.77E-06	(µg/g DW plant)/ (µg/g air)	[1]
75-05-8	Acetonitrile	7.02E-04	(µg/g DW plant)/ (µg/g air)	[3]
75-07-0	Acetaldehyde	4.13E-04	(µg/g DW plant)/ (µg/g air)	[3]
75-09-2	Dichloromethane (Methylene Chloride)	6.16E-04	(µg/g DW plant)/ (µg/g air)	[3]
75-15-0	Carbon disulfide	4.10E-04	(µg/g DW plant)/ (µg/g air)	[3]
75-21-8	Ethylene oxide (Oxirane)	1.81E-04	(µg/g DW plant)/ (µg/g air)	[3]
75-25-2	Bromoform	2.87E-06	(µg/g DW plant)/ (µg/g air)	[3]
75-27-4	Bromodichloromethane	6.02E-03	(µg/g DW plant)/ (µg/g air)	[3]
75-29-6	2-Chloropropane	3.37E-04	(µg/g DW plant)/ (µg/g air)	[1]
75-34-3	1,1-Dichloroethane	8.25E-04	(µg/g DW plant)/ (µg/g air)	[3]
75-35-4	1,1-Dichloroethene	3.71E-04	(µg/g DW plant)/ (µg/g air)	[3]
75-44-5	Phosgene (hydrogen phosphide)	1.44E-03	(µg/g DW plant)/ (µg/g air)	[11]
75-45-6	Chlorodifluoromethane	1.95E-05	(µg/g DW plant)/ (µg/g air)	[3]
75-50-3	Trimethylamine	7.96E-04	(µg/g DW plant)/ (µg/g air)	[1]
75-69-4	Trichlorofluoromethane	2.65E-04	(µg/g DW plant)/ (µg/g air)	[3]
75-71-8	Dichlorodifluoromethane	3.25E-05	(µg/g DW plant)/ (µg/g air)	[3]
76-01-7	Pentachloroethane	7.74E-02	(µg/g DW plant)/ (µg/g air)	[1]
76-13-1	1,2,2-Trichlorotrifluoroethane	2.47E-04	(µg/g DW plant)/ (µg/g air)	[1]
76-44-8	Heptachlor	1.42E-03	(µg/g DW plant)/ (µg/g air)	[3]
764-41-0	1,4-Dichloro-2-butene	4.95E-02	(µg/g DW plant)/ (µg/g air)	[1]
7647-01-0	Hydrogen chloride			
765-34-4	Glycidylaldehyde	5.30E-02	(µg/g DW plant)/ (µg/g air)	[1]
7664-39-3	Hydrogen Fluoride			
7664-41-7	Ammonia/Ammonium			
77-47-4	Hexachlorocyclopentadiene	4.83E-01	(µg/g DW plant)/ (µg/g air)	[3]
77-78-1	Dimethyl sulfate	2.40E-01	(µg/g DW plant)/ (µg/g air)	[1]
7704-34-9	Total Sulfur (thermodynamically stable)	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7723-14-0	Phosphorus			

Table 3-5 Air-to-Plant Biotransfer Factors for Aboveground Produce

CAS Registry Number	Constituent Name	Air-to-Plant Biotransfer for Aboveground Produce (Bv_{ag})	Units for Air-To-Plant Biotransfer for Aboveground Produce	Reference
7782-41-4	Fluorine gas F2			
7782-49-2	Selenium	0.00E+00	(µg/g DW plant)/ (µg/g air)	[2]
7782-50-5	Chlorine			
78-83-1	2-Methylpropyl alcohol	3.68E-02	(µg/g DW plant)/ (µg/g air)	[1]
78-87-5	1,2-Dichloropropane	2.69E-03	(µg/g DW plant)/ (µg/g air)	[3]
78-93-3	2-Butanone	2.03E-03	(µg/g DW plant)/ (µg/g air)	[3]
79-00-5	1,1,2-Trichloroethane	8.29E-03	(µg/g DW plant)/ (µg/g air)	[3]
79-01-6	1,1,2-Trichloroethylene	2.01E-03	(µg/g DW plant)/ (µg/g air)	[3]
79-10-7	2-Propenoic acid	3.57E-01	(µg/g DW plant)/ (µg/g air)	[1]
79-34-5	1,1,2,2-Tetrachloroethane	5.91E-02	(µg/g DW plant)/ (µg/g air)	[3]
79-46-9	2-Nitropropane	4.59E-03	(µg/g DW plant)/ (µg/g air)	[1]
80-62-6	Methyl methacrylate	5.18E-03	(µg/g DW plant)/ (µg/g air)	[1]
82-68-8	Pentachloronitrobenzene (PCNB)	1.29E+01	(µg/g DW plant)/ (µg/g air)	[3]
822-06-0	Hexamethylene-1,5-diisocyanate	2.98E+00	(µg/g DW plant)/ (µg/g air)	[1]
823-40-5	Toluene-2,6-diamine	8.70E+01	(µg/g DW plant)/ (µg/g air)	[1]
83-32-9	Acenaphthene	4.97E+00	(µg/g DW plant)/ (µg/g air)	[3]
832-69-9	1-Methylphenanthrene	2.92E+02	(µg/g DW plant)/ (µg/g air)	[1]
84-66-2	Diethyl phthalate	5.71E+01	(µg/g DW plant)/ (µg/g air)	[3]
84-74-2	Di-n-butylphthalate	3.15E+03	(µg/g DW plant)/ (µg/g air)	[3]
85-01-8	Phenanthrene	1.51E+02	(µg/g DW plant)/ (µg/g air)	[3]
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	7.50E-01	(µg/g DW plant)/ (µg/g air)	[3]
85-68-7	Butylbenzylphthalate	7.11E+03	(µg/g DW plant)/ (µg/g air)	[3]
86-73-7	Fluorene	2.60E+01	(µg/g DW plant)/ (µg/g air)	[3]
87-61-6	1,2,3-Trichlorobenzene	9.20E-01	(µg/g DW plant)/ (µg/g air)	[3]
87-68-3	Hexachlorobutadiene	8.93E-01	(µg/g DW plant)/ (µg/g air)	[3]
87-86-5	Pentachlorophenol	6.29E+05	(µg/g DW plant)/ (µg/g air)	[3]
88-06-2	2,4,6-Trichlorophenol	6.25E+01	(µg/g DW plant)/ (µg/g air)	[3]
88-74-4	o-Nitroaniline (2-nitroaniline)	4.79E+01	(µg/g DW plant)/ (µg/g air)	[3]
88-75-5	2-Nitrophenol	4.76E-01	(µg/g DW plant)/ (µg/g air)	[3]
90-04-0	o-Anisidine	1.09E+00	(µg/g DW plant)/ (µg/g air)	[1]
90-12-0	1-Methylnaphthalene	1.44E+00	(µg/g DW plant)/ (µg/g air)	[1]
91-20-3	Naphthalene	3.81E-01	(µg/g DW plant)/ (µg/g air)	[3]

Table 3-5 Air-to-Plant Biotransfer Factors for Aboveground Produce

CAS Registry Number	Constituent Name	Air-to-Plant Biotransfer for Aboveground Produce (Bv_{ag})	Units for Air-To-Plant Biotransfer for Aboveground Produce	Reference
91-22-5	Quinoline	4.86E+00	(µg/g DW plant)/ (µg/g air)	[1]
91-57-6	2-Methylnaphthalene	1.39E+00	(µg/g DW plant)/ (µg/g air)	[1]
91-58-7	2-Chloronaphthalene	7.08E-01	(µg/g DW plant)/ (µg/g air)	[3]
91-94-1	3,3'-Dichlorobenzidine	7.65E+04	(µg/g DW plant)/ (µg/g air)	[3]
92-52-4	1,1`-Biphenyl	3.38E+00	(µg/g DW plant)/ (µg/g air)	[1]
924-16-3	N-Nitroso-di-n-Buetylamine	1.96E-02	(µg/g DW plant)/ (µg/g air)	[3]
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	2.05E+00	(µg/g DW plant)/ (µg/g air)	[3]
94-75-7	2,4-D	1.55E+03	(µg/g DW plant)/ (µg/g air)	[1]
95-48-7	o-Cresol	5.56E+00	(µg/g DW plant)/ (µg/g air)	[3]
95-49-8	o-Chlorotoluene	6.87E-02	(µg/g DW plant)/ (µg/g air)	[1]
95-50-1	1,2-Dichlorobenzene	1.17E-01	(µg/g DW plant)/ (µg/g air)	[3]
95-53-4	o-Toluidine	5.23E-01	(µg/g DW plant)/ (µg/g air)	[3]
95-57-8	2-Chlorophenol	2.79E-02	(µg/g DW plant)/ (µg/g air)	[3]
95-63-6	1,2,4-Trimethyl benzene	6.66E-02	(µg/g DW plant)/ (µg/g air)	[1]
95-94-3	1,2,4,5-Tetrachlorobenzene	2.78E+00	(µg/g DW plant)/ (µg/g air)	[3]
95-95-4	2,4,5-Trichlorophenol	1.18E+02	(µg/g DW plant)/ (µg/g air)	[3]
96-12-8	1,2-Dibromo-3-chloropropane	1.05E-01	(µg/g DW plant)/ (µg/g air)	[3]
96-18-4	1,2,3-Trichloropropane	1.84E-02	(µg/g DW plant)/ (µg/g air)	[3]
96-45-7	Ethylene thiourea	3.31E-02	(µg/g DW plant)/ (µg/g air)	[1]
97-63-2	Ethyl methacrylate	7.73E-03	(µg/g DW plant)/ (µg/g air)	[3]
98-01-1	Furfural	4.06E-02	(µg/g DW plant)/ (µg/g air)	[1]
98-06-6	tert-Butyl benzene	1.01E-01	(µg/g DW plant)/ (µg/g air)	[1]
98-07-7	Benzotrichloride	3.07E+00	(µg/g DW plant)/ (µg/g air)	[1]
98-82-8	Cumene	4.06E-04	(µg/g DW plant)/ (µg/g air)	[3]
98-83-9	Methyl styrene (mixed isomers)	9.44E-02	(µg/g DW plant)/ (µg/g air)	[1]
98-86-2	Acetophenone	2.52E-01	(µg/g DW plant)/ (µg/g air)	[3]
98-95-3	Nitrobenzene	2.17E-01	(µg/g DW plant)/ (µg/g air)	[3]
99-35-4	1,3,5-Trinitrobenzene	3.21E+03	(µg/g DW plant)/ (µg/g air)	[3]
99-65-0	1,3-Dinitrobenzene	9.62E+00	(µg/g DW plant)/ (µg/g air)	[3]

Reference	Reference (source) for Air-To-Plant Biotransfer for Aboveground Produce
[1]	Calculated value per Eq. A-2-19 and A-2-20 in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm).
[2]	Default value from Section A2-2.12-4 of EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm).
[3]	EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013).
[4]	Surrogate value from 2,4-Dinitrotoluene.
[5]	Surrogate value from Acenaphthene.
[6]	Surrogate value from Acrylonitrile.
[7]	Surrogate value from Benzo(a)pyrene.
[8]	Surrogate value from Chrysene.
[9]	Surrogate value from Dibenz[a,h]anthracene.
[10]	Surrogate value from Trichlorofluoromethane.
[11]	Surrogate value from cis-1,2-Dichloroethene.

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4 Animal Biotransfer and Bioconcentration Factors for Human Health Risk Assessment

Table 4-1 presents the biotransfer factors for game and livestock (including dairy). The values represent the contaminant concentration in animal tissue (mass of the constituent per unit mass of animal fresh weight, FW) ratioed to the daily intake of the contaminant by the animal. Blank entries in the table indicate where data are not available.

Table 4-1 Biotransfer Factors for Beef, Game, Milk, and Pork

CAS Registry Number	Constituent Name	Biotransfer Factor in Beef (Ba_{beef}) and Game (Ba_{game})	Units for Biotransfer Factor in Beef and Game	Reference	Biotransfer Factor in Milk (Ba_{milk})	Units for Biotransfer Factor in Milk	Reference	Biotransfer Factor in Pork (Ba_{pork})	Units for Biotransfer Factor in Pork	Reference
100-02-7	p-Nitrophenol	2.52E-03	day/kg FW	[4]	5.30E-04	day/kg FW	[5]	3.05E-03	day/kg FW	[2]
100-21-0	Phthalic acid	2.50E-06	day/kg FW	[6]	7.90E-07	day/kg FW	[7]	3.51E-03	day/kg FW	[1]
100-25-4	1,4-Dinitrobenzene	7.21E-07	day/kg FW	[6]	2.28E-07	day/kg FW	[7]	1.42E-03	day/kg FW	[1]
100-40-3	4-Ethenylcyclohexene	2.48E-02	day/kg FW	[3]	5.23E-03	day/kg FW	[4]	3.00E-02	day/kg FW	[1]
100-41-4	Ethyl benzene	1.21E-02	day/kg FW	[4]	2.56E-03	day/kg FW	[5]	1.47E-02	day/kg FW	[2]
100-42-5	Styrene	1.09E-02	day/kg FW	[4]	2.30E-03	day/kg FW	[5]	1.32E-02	day/kg FW	[2]
100-44-7	Benzyl chloride	4.53E-03	day/kg FW	[4]	9.54E-04	day/kg FW	[5]	5.48E-03	day/kg FW	[2]
100-47-0	Benzonitrile	1.40E-03	day/kg FW	[4]	2.95E-04	day/kg FW	[5]	1.70E-03	day/kg FW	[2]
100-51-6	Benzyl alcohol	5.97E-04	day/kg FW	[4]	1.26E-04	day/kg FW	[5]	7.23E-04	day/kg FW	[2]
100-52-7	Benzaldehyde	1.22E-03	day/kg FW	[4]	2.56E-04	day/kg FW	[5]	1.47E-03	day/kg FW	[2]
10028-15-6	Ozone									
10028-17-8	Tritium	1.20E-02	day/kg FW	[6]	1.00E-02	day/kg FW	[7]			
10045-97-3	Cesium-137	3.00E-02	day/kg FW	[1]	8.00E-03	day/kg FW	[1]	2.40E-01	day/kg FW	[4]
10061-01-5	cis-1,3-Dichloropropene	2.87E-06	day/kg FW	[6]	9.07E-07	day/kg FW	[7]	3.00E-03	day/kg FW	[12]
10061-02-6	trans-1,3-Dichloropropene	2.68E-06	day/kg FW	[6]	8.47E-07	day/kg FW	[7]	3.68E-03	day/kg FW	[1]
10098-91-6	Yttrium-90	2.00E-03	day/kg FW	[1]	2.00E-05	day/kg FW	[1]			
10098-97-2	Strontium-90	1.00E-02	day/kg FW	[1]	1.00E-03	day/kg FW	[1]	4.00E-02	day/kg FW	[4]
101-55-3	4-Bromophenylphenyl ether	4.05E-02	day/kg FW	[4]	8.52E-03	day/kg FW	[5]	4.90E-02	day/kg FW	[2]
101-77-9	4,4-Methylenedianiline	9.73E-07	day/kg FW	[6]	3.07E-07	day/kg FW	[7]	1.79E-03	day/kg FW	[1]
10102-44-0	Nitrogen dioxide									
10198-40-0	Cobalt-60	2.00E-02	day/kg FW	[1]	2.00E-03	day/kg FW	[1]	2.00E-03	day/kg FW	[4]

Table 4-1 Biotransfer Factors for Beef, Game, Milk, and Pork

CAS Registry Number	Constituent Name	Biotransfer Factor in Beef (Ba_{beef}) and Game (Ba_{game})	Units for Biotransfer Factor in Beef and Game	Reference	Biotransfer Factor in Milk (Ba_{milk})	Units for Biotransfer Factor in Milk	Reference	Biotransfer Factor in Pork (Ba_{pork})	Units for Biotransfer Factor in Pork	Reference
103-33-3	Azobenzene	1.65E-04	day/kg FW	[6]	5.22E-05	day/kg FW	[7]	2.78E-02	day/kg FW	[1]
103-65-1	n-Propyl benzene (Isocumene)	1.22E-04	day/kg FW	[6]	3.87E-05	day/kg FW	[7]	2.52E-02	day/kg FW	[1]
104-51-8	n-Butylbenzene	6.00E-04	day/kg FW	[6]	1.90E-04	day/kg FW	[7]	3.88E-02	day/kg FW	[1]
104-76-7	2-Ethyl-1-hexanol	7.98E-03	day/kg FW	[3]	1.68E-03	day/kg FW	[4]	9.66E-03	day/kg FW	[1]
105-67-9	2,4-Dimethylphenol	4.53E-03	day/kg FW	[4]	9.53E-04	day/kg FW	[5]	5.48E-03	day/kg FW	[2]
10595-95-6	n-Nitrosomethylethylamine	2.74E-08	day/kg FW	[6]	8.66E-09	day/kg FW	[7]	6.99E-05	day/kg FW	[1]
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	5.34E-05	day/kg FW	[6]	1.69E-05	day/kg FW	[7]	1.85E-02	day/kg FW	[1]
106-44-5	p-Cresol (4-methyl phenol)	2.48E-03	day/kg FW	[4]	5.22E-04	day/kg FW	[5]	3.00E-03	day/kg FW	[2]
106-46-7	1,4-Dichlorobenzene	1.78E-02	day/kg FW	[4]	3.75E-03	day/kg FW	[5]	2.16E-02	day/kg FW	[2]
106-47-8	p-Chloroaniline	5.62E-05	day/kg FW	[4]	1.18E-05	day/kg FW	[5]	6.81E-05	day/kg FW	[2]
106-49-0	p-Toluidine	6.14E-07	day/kg FW	[6]	1.94E-07	day/kg FW	[7]	1.25E-03	day/kg FW	[1]
106-51-4	Quinone	8.49E-05	day/kg FW	[3]	1.79E-05	day/kg FW	[4]	1.03E-04	day/kg FW	[1]
106-88-7	1,2-Epoxybutane	1.81E-07	day/kg FW	[6]	5.72E-08	day/kg FW	[7]	4.45E-04	day/kg FW	[1]
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	3.09E-05	day/kg FW	[4]	6.50E-06	day/kg FW	[5]	3.74E-05	day/kg FW	[2]
106-93-4	Ethylene dibromide	2.90E-03	day/kg FW	[4]	6.11E-04	day/kg FW	[5]	3.51E-03	day/kg FW	[2]
106-99-0	1,3-Butadiene	2.44E-06	day/kg FW	[6]	7.72E-07	day/kg FW	[7]	3.46E-03	day/kg FW	[1]
107-02-8	Acrolein	5.11E-05	day/kg FW	[4]	1.07E-05	day/kg FW	[5]	6.18E-05	day/kg FW	[2]
107-05-1	3-Chloropropene	2.13E-06	day/kg FW	[6]	6.72E-07	day/kg FW	[7]	3.15E-03	day/kg FW	[1]
107-06-2	1,2-Dichloroethane	1.26E-03	day/kg FW	[4]	2.66E-04	day/kg FW	[5]	1.53E-03	day/kg FW	[2]
107-12-0	Propionitrile	3.61E-08	day/kg FW	[6]	1.14E-08	day/kg FW	[7]	9.34E-05	day/kg FW	[1]
107-13-1	Acrylonitrile	9.55E-05	day/kg FW	[4]	2.01E-05	day/kg FW	[5]	1.16E-04	day/kg FW	[2]
107-19-7	Propargyl alcohol	1.04E-08	day/kg FW	[6]	3.29E-09	day/kg FW	[7]	2.40E-05	day/kg FW	[1]
107-21-1	Ethylene glycol (1,2-ethanediol)	1.09E-09	day/kg FW	[6]	3.45E-10	day/kg FW	[7]	1.10E-05	day/kg FW	[1]
107-98-2	Propylene glycol monomethyl ether	8.09E-09	day/kg FW	[6]	2.56E-09	day/kg FW	[7]	1.79E-05	day/kg FW	[1]
108-05-4	Acetic acid vinyl ester	2.80E-04	day/kg FW	[4]	5.89E-05	day/kg FW	[5]	3.39E-04	day/kg FW	[2]
108-10-1	4-Methyl-2-pentanone	7.25E-04	day/kg FW	[4]	1.53E-04	day/kg FW	[5]	8.77E-04	day/kg FW	[2]

Table 4-1 Biotransfer Factors for Beef, Game, Milk, and Pork

CAS Registry Number	Constituent Name	Biotransfer Factor in Beef (Ba_{beef}) and Game (Ba_{game})	Units for Biotransfer Factor in Beef and Game	Reference	Biotransfer Factor in Milk (Ba_{milk})	Units for Biotransfer Factor in Milk	Reference	Biotransfer Factor in Pork (Ba_{pork})	Units for Biotransfer Factor in Pork	Reference
108-39-4	m-Cresol	2.73E-03	day/kg FW	[4]	5.74E-04	day/kg FW	[5]	3.30E-03	day/kg FW	[2]
108-60-1	bis (2-Chloroisopropyl)ether	7.55E-06	day/kg FW	[6]	2.39E-06	day/kg FW	[7]	7.02E-03	day/kg FW	[1]
108-67-8	1,3,5-Trimethylbenzene	1.66E-02	day/kg FW	[4]	3.50E-03	day/kg FW	[5]	2.01E-02	day/kg FW	[2]
108-86-1	Bromobenzene (Phenyl bromide)	2.44E-05	day/kg FW	[6]	7.72E-06	day/kg FW	[7]	1.31E-02	day/kg FW	[1]
108-87-2	Methylcyclohexane	1.02E-04	day/kg FW	[6]	3.22E-05	day/kg FW	[7]	2.37E-02	day/kg FW	[1]
108-88-3	Toluene	7.69E-03	day/kg FW	[4]	1.62E-03	day/kg FW	[5]	9.31E-03	day/kg FW	[2]
108-90-7	Chlorobenzene	8.68E-03	day/kg FW	[4]	1.83E-03	day/kg FW	[5]	1.05E-02	day/kg FW	[2]
108-94-1	Cyclohexanone	1.61E-07	day/kg FW	[6]	5.10E-08	day/kg FW	[7]	4.01E-04	day/kg FW	[1]
108-95-2	Phenol	1.26E-03	day/kg FW	[4]	2.65E-04	day/kg FW	[5]	1.52E-03	day/kg FW	[2]
109-74-0	n-Butanenitrile	1.81E-04	day/kg FW	[3]	3.81E-05	day/kg FW	[4]	2.19E-04	day/kg FW	[1]
109-75-1	3-Butenenitrile	1.35E-04	day/kg FW	[3]	2.85E-05	day/kg FW	[4]	1.64E-04	day/kg FW	[1]
109-77-3	Malononitrile	6.28E-09	day/kg FW	[6]	1.98E-09	day/kg FW	[7]	1.33E-05	day/kg FW	[1]
109-86-4	2-Methoxyethanol	4.25E-09	day/kg FW	[6]	1.34E-09	day/kg FW	[7]	1.10E-05	day/kg FW	[1]
109-99-9	Tetrahydrofuran	1.55E-04	day/kg FW	[4]	3.26E-05	day/kg FW	[5]	1.87E-04	day/kg FW	[2]
110-00-9	Furan	5.47E-07	day/kg FW	[6]	1.73E-07	day/kg FW	[7]	1.14E-03	day/kg FW	[1]
110-54-3	n-Hexane	2.00E-04	day/kg FW	[6]	6.30E-05	day/kg FW	[7]	2.94E-02	day/kg FW	[1]
110-59-8	Pentanenitrile	6.21E-04	day/kg FW	[3]	1.31E-04	day/kg FW	[4]	7.52E-04	day/kg FW	[1]
110-80-5	2-Ethoxyethanol	1.20E-08	day/kg FW	[6]	3.78E-09	day/kg FW	[7]	2.81E-05	day/kg FW	[1]
110-82-7	Cyclohexane	6.89E-05	day/kg FW	[6]	2.18E-05	day/kg FW	[7]	2.05E-02	day/kg FW	[1]
110-83-8	Cyclohexene	1.81E-05	day/kg FW	[6]	5.72E-06	day/kg FW	[7]	1.13E-02	day/kg FW	[1]
110-86-1	Pyridine	2.36E-04	day/kg FW	[4]	4.96E-05	day/kg FW	[5]	2.85E-04	day/kg FW	[2]
111-15-9	Ethylene glycol monoethyl ether acetate	9.73E-08	day/kg FW	[6]	3.07E-08	day/kg FW	[7]	2.50E-04	day/kg FW	[1]
111-44-4	Bis(2-chloroethyl)ether	8.60E-04	day/kg FW	[4]	1.81E-04	day/kg FW	[5]	1.04E-03	day/kg FW	[2]
111-65-9	n-Octane	4.03E-02	day/kg FW	[3]	8.48E-03	day/kg FW	[4]	4.87E-02	day/kg FW	[1]
111-76-2	2-Butoxyethanol	1.69E-07	day/kg FW	[6]	5.34E-08	day/kg FW	[7]	4.18E-04	day/kg FW	[1]
111-84-2	n-Nonane	1.12E-02	day/kg FW	[6]	3.53E-03	day/kg FW	[7]	4.86E-02	day/kg FW	[1]
111-91-1	Bis(2-chloroethoxy)methane	4.99E-07	day/kg FW	[6]	1.58E-07	day/kg FW	[7]	1.06E-03	day/kg FW	[1]
112-30-1	1-Decanol	9.29E-04	day/kg FW	[6]	2.94E-04	day/kg FW	[7]	4.21E-02	day/kg FW	[1]

Table 4-1 Biotransfer Factors for Beef, Game, Milk, and Pork

CAS Registry Number	Constituent Name	Biotransfer Factor in Beef (Ba_{beef}) and Game (Ba_{game})	Units for Biotransfer Factor in Beef and Game	Reference	Biotransfer Factor in Milk (Ba_{milk})	Units for Biotransfer Factor in Milk	Reference	Biotransfer Factor in Pork (Ba_{pork})	Units for Biotransfer Factor in Pork	Reference
112-31-2	Decanal	2.20E-02	day/kg FW	[3]	4.63E-03	day/kg FW	[4]	2.66E-02	day/kg FW	[1]
112-40-3	Dodecane	3.65E-02	day/kg FW	[3]	7.68E-03	day/kg FW	[4]	4.42E-02	day/kg FW	[1]
1120-21-4	Undecane	3.97E-02	day/kg FW	[3]	8.36E-03	day/kg FW	[4]	4.81E-02	day/kg FW	[1]
1120-71-4	1,3-Propane sultone	1.31E-08	day/kg FW	[6]	4.15E-09	day/kg FW	[7]	3.12E-05	day/kg FW	[1]
117-81-7	Bis(2-ethylhexyl) phthalate	3.99E-02	day/kg FW	[4]	8.40E-03	day/kg FW	[5]	4.83E-02	day/kg FW	[2]
117-84-0	Di-n-octylphthalate	7.77E-03	day/kg FW	[4]	1.64E-03	day/kg FW	[5]	9.40E-03	day/kg FW	[2]
118-74-1	Hexachlorobenzene	4.06E-02	day/kg FW	[4]	8.55E-03	day/kg FW	[5]	4.92E-02	day/kg FW	[2]
119-90-4	3,3'-Dimethoxybenzidine	2.14E-03	day/kg FW	[4]	4.51E-04	day/kg FW	[5]	2.59E-03	day/kg FW	[2]
120-12-7	Anthracene	3.38E-02	day/kg FW	[4]	7.12E-03	day/kg FW	[5]	4.09E-02	day/kg FW	[2]
120-82-1	1,2,4-Trichlorobenzene	2.60E-02	day/kg FW	[4]	5.47E-03	day/kg FW	[5]	3.15E-02	day/kg FW	[2]
120-83-2	2,4-Dichlorophenol	5.71E-03	day/kg FW	[4]	1.20E-03	day/kg FW	[5]	6.92E-03	day/kg FW	[2]
121-14-2	2,4-Dinitrotoluene	2.81E-03	day/kg FW	[4]	5.92E-04	day/kg FW	[5]	3.41E-03	day/kg FW	[2]
122-39-4	N,N-Diphenylamine	7.91E-05	day/kg FW	[6]	2.50E-05	day/kg FW	[7]	2.16E-02	day/kg FW	[1]
122-66-7	1,2-Diphenylhydrazine	9.75E-03	day/kg FW	[4]	2.05E-03	day/kg FW	[5]	1.18E-02	day/kg FW	[2]
123-33-1	Maleic hydrazide	3.61E-09	day/kg FW	[6]	1.14E-09	day/kg FW	[7]	1.10E-05	day/kg FW	[1]
123-38-6	Propionaldehyde	9.73E-08	day/kg FW	[6]	3.07E-08	day/kg FW	[7]	2.50E-04	day/kg FW	[1]
123-72-8	Butanal	3.83E-04	day/kg FW	[3]	8.07E-05	day/kg FW	[4]	4.64E-04	day/kg FW	[1]
123-91-1	1,4-Dioxan	2.65E-05	day/kg FW	[4]	5.57E-06	day/kg FW	[5]	3.20E-05	day/kg FW	[2]
124-18-5	Decane	2.56E-03	day/kg FW	[6]	8.08E-04	day/kg FW	[7]	4.76E-02	day/kg FW	[1]
124-38-9	Carbon dioxide	3.46E-04	day/kg FW	[3]	7.28E-05	day/kg FW	[4]	4.18E-04	day/kg FW	[1]
124-48-1	Chlorodibromomethane	4.10E-03	day/kg FW	[4]	8.63E-04	day/kg FW	[5]	4.96E-03	day/kg FW	[2]
126-73-8	Tributyl phosphate	2.50E-04	day/kg FW	[6]	7.90E-05	day/kg FW	[7]	3.15E-02	day/kg FW	[1]
126-98-7	2-Methyl-2-propenenitrile	1.85E-04	day/kg FW	[4]	3.90E-05	day/kg FW	[5]	2.24E-04	day/kg FW	[2]
127-18-4	1,1,2,2-Tetrachloroethene	1.63E-02	day/kg FW	[4]	3.43E-03	day/kg FW	[5]	1.97E-02	day/kg FW	[2]
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	3.15E-03	day/kg FW	[6]	9.95E-04	day/kg FW	[7]	4.83E-02	day/kg FW	[1]
129-00-0	Pyrene	3.84E-02	day/kg FW	[4]	8.09E-03	day/kg FW	[5]	4.65E-02	day/kg FW	[2]
131-11-3	Dimethyl Phthalate	1.40E-03	day/kg FW	[4]	2.95E-04	day/kg FW	[5]	1.70E-03	day/kg FW	[2]
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	3.30E-04	day/kg FW	[6]	1.04E-04	day/kg FW	[7]	3.39E-02	day/kg FW	[1]

Table 4-1 Biotransfer Factors for Beef, Game, Milk, and Pork

CAS Registry Number	Constituent Name	Biotransfer Factor in Beef (Ba_{beef}) and Game (Ba_{game})	Units for Biotransfer Factor in Beef and Game	Reference	Biotransfer Factor in Milk (Ba_{milk})	Units for Biotransfer Factor in Milk	Reference	Biotransfer Factor in Pork (Ba_{pork})	Units for Biotransfer Factor in Pork	Reference
132-64-9	Dibenzofuran	3.30E-04	day/kg FW	[6]	1.04E-04	day/kg FW	[7]	3.39E-02	day/kg FW	[1]
133-06-2	Captan	1.58E-05	day/kg FW	[6]	4.98E-06	day/kg FW	[7]	1.05E-02	day/kg FW	[1]
1330-20-7	Xylenes (mixed isomers)	3.61E-05	day/kg FW	[6]	1.14E-05	day/kg FW	[7]	1.56E-02	day/kg FW	[1]
1336-36-3	Polychlorinated biphenyls	3.15E-01	day/kg FW	[6]	3.45E-02	day/kg FW	[6]	4.12E-02	day/kg FW	[1]
134-32-7	alpha-Naphthylamine	4.45E-06	day/kg FW	[6]	1.40E-06	day/kg FW	[7]	5.11E-03	day/kg FW	[1]
135-98-8	sec-Butylbenzene	9.29E-04	day/kg FW	[6]	2.94E-04	day/kg FW	[7]	4.21E-02	day/kg FW	[1]
13966-29-5	Uranium-234	3.40E-04	day/kg FW	[1]	6.00E-04	day/kg FW	[1]	6.20E-02	day/kg FW	[4]
13967-48-1	Ruthenium-106	2.00E-03	day/kg FW	[1]	3.30E-06	day/kg FW	[1]			
13967-70-9	Cesium-134	3.00E-02	day/kg FW	[1]	8.00E-03	day/kg FW	[1]	2.40E-01	day/kg FW	[4]
13968-55-3	Uranium-233	3.40E-04	day/kg FW	[1]	6.00E-04	day/kg FW	[1]	6.20E-02	day/kg FW	[4]
13981-15-2	Curium-244	2.00E-05	day/kg FW	[1]	2.00E-06	day/kg FW	[1]			
13981-16-3	Plutonium-238	1.00E-04	day/kg FW	[1]	1.00E-06	day/kg FW	[1]	8.00E-05	day/kg FW	[4]
13981-37-8	Nickel-63	5.00E-03	day/kg FW	[1]	2.00E-02	day/kg FW	[1]			
13982-10-0	Plutonium-242	1.00E-04	day/kg FW	[1]	1.00E-06	day/kg FW	[1]	8.00E-05	day/kg FW	[4]
13982-63-3	Radium-226	1.00E-03	day/kg FW	[1]	1.00E-03	day/kg FW	[1]			
13982-70-2	Uranium-236	3.40E-04	day/kg FW	[1]	6.00E-04	day/kg FW	[1]	6.20E-02	day/kg FW	[4]
13994-20-2	Neptunium-237	1.00E-03	day/kg FW	[1]	5.00E-06	day/kg FW	[1]			
141-78-6	Acetic acid ethyl ester	1.34E-07	day/kg FW	[6]	4.24E-08	day/kg FW	[7]	3.39E-04	day/kg FW	[1]
14119-32-5	Plutonium-241	1.00E-04	day/kg FW	[1]	1.00E-06	day/kg FW	[1]	8.00E-05	day/kg FW	[4]
14119-33-6	Plutonium-240	1.00E-04	day/kg FW	[1]	1.00E-06	day/kg FW	[1]	8.00E-05	day/kg FW	[4]
14133-76-7	Technetium-99	1.00E-04	day/kg FW	[1]	1.00E-03	day/kg FW	[1]	1.50E-04	day/kg FW	[4]
14158-29-3	Uranium-232	3.40E-04	day/kg FW	[1]	6.00E-04	day/kg FW	[1]	6.20E-02	day/kg FW	[4]
14234-35-6	Antimony-125	1.00E-03	day/kg FW	[1]	1.00E-04	day/kg FW	[1]			
14265-44-2	Phosphate									
14331-85-2	Protactinium-231	5.00E-03	day/kg FW	[1]	5.00E-06	day/kg FW	[1]			
14336-70-0	Nickel-59	5.00E-03	day/kg FW	[1]	2.00E-02	day/kg FW	[1]			
14391-16-3	Europium-155	2.00E-03	day/kg FW	[1]	2.00E-05	day/kg FW	[1]			
145-73-3	Endothall	2.03E-06	day/kg FW	[6]	6.42E-07	day/kg FW	[7]	3.05E-03	day/kg FW	[1]
14596-10-2	Americium-241	5.00E-05	day/kg FW	[1]	2.00E-06	day/kg FW	[1]	1.70E-04	day/kg FW	[4]
14683-23-9	Europium-152	2.00E-03	day/kg FW	[1]	2.00E-05	day/kg FW	[1]			

Table 4-1 Biotransfer Factors for Beef, Game, Milk, and Pork

CAS Registry Number	Constituent Name	Biotransfer Factor in Beef (Ba_{beef}) and Game (Ba_{game})	Units for Biotransfer Factor in Beef and Game	Reference	Biotransfer Factor in Milk (Ba_{milk})	Units for Biotransfer Factor in Milk	Reference	Biotransfer Factor in Pork (Ba_{pork})	Units for Biotransfer Factor in Pork	Reference
14762-75-5	Carbon-14	3.10E-02	day/kg FW	[1]	1.20E-02	day/kg FW	[1]			
14797-55-8	Nitrate									
14797-65-0	Nitrite									
14808-79-8	Sulfate									
14952-40-0	Actinium-227	2.00E-05	day/kg FW	[1]	2.00E-05	day/kg FW	[1]			
14993-75-0	Americium-243	5.00E-05	day/kg FW	[1]	2.00E-06	day/kg FW	[1]	1.70E-04	day/kg FW	[4]
15046-84-1	Iodine-129	7.00E-03	day/kg FW	[1]	1.00E-02	day/kg FW	[1]	3.30E-03	day/kg FW	[4]
15117-48-3	Plutonium-239	1.00E-04	day/kg FW	[1]	1.00E-06	day/kg FW	[1]	8.00E-05	day/kg FW	[4]
15117-96-1	Uranium-235	3.40E-04	day/kg FW	[1]	6.00E-04	day/kg FW	[1]	6.20E-02	day/kg FW	[4]
15262-20-1	Radium-228	1.00E-03	day/kg FW	[1]	1.00E-03	day/kg FW	[1]			
15510-73-3	Curium-242	2.00E-05	day/kg FW	[1]	2.00E-06	day/kg FW	[1]			
15585-10-1	Europium-154	2.00E-03	day/kg FW	[1]	2.00E-05	day/kg FW	[1]			
15594-54-4	Thorium-229	1.00E-04	day/kg FW	[1]	5.00E-06	day/kg FW	[1]			
156-59-2	cis-1,2-Dichloroethene	2.48E-03	day/kg FW	[4]	5.22E-04	day/kg FW	[5]	3.00E-03	day/kg FW	[2]
156-60-5	1,2-trans-Dichloroethene	3.38E-03	day/kg FW	[4]	7.12E-04	day/kg FW	[5]	4.09E-03	day/kg FW	[2]
15715-94-3	Samarium-151	2.00E-03	day/kg FW	[1]	2.00E-05	day/kg FW	[1]			
15751-77-6	Zirconium-93	1.00E-06	day/kg FW	[1]	6.00E-07	day/kg FW	[1]			
15757-87-6	Curium-243	2.00E-05	day/kg FW	[1]	2.00E-06	day/kg FW	[1]			
15758-45-9	Selenium-79	1.00E-01	day/kg FW	[1]	1.00E-02	day/kg FW	[1]	3.20E-01	day/kg FW	[4]
15832-50-5	Tin-126	1.00E-02	day/kg FW	[1]	1.00E-03	day/kg FW	[1]			
1634-04-4	Methyl tert-butyl ether	2.18E-07	day/kg FW	[6]	6.88E-08	day/kg FW	[7]	5.25E-04	day/kg FW	[1]
16887-00-6	Chloride	6.00E-02	day/kg FW	[1]	2.00E-02	day/kg FW	[1]			
16984-48-8	Fluoride	2.00E-02	day/kg FW	[1]	7.00E-03	day/kg FW	[1]			
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	2.61E-02	day/kg FW	[4]	5.50E-03	day/kg FW	[5]	3.16E-02	day/kg FW	[2]
18540-29-9	Chromium(VI)	9.00E-03	day/kg FW	[1]	2.00E-03	day/kg FW	[1]			
189-55-9	Dibenzo[a,i]pyrene	4.76E-01	day/kg FW	[6]	3.45E-02	day/kg FW	[6]	4.55E-02	day/kg FW	[8]
189-64-0	Dibenzo[a,h]pyrene	4.76E-01	day/kg FW	[6]	3.45E-02	day/kg FW	[6]	2.21E-02	day/kg FW	[1]
191-24-2	Benzo(g,h,i)perylene	1.07E-01	day/kg FW	[6]	3.37E-02	day/kg FW	[7]	3.50E-02	day/kg FW	[1]
191-30-0	Dibenzo(a,l)pyrene	1.28E+00	day/kg FW	[6]	3.45E-02	day/kg FW	[6]	1.47E-02	day/kg FW	[1]

Table 4-1 Biotransfer Factors for Beef, Game, Milk, and Pork

CAS Registry Number	Constituent Name	Biotransfer Factor in Beef (Ba_{beef}) and Game (Ba_{game})	Units for Biotransfer Factor in Beef and Game	Reference	Biotransfer Factor in Milk (Ba_{milk})	Units for Biotransfer Factor in Milk	Reference	Biotransfer Factor in Pork (Ba_{pork})	Units for Biotransfer Factor in Pork	Reference
192-65-4	Dibenzo[a,e]pyrene	1.28E+00	day/kg FW	[6]	3.45E-02	day/kg FW	[6]	2.21E-02	day/kg FW	[1]
192-97-2	Benzo(e)pyrene	3.19E-02	day/kg FW	[3]	6.71E-03	day/kg FW	[4]	3.86E-02	day/kg FW	[1]
193-39-5	Indeno(1,2,3-cd)pyrene	2.94E-02	day/kg FW	[4]	6.19E-03	day/kg FW	[5]	3.56E-02	day/kg FW	[2]
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	1.79E-02	day/kg FW	[4]	3.78E-03	day/kg FW	[5]	2.17E-02	day/kg FW	[2]
205-82-3	Benzo[j]fluoranthene	3.22E-02	day/kg FW	[6]	1.02E-02	day/kg FW	[7]	4.40E-02	day/kg FW	[1]
205-99-2	Benzo(b)fluoranthene	3.62E-02	day/kg FW	[4]	7.62E-03	day/kg FW	[5]	4.38E-02	day/kg FW	[2]
206-44-0	Fluoranthene	3.92E-02	day/kg FW	[4]	8.26E-03	day/kg FW	[5]	4.75E-02	day/kg FW	[2]
207-08-9	Benzo(k)fluoranthene	3.65E-02	day/kg FW	[4]	7.68E-03	day/kg FW	[5]	4.42E-02	day/kg FW	[2]
208-96-8	Acenaphthylene	2.18E-04	day/kg FW	[6]	6.88E-05	day/kg FW	[7]	3.02E-02	day/kg FW	[1]
218-01-9	Chrysene	3.99E-02	day/kg FW	[4]	8.41E-03	day/kg FW	[5]	4.83E-02	day/kg FW	[2]
224-42-0	Dibenz[a,j]acridine	1.07E-02	day/kg FW	[6]	3.37E-03	day/kg FW	[7]	3.75E-02	day/kg FW	[10]
2245-38-7	2,3,5-Trimethylnaphthalene	3.76E-02	day/kg FW	[3]	7.91E-03	day/kg FW	[4]	4.55E-02	day/kg FW	[1]
226-36-8	Dibenz[a,h]acridine	1.34E-02	day/kg FW	[6]	4.24E-03	day/kg FW	[7]	3.75E-02	day/kg FW	[10]
22967-92-6	Methyl mercury	7.80E-04	day/kg FW	[4]	3.38E-04	day/kg FW	[5]	5.07E-06	day/kg FW	[2]
23950-58-5	Pronamide	1.68E-02	day/kg FW	[4]	3.53E-03	day/kg FW	[5]	2.03E-02	day/kg FW	[2]
24959-67-9	Bromide	2.00E-02	day/kg FW	[1]	2.00E-02	day/kg FW	[1]			
27154-33-2	Trichlorofluoroethane	5.96E-03	day/kg FW	[10]	1.25E-03	day/kg FW	[10]	7.21E-03	day/kg FW	[11]
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	3.30E-01	day/kg FW	[6]	3.45E-02	day/kg FW	[6]	2.52E-02	day/kg FW	[1]
319-84-6	alpha-BHC	2.27E-02	day/kg FW	[4]	4.77E-03	day/kg FW	[5]	2.74E-02	day/kg FW	[2]
319-85-7	beta-BHC	2.27E-02	day/kg FW	[4]	4.77E-03	day/kg FW	[5]	2.74E-02	day/kg FW	[2]
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	1.07E-01	day/kg FW	[6]	3.37E-02	day/kg FW	[7]	3.50E-02	day/kg FW	[1]
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	1.54E-01	day/kg FW	[6]	3.45E-02	day/kg FW	[6]	3.18E-02	day/kg FW	[1]
3268-87-9	Octachlorodibenzo(p)dioxin	6.85E-03	day/kg FW	[4]	1.44E-03	day/kg FW	[5]	8.30E-03	day/kg FW	[2]

Table 4-1 Biotransfer Factors for Beef, Game, Milk, and Pork

CAS Registry Number	Constituent Name	Biotransfer Factor in Beef (Ba_{beef}) and Game (Ba_{game})	Units for Biotransfer Factor in Beef and Game	Reference	Biotransfer Factor in Milk (Ba_{milk})	Units for Biotransfer Factor in Milk	Reference	Biotransfer Factor in Pork (Ba_{pork})	Units for Biotransfer Factor in Pork	Reference
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	6.43E-01	day/kg FW	[6]	3.45E-02	day/kg FW	[6]	1.97E-02	day/kg FW	[1]
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	8.77E-03	day/kg FW	[4]	1.85E-03	day/kg FW	[5]	1.06E-02	day/kg FW	[2]
3697-24-3	5-Methylchrysene	2.94E-02	day/kg FW	[6]	9.28E-03	day/kg FW	[7]	4.83E-02	day/kg FW	[9]
378253-40-8	Barium-137m	2.00E-04	day/kg FW	[1]	5.00E-04	day/kg FW	[1]			
378253-44-2	Cadmium-113m	4.00E-04	day/kg FW	[1]	1.00E-03	day/kg FW	[1]	1.50E-02	day/kg FW	[4]
378782-82-2	Niobium-93m	3.00E-07	day/kg FW	[1]	2.00E-06	day/kg FW	[1]	2.00E-04	day/kg FW	[4]
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	9.95E-01	day/kg FW	[6]	3.45E-02	day/kg FW	[6]	1.64E-02	day/kg FW	[1]
39001-02-0	Octachlorodibenzofuran	8.77E-03	day/kg FW	[4]	1.85E-03	day/kg FW	[5]	1.06E-02	day/kg FW	[2]
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	1.10E-02	day/kg FW	[4]	2.32E-03	day/kg FW	[5]	1.33E-02	day/kg FW	[2]
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	2.45E+00	day/kg FW	[5]	3.45E-02	day/kg FW	[6]	8.30E-03	day/kg FW	[1]
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	2.88E-02	day/kg FW	[4]	6.05E-03	day/kg FW	[5]	3.48E-02	day/kg FW	[2]
4170-30-3	Crotonaldehyde (Propylene aldehyde)	9.95E-08	day/kg FW	[6]	3.15E-08	day/kg FW	[7]	2.56E-04	day/kg FW	[1]
41851-50-7	Chlorocyclopentadiene	6.73E-06	day/kg FW	[6]	2.13E-06	day/kg FW	[7]	6.57E-03	day/kg FW	[1]
460-19-5	Cyanogen (oxalonitrile)	2.90E-08	day/kg FW	[6]	9.30E-09	day/kg FW	[7]	7.52E-05	day/kg FW	[1]
4786-20-3	2-Butenenitrile	2.21E-04	day/kg FW	[3]	4.65E-05	day/kg FW	[4]	2.67E-04	day/kg FW	[1]
50-00-0	Formaldehyde	1.21E-04	day/kg FW	[4]	2.54E-05	day/kg FW	[5]	1.46E-04	day/kg FW	[2]
50-32-8	Benzo(a)pyrene	3.76E-02	day/kg FW	[4]	7.91E-03	day/kg FW	[5]	4.55E-02	day/kg FW	[2]
506-68-3	Cyanogen bromide (bromocyanide)	2.51E-05	day/kg FW	[3]	5.29E-06	day/kg FW	[4]	3.04E-05	day/kg FW	[1]
506-77-4	Cyanogen chloride	4.00E-08	day/kg FW	[6]	1.30E-08	day/kg FW	[7]	2.40E-05	day/kg FW	[1]
51-28-5	2,4-Dinitrophenol	5.56E-05	day/kg FW	[4]	1.17E-05	day/kg FW	[5]	6.74E-05	day/kg FW	[2]

Table 4-1 Biotransfer Factors for Beef, Game, Milk, and Pork

CAS Registry Number	Constituent Name	Biotransfer Factor in Beef (Ba_{beef}) and Game (Ba_{game})	Units for Biotransfer Factor in Beef and Game	Reference	Biotransfer Factor in Milk (Ba_{milk})	Units for Biotransfer Factor in Milk	Reference	Biotransfer Factor in Pork (Ba_{pork})	Units for Biotransfer Factor in Pork	Reference
51-79-6	Ethyl carbamate (urethane)	1.77E-08	day/kg FW	[6]	5.59E-09	day/kg FW	[7]	4.36E-05	day/kg FW	[1]
510-15-6	Chlorobenzilate	3.18E-02	day/kg FW	[4]	6.69E-03	day/kg FW	[5]	3.85E-02	day/kg FW	[2]
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	3.65E-02	day/kg FW	[4]	7.68E-03	day/kg FW	[5]	4.42E-02	day/kg FW	[2]
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	7.91E-01	day/kg FW	[6]	3.45E-02	day/kg FW	[6]	1.81E-02	day/kg FW	[1]
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	1.22E-06	day/kg FW	[6]	3.87E-07	day/kg FW	[7]	2.12E-03	day/kg FW	[1]
53-70-3	Dibenz[a,h]anthracene	3.10E-02	day/kg FW	[4]	6.52E-03	day/kg FW	[5]	3.75E-02	day/kg FW	[2]
532-27-4	2-Chloroacetophenone	2.13E-06	day/kg FW	[6]	6.72E-07	day/kg FW	[7]	3.15E-03	day/kg FW	[1]
534-52-1	4,6-Dinitro-o-cresol	3.37E-06	day/kg FW	[6]	1.07E-06	day/kg FW	[7]	4.28E-03	day/kg FW	[1]
5385-75-1	Dibenzo(a,e)fluoranthene	4.76E-01	day/kg FW	[9]	3.45E-02	day/kg FW	[6]	2.21E-02	day/kg FW	[1]
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	3.08E-06	day/kg FW	[6]	9.72E-07	day/kg FW	[7]	3.51E-03	day/kg FW	[1]
540-73-8	1,2-Dimethylhydrazine	7.21E-09	day/kg FW	[6]	2.28E-09	day/kg FW	[7]	1.57E-05	day/kg FW	[1]
540-84-1	2,2,4-Trimethylpentane	3.08E-04	day/kg FW	[6]	9.72E-05	day/kg FW	[7]	3.33E-02	day/kg FW	[1]
541-73-1	1,3-Dichlorobenzene	1.94E-02	day/kg FW	[4]	4.08E-03	day/kg FW	[5]	2.35E-02	day/kg FW	[2]
542-75-6	1,3-Dichloropropene	1.50E-03	day/kg FW	[4]	3.17E-04	day/kg FW	[5]	1.82E-03	day/kg FW	[2]
542-88-1	Bis(chloromethyl)ether	9.29E-08	day/kg FW	[6]	2.94E-08	day/kg FW	[7]	2.40E-04	day/kg FW	[1]
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	1.64E-02	day/kg FW	[4]	3.46E-03	day/kg FW	[5]	1.99E-02	day/kg FW	[2]
56-23-5	Carbon tetrachloride	8.68E-03	day/kg FW	[4]	1.83E-03	day/kg FW	[5]	1.05E-02	day/kg FW	[2]
56-49-5	3-Methylcholanthrene	6.58E-02	day/kg FW	[6]	2.08E-02	day/kg FW	[7]	3.90E-02	day/kg FW	[1]
56-55-3	Benzo(a)anthracene	3.99E-02	day/kg FW	[4]	8.41E-03	day/kg FW	[5]	4.83E-02	day/kg FW	[2]
57-12-5	Cyanide	9.07E-06	day/kg FW	[4]	1.91E-06	day/kg FW	[5]	1.10E-05	day/kg FW	[2]
57-24-9	Strychnine	2.60E-03	day/kg FW	[4]	5.48E-04	day/kg FW	[5]	3.15E-03	day/kg FW	[2]
57-74-9	Chlordane	4.06E-02	day/kg FW	[4]	8.56E-03	day/kg FW	[5]	4.92E-02	day/kg FW	[2]
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	3.10E-02	day/kg FW	[4]	6.52E-03	day/kg FW	[5]	3.75E-02	day/kg FW	[2]
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	2.63E-02	day/kg FW	[4]	5.53E-03	day/kg FW	[5]	3.18E-02	day/kg FW	[2]

Table 4-1 Biotransfer Factors for Beef, Game, Milk, and Pork

CAS Registry Number	Constituent Name	Biotransfer Factor in Beef (Ba_{beef}) and Game (Ba_{game})	Units for Biotransfer Factor in Beef and Game	Reference	Biotransfer Factor in Milk (Ba_{milk})	Units for Biotransfer Factor in Milk	Reference	Biotransfer Factor in Pork (Ba_{pork})	Units for Biotransfer Factor in Pork	Reference
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	2.28E-02	day/kg FW	[4]	4.80E-03	day/kg FW	[5]	2.76E-02	day/kg FW	[2]
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	2.39E-01	day/kg FW	[6]	3.45E-02	day/kg FW	[6]	2.52E-02	day/kg FW	[1]
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	1.79E-02	day/kg FW	[4]	3.78E-03	day/kg FW	[5]	2.17E-02	day/kg FW	[2]
58-89-9	gamma-BHC (Lindane)	1.31E-04	day/kg FW	[6]	4.15E-05	day/kg FW	[7]	3.43E-02	day/kg FW	[1]
58-90-2	2,3,4,6-Tetrachlorophenol	7.33E-05	day/kg FW	[4]	1.54E-05	day/kg FW	[5]	8.87E-05	day/kg FW	[2]
581-42-0	2,6-Dimethylnaphthalene	3.10E-02	day/kg FW	[3]	6.53E-03	day/kg FW	[4]	3.75E-02	day/kg FW	[1]
584-84-9	2,4-Toluene diisocyanate	2.81E-03	day/kg FW	[7]	5.92E-04	day/kg FW	[8]	3.41E-03	day/kg FW	[5]
589-38-8	3-Hexanone	7.82E-04	day/kg FW	[3]	1.65E-04	day/kg FW	[4]	9.47E-04	day/kg FW	[1]
59-50-7	4-Chloro-3-methylphenol	1.21E-02	day/kg FW	[4]	2.56E-03	day/kg FW	[5]	1.47E-02	day/kg FW	[2]
59-89-2	N-Nitrosomorpholine	9.08E-09	day/kg FW	[6]	2.87E-09	day/kg FW	[7]	2.05E-05	day/kg FW	[1]
591-50-4	Benzene, iodo-	1.41E-02	day/kg FW	[3]	2.98E-03	day/kg FW	[4]	1.71E-02	day/kg FW	[1]
591-78-6	2-Hexanone	6.00E-07	day/kg FW	[6]	1.90E-07	day/kg FW	[7]	1.23E-03	day/kg FW	[1]
593-60-2	Bromoethene (Vinyl bromide)	9.29E-07	day/kg FW	[6]	2.94E-07	day/kg FW	[7]	1.73E-03	day/kg FW	[1]
593-74-8	Dimethyl Mercury	9.73E-06	day/kg FW	[6]	3.07E-06	day/kg FW	[7]			
60-11-7	Dimethyl aminoazobenzene	9.50E-04	day/kg FW	[6]	3.00E-04	day/kg FW	[7]	4.22E-02	day/kg FW	[1]
60-29-7	Ethyl ether	1.94E-07	day/kg FW	[6]	6.13E-08	day/kg FW	[7]	4.74E-04	day/kg FW	[1]
60-35-5	Acetamide	1.37E-09	day/kg FW	[6]	4.34E-10	day/kg FW	[7]	1.10E-05	day/kg FW	[1]
602-87-9	5-Nitroacenaphthene	1.77E-04	day/kg FW	[6]	5.59E-05	day/kg FW	[7]	2.94E-02	day/kg FW	[6]
606-20-2	2,6-Dinitrotoluene	1.85E-03	day/kg FW	[4]	3.89E-04	day/kg FW	[5]	2.23E-03	day/kg FW	[2]
608-93-5	Pentachlorobenzene	4.02E-02	day/kg FW	[4]	8.47E-03	day/kg FW	[5]	4.87E-02	day/kg FW	[2]
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	2.28E-02	day/kg FW	[4]	4.80E-03	day/kg FW	[5]	2.76E-02	day/kg FW	[2]
61626-71-9	Dichloropentadiene	6.73E-06	day/kg FW	[8]	2.13E-06	day/kg FW	[9]	6.57E-03	day/kg FW	[1]
62-50-0	Ethyl methanesulfonate	5.93E-05	day/kg FW	[4]	1.25E-05	day/kg FW	[5]	7.18E-05	day/kg FW	[2]
62-53-3	Aniline	4.00E-04	day/kg FW	[4]	8.41E-05	day/kg FW	[5]	4.84E-04	day/kg FW	[2]

Table 4-1 Biotransfer Factors for Beef, Game, Milk, and Pork

CAS Registry Number	Constituent Name	Biotransfer Factor in Beef (Ba_{beef}) and Game (Ba_{game})	Units for Biotransfer Factor in Beef and Game	Reference	Biotransfer Factor in Milk (Ba_{milk})	Units for Biotransfer Factor in Milk	Reference	Biotransfer Factor in Pork (Ba_{pork})	Units for Biotransfer Factor in Pork	Reference
62-75-9	N-Nitroso-N,N-dimethylamine	6.73E-09	day/kg FW	[6]	2.13E-09	day/kg FW	[7]	1.44E-05	day/kg FW	[1]
621-64-7	N-Nitroso-di-n-propylamine	9.79E-04	day/kg FW	[4]	2.06E-04	day/kg FW	[5]	1.19E-03	day/kg FW	[2]
624-83-9	Methyl isocyanate	1.54E-07	day/kg FW	[6]	4.87E-08	day/kg FW	[7]	1.16E-04	day/kg FW	[7]
628-73-9	Hexanenitrile	1.67E-03	day/kg FW	[3]	3.51E-04	day/kg FW	[4]	2.02E-03	day/kg FW	[1]
630-08-0	Carbon monoxide	6.28E-08	day/kg FW	[6]	1.98E-08	day/kg FW	[7]			
630-20-6	1,1,1,2-Tetrachloroethane	1.13E-02	day/kg FW	[4]	2.37E-03	day/kg FW	[5]	1.36E-02	day/kg FW	[2]
64-18-6	Formic acid (methanoic acid)	5.13E-05	day/kg FW	[4]	1.08E-05	day/kg FW	[5]	6.20E-05	day/kg FW	[2]
65-85-0	Benzoic acid	5.65E-05	day/kg FW	[4]	1.19E-05	day/kg FW	[5]	6.84E-05	day/kg FW	[2]
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	2.39E-01	day/kg FW	[6]	3.45E-02	day/kg FW	[6]	2.52E-02	day/kg FW	[1]
67-56-1	Methyl alcohol	9.07E-06	day/kg FW	[4]	1.91E-06	day/kg FW	[5]	1.10E-05	day/kg FW	[2]
67-63-0	2-Propyl alcohol	2.81E-08	day/kg FW	[6]	8.86E-09	day/kg FW	[7]	7.16E-05	day/kg FW	[1]
67-64-1	2-Propanone (Acetone)	2.86E-05	day/kg FW	[4]	6.02E-06	day/kg FW	[5]	3.46E-05	day/kg FW	[2]
67-66-3	Chloroform	2.90E-03	day/kg FW	[4]	6.11E-04	day/kg FW	[5]	3.51E-03	day/kg FW	[2]
67-72-1	Hexachloroethane	2.48E-02	day/kg FW	[4]	5.23E-03	day/kg FW	[5]	3.00E-02	day/kg FW	[2]
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	1.64E-02	day/kg FW	[4]	3.46E-03	day/kg FW	[5]	1.99E-02	day/kg FW	[2]
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	9.95E-01	day/kg FW	[6]	3.45E-02	day/kg FW	[6]	1.64E-02	day/kg FW	[1]
70-30-4	Hexachlorophene	1.44E-02	day/kg FW	[4]	3.03E-03	day/kg FW	[5]	1.74E-02	day/kg FW	[2]
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	5.47E-02	day/kg FW	[6]	1.73E-02	day/kg FW	[7]	2.52E-02	day/kg FW	[1]
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	2.28E-02	day/kg FW	[4]	4.80E-03	day/kg FW	[5]	2.76E-02	day/kg FW	[2]
71-36-3	n-Butyl alcohol	1.90E-07	day/kg FW	[6]	5.99E-08	day/kg FW	[7]	4.64E-04	day/kg FW	[1]
71-43-2	Benzene	3.38E-03	day/kg FW	[4]	7.12E-04	day/kg FW	[5]	4.09E-03	day/kg FW	[2]
71-55-6	1,1,1-Trichloroethane	5.96E-03	day/kg FW	[4]	1.25E-03	day/kg FW	[5]	7.21E-03	day/kg FW	[2]
72-43-5	Methoxychlor	3.75E-02	day/kg FW	[4]	7.89E-03	day/kg FW	[5]	4.54E-02	day/kg FW	[2]

Table 4-1 Biotransfer Factors for Beef, Game, Milk, and Pork

CAS Registry Number	Constituent Name	Biotransfer Factor in Beef (Ba_{beef}) and Game (Ba_{game})	Units for Biotransfer Factor in Beef and Game	Reference	Biotransfer Factor in Milk (Ba_{milk})	Units for Biotransfer Factor in Milk	Reference	Biotransfer Factor in Pork (Ba_{pork})	Units for Biotransfer Factor in Pork	Reference
72-55-9	4,4-DDE	3.99E-02	day/kg FW	[4]	8.41E-03	day/kg FW	[5]	4.83E-02	day/kg FW	[2]
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	2.28E-02	day/kg FW	[4]	4.80E-03	day/kg FW	[5]	2.76E-02	day/kg FW	[2]
74-83-9	Bromomethane	7.11E-04	day/kg FW	[4]	1.50E-04	day/kg FW	[5]	8.61E-04	day/kg FW	[2]
74-87-3	Chloromethane	4.08E-04	day/kg FW	[4]	8.59E-05	day/kg FW	[5]	4.94E-04	day/kg FW	[2]
74-88-4	Iodomethane	8.09E-07	day/kg FW	[6]	2.56E-07	day/kg FW	[7]	1.55E-03	day/kg FW	[1]
74-95-3	Methylene bromide	1.33E-03	day/kg FW	[4]	2.80E-04	day/kg FW	[5]	1.61E-03	day/kg FW	[2]
74-97-5	Bromochloromethane	6.43E-07	day/kg FW	[6]	2.03E-07	day/kg FW	[7]	1.30E-03	day/kg FW	[1]
7429-90-5	Aluminum	5.00E-04	day/kg FW	[1]	2.00E-04	day/kg FW	[1]			
7439-89-6	Iron	2.00E-02	day/kg FW	[1]	3.00E-04	day/kg FW	[1]	2.60E-02	day/kg FW	[3]
7439-92-1	Lead	8.00E-04	day/kg FW	[1]	3.00E-04	day/kg FW	[1]			
7439-93-2	Lithium	1.00E-02	day/kg FW	[6]	2.00E-02	day/kg FW	[3]			
7439-95-4	Magnesium	5.00E-03	day/kg FW	[6]	4.00E-03	day/kg FW	[3]			
7439-96-5	Manganese	5.00E-04	day/kg FW	[1]	3.00E-04	day/kg FW	[1]	3.60E-03	day/kg FW	[3]
7439-97-6	Mercury	1.00E-01	day/kg FW	[1]	5.00E-04	day/kg FW	[1]	0.00E+00	day/kg FW	[2]
7439-98-7	Molybdenum	1.00E-03	day/kg FW	[1]	1.70E-03	day/kg FW	[1]			
7440-02-0	Nickel	5.00E-03	day/kg FW	[1]	2.00E-02	day/kg FW	[1]			
7440-16-6	Rhodium	1.00E-03	day/kg FW	[1]	5.00E-03	day/kg FW	[1]			
7440-22-4	Silver	3.00E-03	day/kg FW	[1]	2.50E-02	day/kg FW	[1]			
7440-23-5	Sodium	8.00E-02	day/kg FW	[1]	4.00E-02	day/kg FW	[1]			
7440-24-6	Strontium (total)	8.00E-03	day/kg FW	[1]	2.00E-03	day/kg FW	[1]			
7440-25-7	Tantalum	5.00E-06	day/kg FW	[1]	5.00E-06	day/kg FW	[1]			
7440-28-0	Thallium	2.00E-02	day/kg FW	[1]	3.00E-03	day/kg FW	[1]			
7440-29-1	Thorium-232	1.00E-04	day/kg FW	[1]	5.00E-06	day/kg FW	[1]			
7440-31-5	Tin	1.00E-02	day/kg FW	[1]	1.00E-03	day/kg FW	[1]			
7440-33-7	Tungsten	4.00E-02	day/kg FW	[1]	3.00E-04	day/kg FW	[1]			
7440-36-0	Antimony	1.00E-03	day/kg FW	[1]	1.00E-04	day/kg FW	[1]			
7440-38-2	Arsenic	1.50E-03	day/kg FW	[1]	1.00E-04	day/kg FW	[1]			
7440-39-3	Barium	2.00E-04	day/kg FW	[1]	5.00E-04	day/kg FW	[1]			
7440-41-7	Beryllium	1.00E-03	day/kg FW	[1]	2.00E-06	day/kg FW	[1]			
7440-43-9	Cadmium	4.00E-04	day/kg FW	[1]	1.00E-03	day/kg FW	[1]	1.91E-04	day/kg FW	[2]

Table 4-1 Biotransfer Factors for Beef, Game, Milk, and Pork

CAS Registry Number	Constituent Name	Biotransfer Factor in Beef (Ba_{beef}) and Game (Ba_{game})	Units for Biotransfer Factor in Beef and Game	Reference	Biotransfer Factor in Milk (Ba_{milk})	Units for Biotransfer Factor in Milk	Reference	Biotransfer Factor in Pork (Ba_{pork})	Units for Biotransfer Factor in Pork	Reference
7440-47-3	Chromium	5.50E-03	day/kg FW	[2]	1.50E-03	day/kg FW	[2]			
7440-48-4	Cobalt	2.00E-02	day/kg FW	[1]	2.00E-03	day/kg FW	[1]	1.70E-01	day/kg FW	[3]
7440-50-8	Copper	1.00E-02	day/kg FW	[1]	2.00E-03	day/kg FW	[1]	2.20E-02	day/kg FW	[3]
7440-61-1	Uranium	3.40E-04	day/kg FW	[1]	6.00E-04	day/kg FW	[1]	4.00E-02	day/kg FW	[3]
7440-61-1R	Uranium-238	3.40E-04	day/kg FW	[1]	6.00E-04	day/kg FW	[1]	6.20E-02	day/kg FW	[4]
7440-62-2	Vanadium	2.50E-03	day/kg FW	[6]	2.00E-05	day/kg FW	[3]			
7440-65-5	Yttrium	2.00E-03	day/kg FW	[1]	2.00E-05	day/kg FW	[1]			
7440-66-6	Zinc	1.00E-01	day/kg FW	[1]	1.00E-02	day/kg FW	[1]	1.28E-04	day/kg FW	[2]
7440-67-7	Zirconium	1.00E-06	day/kg FW	[1]	6.00E-07	day/kg FW	[1]			
7446-09-5	Sulfur dioxide									
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	2.39E-01	day/kg FW	[6]	3.45E-02	day/kg FW	[6]	2.80E-02	day/kg FW	[1]
7487-94-7	Mercuric chloride (HgCl2)	5.22E-03	day/kg FW	[4]	2.26E-03	day/kg FW	[5]	3.39E-05	day/kg FW	[2]
75-00-3	Chloroethane	1.05E-03	day/kg FW	[4]	2.22E-04	day/kg FW	[5]	1.28E-03	day/kg FW	[2]
75-01-4	1-Chloroethene	1.05E-03	day/kg FW	[4]	2.22E-04	day/kg FW	[5]	1.28E-03	day/kg FW	[2]
75-02-5	Fluoroethene (vinyl fluoride)	7.11E-04	day/kg FW	[3]	1.50E-04	day/kg FW	[4]	8.61E-04	day/kg FW	[1]
75-05-8	Acetonitrile	2.21E-05	day/kg FW	[4]	4.64E-06	day/kg FW	[5]	2.67E-05	day/kg FW	[2]
75-07-0	Acetaldehyde	3.01E-05	day/kg FW	[4]	6.34E-06	day/kg FW	[5]	3.64E-05	day/kg FW	[2]
75-09-2	Dichloromethane (Methylene Chloride)	8.76E-04	day/kg FW	[4]	1.84E-04	day/kg FW	[5]	1.06E-03	day/kg FW	[2]
75-15-0	Carbon disulfide	3.92E-03	day/kg FW	[4]	8.26E-04	day/kg FW	[5]	4.75E-03	day/kg FW	[2]
75-21-8	Ethylene oxide (Oxirane)	2.45E-05	day/kg FW	[4]	5.15E-06	day/kg FW	[5]	2.96E-05	day/kg FW	[2]
75-25-2	Bromoform	5.00E-03	day/kg FW	[4]	1.05E-03	day/kg FW	[5]	6.05E-03	day/kg FW	[2]
75-27-4	Bromodichloromethane	3.38E-03	day/kg FW	[4]	7.12E-04	day/kg FW	[5]	4.09E-03	day/kg FW	[2]
75-29-6	2-Chloropropane	1.99E-06	day/kg FW	[6]	6.28E-07	day/kg FW	[7]	3.00E-03	day/kg FW	[1]
75-34-3	1,1-Dichloroethane	2.11E-03	day/kg FW	[4]	4.44E-04	day/kg FW	[5]	2.55E-03	day/kg FW	[2]
75-35-4	1,1-Dichloroethene	3.38E-03	day/kg FW	[4]	7.12E-04	day/kg FW	[5]	4.09E-03	day/kg FW	[2]
75-44-5	Phosgene (hydrogen phosphide)	4.87E-09	day/kg FW	[6]	1.54E-09	day/kg FW	[7]	3.00E-03	day/kg FW	[12]

Table 4-1 Biotransfer Factors for Beef, Game, Milk, and Pork

CAS Registry Number	Constituent Name	Biotransfer Factor in Beef (Ba_{beef}) and Game (Ba_{game})	Units for Biotransfer Factor in Beef and Game	Reference	Biotransfer Factor in Milk (Ba_{milk})	Units for Biotransfer Factor in Milk	Reference	Biotransfer Factor in Pork (Ba_{pork})	Units for Biotransfer Factor in Pork	Reference
75-45-6	Chlorodifluoromethane	5.74E-04	day/kg FW	[4]	1.21E-04	day/kg FW	[5]	6.95E-04	day/kg FW	[2]
75-50-3	Trimethylamine	7.72E-05	day/kg FW	[3]	1.62E-05	day/kg FW	[4]	9.34E-05	day/kg FW	[1]
75-69-4	Trichlorofluoromethane	5.96E-03	day/kg FW	[4]	1.25E-03	day/kg FW	[5]	7.21E-03	day/kg FW	[2]
75-71-8	Dichlorodifluoromethane	3.70E-03	day/kg FW	[4]	7.79E-04	day/kg FW	[5]	4.48E-03	day/kg FW	[2]
76-01-7	Pentachloroethane	4.15E-05	day/kg FW	[6]	1.31E-05	day/kg FW	[7]	1.66E-02	day/kg FW	[1]
76-13-1	1,2,2-Trichlorotrifluoroethane	3.61E-05	day/kg FW	[6]	1.14E-05	day/kg FW	[7]	1.56E-02	day/kg FW	[1]
76-44-8	Heptachlor	3.08E-02	day/kg FW	[4]	6.49E-03	day/kg FW	[5]	3.73E-02	day/kg FW	[2]
764-41-0	1,4-Dichloro-2-butene	9.95E-06	day/kg FW	[6]	3.15E-06	day/kg FW	[7]	8.21E-03	day/kg FW	[1]
7647-01-0	Hydrogen chloride	5.23E-05	day/kg FW	[4]	1.10E-05	day/kg FW	[5]	6.33E-05	day/kg FW	[2]
765-34-4	Glycidylaldehyde	1.90E-08	day/kg FW	[6]	5.99E-09	day/kg FW	[7]	4.70E-05	day/kg FW	[1]
7664-39-3	Hydrogen Fluoride									
7664-41-7	Ammonia/Ammonium	2.50E-08	day/kg FW	[6]	7.90E-09	day/kg FW	[7]			
77-47-4	Hexachlorocyclopentadiene	3.95E-02	day/kg FW	[4]	8.32E-03	day/kg FW	[5]	4.78E-02	day/kg FW	[2]
77-78-1	Dimethyl sulfate	3.61E-07	day/kg FW	[6]	1.14E-07	day/kg FW	[7]	8.12E-04	day/kg FW	[1]
7704-34-9	Total Sulfur (thermodynamically stable)	2.00E-01	day/kg FW	[1]	2.00E-02	day/kg FW	[1]			
7723-14-0	Phosphorus	5.00E-02	day/kg FW	[1]	1.60E-02	day/kg FW	[1]			
7782-41-4	Fluorine gas F2	1.50E-01	day/kg FW	[6]	1.00E-03	day/kg FW	[3]			
7782-49-2	Selenium	1.00E-01	day/kg FW	[1]	1.00E-02	day/kg FW	[1]	1.88E-01	day/kg FW	[2]
7782-50-5	Chlorine	3.60E-04	day/kg FW	[4]	7.59E-05	day/kg FW	[5]	4.36E-04	day/kg FW	[2]
78-83-1	2-Methylpropyl alcohol	1.44E-07	day/kg FW	[6]	4.55E-08	day/kg FW	[7]	3.61E-04	day/kg FW	[1]
78-87-5	1,2-Dichloropropane	2.90E-03	day/kg FW	[4]	6.11E-04	day/kg FW	[5]	3.51E-03	day/kg FW	[2]
78-93-3	2-Butanone	1.05E-04	day/kg FW	[4]	2.21E-05	day/kg FW	[5]	1.27E-04	day/kg FW	[2]
79-00-5	1,1,2-Trichloroethane	2.90E-03	day/kg FW	[4]	6.11E-04	day/kg FW	[5]	3.51E-03	day/kg FW	[2]
79-01-6	1,1,2-Trichloroethylene	5.21E-03	day/kg FW	[4]	1.10E-03	day/kg FW	[5]	6.30E-03	day/kg FW	[2]
79-10-7	2-Propenoic acid	5.60E-08	day/kg FW	[6]	1.77E-08	day/kg FW	[7]	1.46E-04	day/kg FW	[1]
79-34-5	1,1,2,2-Tetrachloroethane	5.21E-03	day/kg FW	[4]	1.10E-03	day/kg FW	[5]	6.30E-03	day/kg FW	[2]
79-46-9	2-Nitropropane	2.13E-07	day/kg FW	[6]	6.72E-08	day/kg FW	[7]	5.14E-04	day/kg FW	[1]
80-62-6	Methyl methacrylate	6.00E-07	day/kg FW	[6]	1.90E-07	day/kg FW	[7]	1.23E-03	day/kg FW	[1]

Table 4-1 Biotransfer Factors for Beef, Game, Milk, and Pork

CAS Registry Number	Constituent Name	Biotransfer Factor in Beef (Ba_{beef}) and Game (Ba_{game})	Units for Biotransfer Factor in Beef and Game	Reference	Biotransfer Factor in Milk (Ba_{milk})	Units for Biotransfer Factor in Milk	Reference	Biotransfer Factor in Pork (Ba_{pork})	Units for Biotransfer Factor in Pork	Reference
82-68-8	Pentachloronitrobenzene (PCNB)	3.57E-02	day/kg FW	[4]	7.51E-03	day/kg FW	[5]	4.32E-02	day/kg FW	[2]
822-06-0	Hexamethylene-1,5-diisocyanate	3.96E-05	day/kg FW	[6]	1.25E-05	day/kg FW	[7]	1.63E-02	day/kg FW	[1]
823-40-5	Toluene-2,6-diamine	3.61E-08	day/kg FW	[6]	1.14E-08	day/kg FW	[7]	9.34E-05	day/kg FW	[1]
83-32-9	Acenaphthene	2.43E-02	day/kg FW	[4]	5.12E-03	day/kg FW	[5]	2.94E-02	day/kg FW	[2]
832-69-9	1-Methylphenanthrene	3.98E-02	day/kg FW	[3]	8.37E-03	day/kg FW	[4]	4.81E-02	day/kg FW	[1]
84-66-2	Diethyl phthalate	5.96E-03	day/kg FW	[4]	1.25E-03	day/kg FW	[5]	7.21E-03	day/kg FW	[2]
84-74-2	Di-n-butylphthalate	3.64E-02	day/kg FW	[4]	7.66E-03	day/kg FW	[5]	4.40E-02	day/kg FW	[2]
85-01-8	Phenanthrene	3.38E-02	day/kg FW	[4]	7.12E-03	day/kg FW	[5]	4.09E-02	day/kg FW	[2]
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	1.04E-05	day/kg FW	[4]	2.19E-06	day/kg FW	[5]	1.26E-05	day/kg FW	[2]
85-68-7	Butylbenzylphthalate	3.84E-02	day/kg FW	[4]	8.09E-03	day/kg FW	[5]	4.65E-02	day/kg FW	[2]
86-73-7	Fluorene	2.93E-02	day/kg FW	[4]	6.16E-03	day/kg FW	[5]	3.54E-02	day/kg FW	[2]
87-61-6	1,2,3-Trichlorobenzene	2.68E-02	day/kg FW	[4]	5.65E-03	day/kg FW	[5]	3.25E-02	day/kg FW	[2]
87-68-3	Hexachlorobutadiene	3.75E-02	day/kg FW	[4]	7.89E-03	day/kg FW	[5]	4.54E-02	day/kg FW	[2]
87-86-5	Pentachlorophenol	6.62E-05	day/kg FW	[4]	1.39E-05	day/kg FW	[5]	8.02E-05	day/kg FW	[2]
88-06-2	2,4,6-Trichlorophenol	1.29E-04	day/kg FW	[4]	2.72E-05	day/kg FW	[5]	1.56E-04	day/kg FW	[2]
88-74-4	o-Nitroaniline (2-nitroaniline)	2.29E-03	day/kg FW	[4]	4.82E-04	day/kg FW	[5]	2.77E-03	day/kg FW	[2]
88-75-5	2-Nitrophenol	2.07E-03	day/kg FW	[4]	4.37E-04	day/kg FW	[5]	2.51E-03	day/kg FW	[2]
90-04-0	o-Anisidine	3.78E-07	day/kg FW	[6]	1.20E-07	day/kg FW	[7]	8.44E-04	day/kg FW	[1]
90-12-0	1-Methylnaphthalene	1.85E-04	day/kg FW	[6]	5.86E-05	day/kg FW	[7]	2.88E-02	day/kg FW	[1]
91-20-3	Naphthalene	1.48E-02	day/kg FW	[4]	3.13E-03	day/kg FW	[5]	1.80E-02	day/kg FW	[2]
91-22-5	Quinoline	2.68E-06	day/kg FW	[6]	8.47E-07	day/kg FW	[7]	3.68E-03	day/kg FW	[1]
91-57-6	2-Methylnaphthalene	1.81E-04	day/kg FW	[6]	5.72E-05	day/kg FW	[7]	2.86E-02	day/kg FW	[1]
91-58-7	2-Chloronaphthalene	1.60E-02	day/kg FW	[4]	3.37E-03	day/kg FW	[5]	1.94E-02	day/kg FW	[2]
91-94-1	3,3'-Dichlorobenzidine	1.80E-02	day/kg FW	[4]	3.79E-03	day/kg FW	[5]	2.18E-02	day/kg FW	[2]
92-52-4	1,1`-Biphenyl	2.39E-04	day/kg FW	[6]	7.54E-05	day/kg FW	[7]	3.17E-02	day/kg FW	[1]
924-16-3	N-Nitroso-di-n-Buetylamine	2.56E-03	day/kg FW	[4]	5.39E-04	day/kg FW	[5]	3.10E-03	day/kg FW	[2]

Table 4-1 Biotransfer Factors for Beef, Game, Milk, and Pork

CAS Registry Number	Constituent Name	Biotransfer Factor in Beef (Ba_{beef}) and Game (Ba_{game})	Units for Biotransfer Factor in Beef and Game	Reference	Biotransfer Factor in Milk (Ba_{milk})	Units for Biotransfer Factor in Milk	Reference	Biotransfer Factor in Pork (Ba_{pork})	Units for Biotransfer Factor in Pork	Reference
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	7.32E-03	day/kg FW	[4]	1.54E-03	day/kg FW	[5]	8.86E-03	day/kg FW	[2]
94-75-7	2,4-D	1.61E-05	day/kg FW	[6]	5.10E-06	day/kg FW	[7]	1.06E-02	day/kg FW	[1]
95-48-7	o-Cresol	2.68E-03	day/kg FW	[4]	5.64E-04	day/kg FW	[5]	3.24E-03	day/kg FW	[2]
95-49-8	o-Chlorotoluene	6.58E-05	day/kg FW	[6]	2.08E-05	day/kg FW	[7]	2.01E-02	day/kg FW	[1]
95-50-1	1,2-Dichlorobenzene	1.60E-02	day/kg FW	[4]	3.37E-03	day/kg FW	[5]	1.94E-02	day/kg FW	[2]
95-53-4	o-Toluidine	9.09E-04	day/kg FW	[4]	1.91E-04	day/kg FW	[5]	1.10E-03	day/kg FW	[2]
95-57-8	2-Chlorophenol	3.35E-03	day/kg FW	[4]	7.05E-04	day/kg FW	[5]	4.05E-03	day/kg FW	[2]
95-63-6	1,2,4-Trimethyl benzene	1.07E-04	day/kg FW	[6]	3.37E-05	day/kg FW	[7]	2.41E-02	day/kg FW	[1]
95-94-3	1,2,4,5-Tetrachlorobenzene	3.75E-02	day/kg FW	[4]	7.89E-03	day/kg FW	[5]	4.54E-02	day/kg FW	[2]
95-95-4	2,4,5-Trichlorophenol	1.98E-03	day/kg FW	[4]	4.17E-04	day/kg FW	[5]	2.40E-03	day/kg FW	[2]
96-12-8	1,2-Dibromo-3-chloropropane	4.53E-03	day/kg FW	[4]	9.54E-04	day/kg FW	[5]	5.48E-03	day/kg FW	[2]
96-18-4	1,2,3-Trichloropropane	2.90E-03	day/kg FW	[4]	6.11E-04	day/kg FW	[5]	3.51E-03	day/kg FW	[2]
96-45-7	Ethylene thiourea	5.47E-09	day/kg FW	[6]	1.73E-09	day/kg FW	[7]	1.13E-05	day/kg FW	[1]
97-63-2	Ethyl methacrylate	2.64E-03	day/kg FW	[4]	5.56E-04	day/kg FW	[5]	3.20E-03	day/kg FW	[2]
98-01-1	Furfural	6.43E-08	day/kg FW	[6]	2.03E-08	day/kg FW	[7]	1.67E-04	day/kg FW	[1]
98-06-6	tert-Butyl benzene	3.22E-04	day/kg FW	[6]	1.02E-04	day/kg FW	[7]	3.37E-02	day/kg FW	[1]
98-07-7	Benzotrichloride	1.99E-04	day/kg FW	[6]	6.28E-05	day/kg FW	[7]	2.94E-02	day/kg FW	[1]
98-82-8	Cumene	2.10E-02	day/kg FW	[4]	4.42E-03	day/kg FW	[5]	2.54E-02	day/kg FW	[2]
98-83-9	Methyl styrene (mixed isomers)	6.89E-05	day/kg FW	[6]	2.18E-05	day/kg FW	[7]	2.12E-02	day/kg FW	[1]
98-86-2	Acetophenone	1.45E-03	day/kg FW	[4]	3.06E-04	day/kg FW	[5]	1.76E-03	day/kg FW	[2]
98-95-3	Nitrobenzene	2.29E-03	day/kg FW	[4]	4.82E-04	day/kg FW	[5]	2.77E-03	day/kg FW	[2]
99-35-4	1,3,5-Trinitrobenzene	7.25E-04	day/kg FW	[4]	1.53E-04	day/kg FW	[5]	8.77E-04	day/kg FW	[2]
99-65-0	1,3-Dinitrobenzene	1.26E-03	day/kg FW	[4]	2.66E-04	day/kg FW	[5]	1.53E-03	day/kg FW	[2]
99-87-6	p-Cymene	3.15E-04	day/kg FW	[6]	9.95E-05	day/kg FW	[7]	3.35E-02	day/kg FW	[1]

Reference	Reference (source) for Biotransfer Factor in Beef and Game
[1]	ANL. 2001. *User's Manual for RESRAD Version 6*, ANL/EAD-4, Environmental Assessment Division, Argonne National Laboratory, Argonne, IL

Reference	Reference (source) for Biotransfer Factor in Beef and Game
[2]	Baes CF, Sharp RD, Sjoreen AL, and Shor RW. 1984. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture*, ORNL-5786, Oak Ridge National Laboratory, Oak Ridge, TN (http://homer.ornl.gov/baes/documents/ornl5786.html)
[3]	Calculated value per Eqs. A-2-21 and A-2-23 in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm)
[4]	EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013)
[5]	Mass-limited biotransfer factor for beef (exposure duration/mass of product)
[6]	ORNL. *The Risk Assessment Information System (RAIS) Database*. Copyright © 2013 Oak Ridge National Laboratory and The University of Tennessee, Oak Ridge, TN (http://rais.ornl.gov, accessed April 2014)
[7]	Surrogate value from 2,4-Dinitrotoluene
[8]	Surrogate value from Chlorocyclopentadiene
[9]	Surrogate value from Dibenzo[a,i]pyrene
[10]	Surrogate value from Trichlorofluoromethane

Reference	Reference (source) for Biotransfer Factor in Milk
[1]	ANL. 2001. *User's Manual for RESRAD Version 6*, ANL/EAD-4, Environmental Assessment Division, Argonne National Laboratory, Argonne, IL
[2]	Baes CF, Sharp RD, Sjoreen AL, and Shor RW. 1984. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture*, ORNL-5786, Oak Ridge National Laboratory, Oak Ridge, TN (http://homer.ornl.gov/baes/documents/ornl5786.html)
[3]	Baes CF, Sharp RD, Sjoreen AL, and Shor RW. 1984. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture*, ORNL-5786, Oak Ridge National Laboratory, Oak Ridge, TN (http://homer.ornl.gov/baes/documents/ornl5786.html)
[4]	Calculated value per Eqs. A-2-21 and A-2-22 in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm)
[5]	EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013)
[6]	Mass-limited biotransfer factor for milk (exposure duration/mass of product)
[7]	ORNL. *The Risk Assessment Information System (RAIS) Database*. Copyright © 2013 Oak Ridge National Laboratory and The University of Tennessee, Oak Ridge, TN (http://rais.ornl.gov, accessed April 2014)
[8]	Surrogate value from 2,4-Dinitrotoluene
[9]	Surrogate value from Chlorocyclopentadiene
[10]	Surrogate value from Trichlorofluoromethane

Reference	Reference (source) for Biotransfer Factor in Pork
[1]	Calculated value per Eqs. A-2-21 and A-2-26 in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm)

Reference	Reference (source) for Biotransfer Factor in Pork
[2]	EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013)
[3]	Ng CY, Colsher CS, and Thompson SE. 1982. *Transfer Coefficients for Assessing the Dose from Radionuclides in Meat and Eggs*. NUREG/CR-2976, UCID-19464, Lawrence Livermore National Laboratory, Livermore, California.
[4]	ORNL. *The Risk Assessment Information System (RAIS) Database*. Copyright © 2013 Oak Ridge National Laboratory and The University of Tennessee, Oak Ridge, TN (http://rais.ornl.gov, accessed April 2014)
[5]	Surrogate value from 2,4-Dinitrotoluene
[6]	Surrogate value from Acenaphthene
[7]	Surrogate value from Acrylonitrile
[8]	Surrogate value from Benzo(a)pyrene
[9]	Surrogate value from Chrysene
[10]	Surrogate value from Dibenz[a,h]anthracene
[11]	Surrogate value from Trichlorofluoromethane
[12]	Surrogate value from cis-1,2-Dichloroethene

Table 4-2 presents the biotransfer factors for chicken (including wild fowl) and their eggs. The values represent the contaminant concentration in animal tissue (mass of the constituent per unit mass of animal fresh weight, FW) ratioed to the daily intake of the contaminant by the animal. Blank entries in the table indicate where data are not available.

Table 4-2 Biotransfer Factors for Chicken and Eggs

CAS Registry Number	Constituent Name	Biotransfer Factor in Chicken ($Ba_{chicken}$)	Units for Biotransfer Factor in Chicken	Reference	Biotransfer Factor in Eggs (Ba_{eggs})	Units for Biotransfer Factor in Eggs	Reference
100-02-7	p-Nitrophenol	1.86E-03	day/kg FW	[2]	1.06E-03	day/kg FW	[2]
100-21-0	Phthalic acid	2.14E-03	day/kg FW	[1]	1.22E-03	day/kg FW	[1]
100-25-4	1,4-Dinitrobenzene	8.66E-04	day/kg FW	[1]	4.95E-04	day/kg FW	[1]
100-40-3	4-Ethenylcyclohexene	1.83E-02	day/kg FW	[1]	1.05E-02	day/kg FW	[1]
100-41-4	Ethyl benzene	8.95E-03	day/kg FW	[2]	5.11E-03	day/kg FW	[2]
100-42-5	Styrene	8.04E-03	day/kg FW	[2]	4.59E-03	day/kg FW	[2]
100-44-7	Benzyl chloride	3.34E-03	day/kg FW	[2]	1.91E-03	day/kg FW	[2]
100-47-0	Benzonitrile	1.03E-03	day/kg FW	[2]	5.91E-04	day/kg FW	[2]
100-51-6	Benzyl alcohol	4.40E-04	day/kg FW	[2]	2.51E-04	day/kg FW	[2]
100-52-7	Benzaldehyde	8.97E-04	day/kg FW	[2]	5.13E-04	day/kg FW	[2]
10028-15-6	Ozone						
10028-17-8	Tritium						
10045-97-3	Cesium-137	3.00E+00	day/kg FW	[4]	4.00E-01	day/kg FW	[4]
10061-01-5	cis-1,3-Dichloropropene	1.83E-03	day/kg FW	[12]	1.04E-03	day/kg FW	[12]
10061-02-6	trans-1,3-Dichloropropene	2.24E-03	day/kg FW	[1]	1.28E-03	day/kg FW	[1]
10098-91-6	Yttrium-90	1.00E-02	day/kg FW	[4]	2.00E-03	day/kg FW	[4]
10098-97-2	Strontium-90	8.00E-02	day/kg FW	[4]	2.00E-01	day/kg FW	[4]
101-55-3	4-Bromophenylphenyl ether	2.98E-02	day/kg FW	[2]	1.70E-02	day/kg FW	[2]
101-77-9	4,4-Methylenedianiline	1.09E-03	day/kg FW	[1]	6.22E-04	day/kg FW	[1]
10102-44-0	Nitrogen dioxide						
10198-40-0	Cobalt-60	2.00E+00	day/kg FW	[4]	1.00E-01	day/kg FW	[4]
103-33-3	Azobenzene	1.69E-02	day/kg FW	[1]	9.68E-03	day/kg FW	[1]
103-65-1	n-Propyl benzene (Isocumene)	1.54E-02	day/kg FW	[1]	8.78E-03	day/kg FW	[1]
104-51-8	n-Butylbenzene	2.36E-02	day/kg FW	[1]	1.35E-02	day/kg FW	[1]
104-76-7	2-Ethyl-1-hexanol	5.88E-03	day/kg FW	[1]	3.36E-03	day/kg FW	[1]
105-67-9	2,4-Dimethylphenol	3.33E-03	day/kg FW	[2]	1.91E-03	day/kg FW	[2]
10595-95-6	n-Nitrosomethylethylamine	4.25E-05	day/kg FW	[1]	2.43E-05	day/kg FW	[1]
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	1.13E-02	day/kg FW	[1]	6.43E-03	day/kg FW	[1]
106-44-5	p-Cresol (4-methyl phenol)	1.83E-03	day/kg FW	[2]	1.04E-03	day/kg FW	[2]

Table 4-2 Biotransfer Factors for Chicken and Eggs

CAS Registry Number	Constituent Name	Biotransfer Factor in Chicken ($Ba_{chicken}$)	Units for Biotransfer Factor in Chicken	Reference	Biotransfer Factor in Eggs (Ba_{eggs})	Units for Biotransfer Factor in Eggs	Reference
106-46-7	1,4-Dichlorobenzene	1.31E-02	day/kg FW	[2]	7.50E-03	day/kg FW	[2]
106-47-8	p-Chloroaniline	4.14E-05	day/kg FW	[2]	2.37E-05	day/kg FW	[2]
106-49-0	p-Toluidine	7.62E-04	day/kg FW	[1]	4.36E-04	day/kg FW	[1]
106-51-4	Quinone	6.25E-05	day/kg FW	[1]	3.57E-05	day/kg FW	[1]
106-88-7	1,2-Epoxybutane	2.71E-04	day/kg FW	[1]	1.55E-04	day/kg FW	[1]
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	2.28E-05	day/kg FW	[2]	1.30E-05	day/kg FW	[2]
106-93-4	Ethylene dibromide	2.14E-03	day/kg FW	[2]	1.22E-03	day/kg FW	[2]
106-99-0	1,3-Butadiene	2.11E-03	day/kg FW	[1]	1.20E-03	day/kg FW	[1]
107-02-8	Acrolein	3.76E-05	day/kg FW	[2]	2.15E-05	day/kg FW	[2]
107-05-1	3-Chloropropene	1.92E-03	day/kg FW	[1]	1.10E-03	day/kg FW	[1]
107-06-2	1,2-Dichloroethane	9.30E-04	day/kg FW	[2]	5.31E-04	day/kg FW	[2]
107-12-0	Propionitrile	5.69E-05	day/kg FW	[1]	3.25E-05	day/kg FW	[1]
107-13-1	Acrylonitrile	7.04E-05	day/kg FW	[2]	4.02E-05	day/kg FW	[2]
107-19-7	Propargyl alcohol	1.46E-05	day/kg FW	[1]	8.36E-06	day/kg FW	[1]
107-21-1	Ethylene glycol (1,2-ethanediol)	6.68E-06	day/kg FW	[1]	3.82E-06	day/kg FW	[1]
107-98-2	Propylene glycol monomethyl ether	1.09E-05	day/kg FW	[1]	6.24E-06	day/kg FW	[1]
108-05-4	Acetic acid vinyl ester	2.06E-04	day/kg FW	[2]	1.18E-04	day/kg FW	[2]
108-10-1	4-Methyl-2-pentanone	5.34E-04	day/kg FW	[2]	3.05E-04	day/kg FW	[2]
108-39-4	m-Cresol	2.01E-03	day/kg FW	[2]	1.15E-03	day/kg FW	[2]
108-60-1	bis (2-Chloroisopropyl)ether	4.27E-03	day/kg FW	[1]	2.44E-03	day/kg FW	[1]
108-67-8	1,3,5-Trimethylbenzene	1.22E-02	day/kg FW	[2]	6.99E-03	day/kg FW	[2]
108-86-1	Bromobenzene (Phenyl bromide)	7.95E-03	day/kg FW	[1]	4.54E-03	day/kg FW	[1]
108-87-2	Methylcyclohexane	1.44E-02	day/kg FW	[1]	8.23E-03	day/kg FW	[1]
108-88-3	Toluene	5.67E-03	day/kg FW	[2]	3.24E-03	day/kg FW	[2]
108-90-7	Chlorobenzene	6.40E-03	day/kg FW	[2]	3.66E-03	day/kg FW	[2]
108-94-1	Cyclohexanone	2.44E-04	day/kg FW	[1]	1.40E-04	day/kg FW	[1]
108-95-2	Phenol	9.28E-04	day/kg FW	[2]	5.30E-04	day/kg FW	[2]
109-74-0	n-Butanenitrile	1.33E-04	day/kg FW	[1]	7.63E-05	day/kg FW	[1]
109-75-1	3-Butenenitrile	9.96E-05	day/kg FW	[1]	5.69E-05	day/kg FW	[1]
109-77-3	Malononitrile	8.10E-06	day/kg FW	[1]	4.63E-06	day/kg FW	[1]
109-86-4	2-Methoxyethanol	6.68E-06	day/kg FW	[1]	3.82E-06	day/kg FW	[1]
109-99-9	Tetrahydrofuran	1.14E-04	day/kg FW	[2]	6.52E-05	day/kg FW	[2]

Table 4-2 Biotransfer Factors for Chicken and Eggs

CAS Registry Number	Constituent Name	Biotransfer Factor in Chicken ($Ba_{chicken}$)	Units for Biotransfer Factor in Chicken	Reference	Biotransfer Factor in Eggs (Ba_{eggs})	Units for Biotransfer Factor in Eggs	Reference
110-00-9	Furan	6.95E-04	day/kg FW	[1]	3.97E-04	day/kg FW	[1]
110-54-3	n-Hexane	1.79E-02	day/kg FW	[1]	1.02E-02	day/kg FW	[1]
110-59-8	Pentanenitrile	4.57E-04	day/kg FW	[1]	2.61E-04	day/kg FW	[1]
110-80-5	2-Ethoxyethanol	1.71E-05	day/kg FW	[1]	9.78E-06	day/kg FW	[1]
110-82-7	Cyclohexane	1.25E-02	day/kg FW	[1]	7.12E-03	day/kg FW	[1]
110-83-8	Cyclohexene	6.86E-03	day/kg FW	[1]	3.92E-03	day/kg FW	[1]
110-86-1	Pyridine	1.74E-04	day/kg FW	[2]	9.93E-05	day/kg FW	[2]
111-15-9	Ethylene glycol monoethyl ether acetate	1.52E-04	day/kg FW	[1]	8.71E-05	day/kg FW	[1]
111-44-4	Bis(2-chloroethyl)ether	6.33E-04	day/kg FW	[2]	3.62E-04	day/kg FW	[2]
111-65-9	n-Octane	2.97E-02	day/kg FW	[1]	1.70E-02	day/kg FW	[1]
111-76-2	2-Butoxyethanol	2.55E-04	day/kg FW	[1]	1.46E-04	day/kg FW	[1]
111-84-2	n-Nonane	2.96E-02	day/kg FW	[1]	1.69E-02	day/kg FW	[1]
111-91-1	Bis(2-chloroethoxy)methane	6.45E-04	day/kg FW	[1]	3.69E-04	day/kg FW	[1]
112-30-1	1-Decanol	2.56E-02	day/kg FW	[1]	1.46E-02	day/kg FW	[1]
112-31-2	Decanal	1.62E-02	day/kg FW	[1]	9.26E-03	day/kg FW	[1]
112-40-3	Dodecane	2.69E-02	day/kg FW	[1]	1.54E-02	day/kg FW	[1]
1120-21-4	Undecane	2.92E-02	day/kg FW	[1]	1.67E-02	day/kg FW	[1]
1120-71-4	1,3-Propane sultone	1.90E-05	day/kg FW	[1]	1.09E-05	day/kg FW	[1]
117-81-7	Bis(2-ethylhexyl) phthalate	2.94E-02	day/kg FW	[2]	1.68E-02	day/kg FW	[2]
117-84-0	Di-n-octylphthalate	5.72E-03	day/kg FW	[2]	3.27E-03	day/kg FW	[2]
118-74-1	Hexachlorobenzene	2.99E-02	day/kg FW	[2]	1.71E-02	day/kg FW	[2]
119-90-4	3,3'-Dimethoxybenzidine	1.58E-03	day/kg FW	[2]	9.03E-04	day/kg FW	[2]
120-12-7	Anthracene	2.49E-02	day/kg FW	[2]	1.42E-02	day/kg FW	[2]
120-82-1	1,2,4-Trichlorobenzene	1.91E-02	day/kg FW	[2]	1.09E-02	day/kg FW	[2]
120-83-2	2,4-Dichlorophenol	4.21E-03	day/kg FW	[2]	2.41E-03	day/kg FW	[2]
121-14-2	2,4-Dinitrotoluene	2.07E-03	day/kg FW	[2]	1.18E-03	day/kg FW	[2]
122-39-4	N,N-Diphenylamine	1.31E-02	day/kg FW	[1]	7.50E-03	day/kg FW	[1]
122-66-7	1,2-Diphenylhydrazine	7.19E-03	day/kg FW	[2]	4.11E-03	day/kg FW	[2]
123-33-1	Maleic hydrazide	6.68E-06	day/kg FW	[1]	3.82E-06	day/kg FW	[1]
123-38-6	Propionaldehyde	1.52E-04	day/kg FW	[1]	8.71E-05	day/kg FW	[1]
123-72-8	Butanal	2.83E-04	day/kg FW	[1]	1.61E-04	day/kg FW	[1]
123-91-1	1,4-Dioxan	1.95E-05	day/kg FW	[2]	1.11E-05	day/kg FW	[2]

Table 4-2 Biotransfer Factors for Chicken and Eggs

CAS Registry Number	Constituent Name	Biotransfer Factor in Chicken ($Ba_{chicken}$)	Units for Biotransfer Factor in Chicken	Reference	Biotransfer Factor in Eggs (Ba_{eggs})	Units for Biotransfer Factor in Eggs	Reference
124-18-5	Decane	2.90E-02	day/kg FW	[1]	1.66E-02	day/kg FW	[1]
124-38-9	Carbon dioxide	2.55E-04	day/kg FW	[1]	1.46E-04	day/kg FW	[1]
124-48-1	Chlorodibromomethane	3.02E-03	day/kg FW	[2]	1.73E-03	day/kg FW	[2]
126-73-8	Tributyl phosphate	1.91E-02	day/kg FW	[1]	1.09E-02	day/kg FW	[1]
126-98-7	2-Methyl-2-propenenitrile	1.36E-04	day/kg FW	[2]	7.80E-05	day/kg FW	[2]
127-18-4	1,1,2,2-Tetrachloroethene	1.20E-02	day/kg FW	[2]	6.87E-03	day/kg FW	[2]
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	2.94E-02	day/kg FW	[1]	1.68E-02	day/kg FW	[1]
129-00-0	Pyrene	2.83E-02	day/kg FW	[2]	1.62E-02	day/kg FW	[2]
131-11-3	Dimethyl Phthalate	1.03E-03	day/kg FW	[2]	5.91E-04	day/kg FW	[2]
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	2.06E-02	day/kg FW	[1]	1.18E-02	day/kg FW	[1]
132-64-9	Dibenzofuran	2.06E-02	day/kg FW	[1]	1.18E-02	day/kg FW	[1]
133-06-2	Captan	6.40E-03	day/kg FW	[1]	3.66E-03	day/kg FW	[1]
1330-20-7	Xylenes (mixed isomers)	9.52E-03	day/kg FW	[1]	5.44E-03	day/kg FW	[1]
1336-36-3	Polychlorinated biphenyls	2.51E-02	day/kg FW	[1]	1.43E-02	day/kg FW	[1]
134-32-7	alpha-Naphthylamine	3.11E-03	day/kg FW	[1]	1.78E-03	day/kg FW	[1]
135-98-8	sec-Butylbenzene	2.56E-02	day/kg FW	[1]	1.46E-02	day/kg FW	[1]
13966-29-5	Uranium-234	1.00E+00	day/kg FW	[4]	1.00E+00	day/kg FW	[4]
13967-48-1	Ruthenium-106	7.00E-03	day/kg FW	[4]	5.00E-03	day/kg FW	[4]
13967-70-9	Cesium-134	3.00E+00	day/kg FW	[4]	4.00E-01	day/kg FW	[4]
13968-55-3	Uranium-233	1.00E+00	day/kg FW	[4]	1.00E+00	day/kg FW	[4]
13981-15-2	Curium-244	6.00E-03	day/kg FW	[4]	4.00E-03	day/kg FW	[4]
13981-16-3	Plutonium-238	3.00E-03	day/kg FW	[4]	5.00E-04	day/kg FW	[4]
13981-37-8	Nickel-63	1.00E-03	day/kg FW	[4]	1.00E-01	day/kg FW	[4]
13982-10-0	Plutonium-242	3.00E-03	day/kg FW	[4]	5.00E-04	day/kg FW	[4]
13982-63-3	Radium-226	3.00E-02	day/kg FW	[4]	3.10E-01	day/kg FW	[4]
13982-70-2	Uranium-236	1.00E+00	day/kg FW	[4]	1.00E+00	day/kg FW	[4]
13994-20-2	Neptunium-237	6.00E-03	day/kg FW	[4]	4.00E-03	day/kg FW	[4]
141-78-6	Acetic acid ethyl ester	2.06E-04	day/kg FW	[1]	1.18E-04	day/kg FW	[1]
14119-32-5	Plutonium-241	3.00E-03	day/kg FW	[4]	5.00E-04	day/kg FW	[4]
14119-33-6	Plutonium-240	3.00E-03	day/kg FW	[4]	5.00E-04	day/kg FW	[4]
14133-76-7	Technetium-99	3.00E-02	day/kg FW	[4]	3.00E+00	day/kg FW	[4]
14158-29-3	Uranium-232	1.00E+00	day/kg FW	[4]	1.00E+00	day/kg FW	[4]
14234-35-6	Antimony-125	6.00E-03	day/kg FW	[4]	7.00E-02	day/kg FW	[4]

Table 4-2 Biotransfer Factors for Chicken and Eggs

CAS Registry Number	Constituent Name	Biotransfer Factor in Chicken ($Ba_{chicken}$)	Units for Biotransfer Factor in Chicken	Reference	Biotransfer Factor in Eggs (Ba_{eggs})	Units for Biotransfer Factor in Eggs	Reference
14265-44-2	Phosphate						
14331-85-2	Protactinium-231	6.00E-03	day/kg FW	[4]	4.00E-03	day/kg FW	[4]
14336-70-0	Nickel-59	1.00E-03	day/kg FW	[4]	1.00E-01	day/kg FW	[4]
14391-16-3	Europium-155	2.00E-03	day/kg FW	[4]	4.00E-05	day/kg FW	[4]
145-73-3	Endothall	1.86E-03	day/kg FW	[1]	1.06E-03	day/kg FW	[1]
14596-10-2	Americium-241	6.00E-03	day/kg FW	[4]	4.00E-03	day/kg FW	[4]
14683-23-9	Europium-152	2.00E-03	day/kg FW	[4]	4.00E-05	day/kg FW	[4]
14762-75-5	Carbon-14						
14797-55-8	Nitrate						
14797-65-0	Nitrite						
14808-79-8	Sulfate						
14952-40-0	Actinium-227	6.00E-03	day/kg FW	[4]	4.00E-03	day/kg FW	[4]
14993-75-0	Americium-243	6.00E-03	day/kg FW	[4]	4.00E-03	day/kg FW	[4]
15046-84-1	Iodine-129	5.00E-02	day/kg FW	[4]	4.40E+00	day/kg FW	[4]
15117-48-3	Plutonium-239	3.00E-03	day/kg FW	[4]	5.00E-04	day/kg FW	[4]
15117-96-1	Uranium-235	1.00E+00	day/kg FW	[4]	1.00E+00	day/kg FW	[4]
15262-20-1	Radium-228	3.00E-02	day/kg FW	[4]	3.10E-01	day/kg FW	[4]
15510-73-3	Curium-242	6.00E-03	day/kg FW	[4]	4.00E-03	day/kg FW	[4]
15585-10-1	Europium-154	2.00E-03	day/kg FW	[4]	4.00E-05	day/kg FW	[4]
15594-54-4	Thorium-229	6.00E-03	day/kg FW	[4]	4.00E-03	day/kg FW	[4]
156-59-2	cis-1,2-Dichloroethene	1.83E-03	day/kg FW	[2]	1.04E-03	day/kg FW	[2]
156-60-5	1,2-trans-Dichloroethene	2.49E-03	day/kg FW	[2]	1.42E-03	day/kg FW	[2]
15715-94-3	Samarium-151	2.00E-03	day/kg FW	[4]	4.00E-05	day/kg FW	[4]
15751-77-6	Zirconium-93	6.00E-05	day/kg FW	[4]	2.00E-04	day/kg FW	[4]
15757-87-6	Curium-243	6.00E-03	day/kg FW	[4]	4.00E-03	day/kg FW	[4]
15758-45-9	Selenium-79	9.00E+00	day/kg FW	[4]	9.00E+00	day/kg FW	[4]
15832-50-5	Tin-126	8.00E-01	day/kg FW	[4]	1.00E+00	day/kg FW	[4]
1634-04-4	Methyl tert-butyl ether	3.19E-04	day/kg FW	[1]	1.83E-04	day/kg FW	[1]
16887-00-6	Chloride						
16984-48-8	Fluoride						
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1.92E-02	day/kg FW	[2]	1.10E-02	day/kg FW	[2]
18540-29-9	Chromium(VI)	2.00E-01	day/kg FW	[4]	9.00E-01	day/kg FW	[4]

Table 4-2 Biotransfer Factors for Chicken and Eggs

CAS Registry Number	Constituent Name	Biotransfer Factor in Chicken ($Ba_{chicken}$)	Units for Biotransfer Factor in Chicken	Reference	Biotransfer Factor in Eggs (Ba_{eggs})	Units for Biotransfer Factor in Eggs	Reference
189-55-9	Dibenzo[a,i]pyrene	2.77E-02	day/kg FW	[8]	1.58E-02	day/kg FW	[8]
189-64-0	Dibenzo[a,h]pyrene	1.35E-02	day/kg FW	[1]	7.69E-03	day/kg FW	[1]
191-24-2	Benzo(g,h,i)perylene	2.13E-02	day/kg FW	[1]	1.22E-02	day/kg FW	[1]
191-30-0	Dibenzo(a,l)pyrene	8.93E-03	day/kg FW	[1]	5.10E-03	day/kg FW	[1]
192-65-4	Dibenzo[a,e]pyrene	1.35E-02	day/kg FW	[1]	7.69E-03	day/kg FW	[1]
192-97-2	Benzo(e)pyrene	2.35E-02	day/kg FW	[1]	1.34E-02	day/kg FW	[1]
193-39-5	Indeno(1,2,3-cd)pyrene	2.17E-02	day/kg FW	[2]	1.24E-02	day/kg FW	[2]
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	1.32E-02	day/kg FW	[2]	7.56E-03	day/kg FW	[2]
205-82-3	Benzo[j]fluoranthene	2.68E-02	day/kg FW	[1]	1.53E-02	day/kg FW	[1]
205-99-2	Benzo(b)fluoranthene	2.67E-02	day/kg FW	[2]	1.52E-02	day/kg FW	[2]
206-44-0	Fluoranthene	2.89E-02	day/kg FW	[2]	1.65E-02	day/kg FW	[2]
207-08-9	Benzo(k)fluoranthene	2.69E-02	day/kg FW	[2]	1.54E-02	day/kg FW	[2]
208-96-8	Acenaphthylene	1.84E-02	day/kg FW	[1]	1.05E-02	day/kg FW	[1]
218-01-9	Chrysene	2.94E-02	day/kg FW	[2]	1.68E-02	day/kg FW	[2]
224-42-0	Dibenz[a,j]acridine	2.28E-02	day/kg FW	[10]	1.30E-02	day/kg FW	[10]
2245-38-7	2,3,5-Trimethylnaphthalene	2.77E-02	day/kg FW	[1]	1.58E-02	day/kg FW	[1]
226-36-8	Dibenz[a,h]acridine	2.28E-02	day/kg FW	[10]	1.30E-02	day/kg FW	[10]
22967-92-6	Methyl mercury	3.58E-03	day/kg FW	[2]	3.58E-03	day/kg FW	[2]
23950-58-5	Pronamide	1.23E-02	day/kg FW	[2]	7.05E-03	day/kg FW	[2]
24959-67-9	Bromide						
27154-33-2	Trichlorofluoroethane	4.39E-03	day/kg FW	[11]	2.51E-03	day/kg FW	[11]
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	1.53E-02	day/kg FW	[1]	8.76E-03	day/kg FW	[1]
319-84-6	alpha-BHC	1.67E-02	day/kg FW	[2]	9.54E-03	day/kg FW	[2]
319-85-7	beta-BHC	1.67E-02	day/kg FW	[2]	9.54E-03	day/kg FW	[2]
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	2.13E-02	day/kg FW	[1]	1.22E-02	day/kg FW	[1]
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	1.94E-02	day/kg FW	[1]	1.11E-02	day/kg FW	[1]
3268-87-9	Octachlorodibenzo(p)dioxin	5.05E-03	day/kg FW	[2]	2.89E-03	day/kg FW	[2]
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	1.20E-02	day/kg FW	[1]	6.85E-03	day/kg FW	[1]
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	6.46E-03	day/kg FW	[2]	3.69E-03	day/kg FW	[2]

Table 4-2 Biotransfer Factors for Chicken and Eggs

CAS Registry Number	Constituent Name	Biotransfer Factor in Chicken ($Ba_{chicken}$)	Units for Biotransfer Factor in Chicken	Reference	Biotransfer Factor in Eggs (Ba_{eggs})	Units for Biotransfer Factor in Eggs	Reference
3697-24-3	5-Methylchrysene	2.94E-02	day/kg FW	[9]	1.68E-02	day/kg FW	[9]
378253-40-8	Barium-137m	9.00E-03	day/kg FW	[4]	9.00E-01	day/kg FW	[4]
378253-44-2	Cadmium-113m	8.00E-01	day/kg FW	[4]	1.00E-01	day/kg FW	[4]
378782-82-2	Niobium-93m	3.00E-04	day/kg FW	[4]	1.00E-03	day/kg FW	[4]
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	1.00E-02	day/kg FW	[1]	5.71E-03	day/kg FW	[1]
39001-02-0	Octachlorodibenzofuran	6.46E-03	day/kg FW	[2]	3.69E-03	day/kg FW	[2]
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	8.11E-03	day/kg FW	[2]	4.63E-03	day/kg FW	[2]
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	5.05E-03	day/kg FW	[1]	2.89E-03	day/kg FW	[1]
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	2.12E-02	day/kg FW	[2]	1.21E-02	day/kg FW	[2]
4170-30-3	Crotonaldehyde (Propylene aldehyde)	1.56E-04	day/kg FW	[1]	8.90E-05	day/kg FW	[1]
41851-50-7	Chlorocyclopentadiene	4.00E-03	day/kg FW	[1]	2.28E-03	day/kg FW	[1]
460-19-5	Cyanogen (oxalonitrile)	4.58E-05	day/kg FW	[1]	2.62E-05	day/kg FW	[1]
4786-20-3	2-Butenenitrile	1.63E-04	day/kg FW	[1]	9.30E-05	day/kg FW	[1]
50-00-0	Formaldehyde	8.88E-05	day/kg FW	[2]	5.08E-05	day/kg FW	[2]
50-32-8	Benzo(a)pyrene	2.77E-02	day/kg FW	[2]	1.58E-02	day/kg FW	[2]
506-68-3	Cyanogen bromide (bromocyanide)	1.85E-05	day/kg FW	[1]	1.06E-05	day/kg FW	[1]
506-77-4	Cyanogen chloride	1.46E-05	day/kg FW	[1]	8.36E-06	day/kg FW	[1]
51-28-5	2,4-Dinitrophenol	4.10E-05	day/kg FW	[2]	2.34E-05	day/kg FW	[2]
51-79-6	Ethyl carbamate (urethane)	2.65E-05	day/kg FW	[1]	1.51E-05	day/kg FW	[1]
510-15-6	Chlorobenzilate	2.34E-02	day/kg FW	[2]	1.34E-02	day/kg FW	[2]
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	2.69E-02	day/kg FW	[2]	1.54E-02	day/kg FW	[2]
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	1.10E-02	day/kg FW	[1]	6.30E-03	day/kg FW	[1]
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	1.29E-03	day/kg FW	[1]	7.39E-04	day/kg FW	[1]
53-70-3	Dibenz[a,h]anthracene	2.28E-02	day/kg FW	[2]	1.30E-02	day/kg FW	[2]
532-27-4	2-Chloroacetophenone	1.92E-03	day/kg FW	[1]	1.10E-03	day/kg FW	[1]
534-52-1	4,6-Dinitro-o-cresol	2.61E-03	day/kg FW	[1]	1.49E-03	day/kg FW	[1]
5385-75-1	Dibenzo(a,e)fluoranthene	1.35E-02	day/kg FW	[1]	7.69E-03	day/kg FW	[1]
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	2.14E-03	day/kg FW	[1]	1.22E-03	day/kg FW	[1]
540-73-8	1,2-Dimethylhydrazine	9.54E-06	day/kg FW	[1]	5.45E-06	day/kg FW	[1]

Table 4-2 Biotransfer Factors for Chicken and Eggs

CAS Registry Number	Constituent Name	Biotransfer Factor in Chicken ($Ba_{chicken}$)	Units for Biotransfer Factor in Chicken	Reference	Biotransfer Factor in Eggs (Ba_{eggs})	Units for Biotransfer Factor in Eggs	Reference
540-84-1	2,2,4-Trimethylpentane	2.02E-02	day/kg FW	[1]	1.16E-02	day/kg FW	[1]
541-73-1	1,3-Dichlorobenzene	1.43E-02	day/kg FW	[2]	8.17E-03	day/kg FW	[2]
542-75-6	1,3-Dichloropropene	1.11E-03	day/kg FW	[2]	6.33E-04	day/kg FW	[2]
542-88-1	Bis(chloromethyl)ether	1.46E-04	day/kg FW	[1]	8.33E-05	day/kg FW	[1]
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	1.21E-02	day/kg FW	[2]	6.92E-03	day/kg FW	[2]
56-23-5	Carbon tetrachloride	6.40E-03	day/kg FW	[2]	3.66E-03	day/kg FW	[2]
56-49-5	3-Methylcholanthrene	2.37E-02	day/kg FW	[1]	1.36E-02	day/kg FW	[1]
56-55-3	Benzo(a)anthracene	2.94E-02	day/kg FW	[2]	1.68E-02	day/kg FW	[2]
57-12-5	Cyanide	6.68E-06	day/kg FW	[2]	3.82E-06	day/kg FW	[2]
57-24-9	Strychnine	1.92E-03	day/kg FW	[2]	1.10E-03	day/kg FW	[2]
57-74-9	Chlordane	2.99E-02	day/kg FW	[2]	1.71E-02	day/kg FW	[2]
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	2.28E-02	day/kg FW	[2]	1.30E-02	day/kg FW	[2]
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	1.94E-02	day/kg FW	[2]	1.11E-02	day/kg FW	[2]
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	1.68E-02	day/kg FW	[2]	9.60E-03	day/kg FW	[2]
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	1.53E-02	day/kg FW	[1]	8.76E-03	day/kg FW	[1]
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	1.32E-02	day/kg FW	[2]	7.56E-03	day/kg FW	[2]
58-89-9	gamma-BHC (Lindane)	2.09E-02	day/kg FW	[1]	1.19E-02	day/kg FW	[1]
58-90-2	2,3,4,6-Tetrachlorophenol	5.40E-05	day/kg FW	[2]	3.08E-05	day/kg FW	[2]
581-42-0	2,6-Dimethylnaphthalene	2.28E-02	day/kg FW	[1]	1.31E-02	day/kg FW	[1]
584-84-9	2,4-Toluene diisocyanate	2.07E-03	day/kg FW	[5]	1.18E-03	day/kg FW	[5]
589-38-8	3-Hexanone	5.76E-04	day/kg FW	[1]	3.29E-04	day/kg FW	[1]
59-50-7	4-Chloro-3-methylphenol	8.95E-03	day/kg FW	[2]	5.11E-03	day/kg FW	[2]
59-89-2	N-Nitrosomorpholine	1.25E-05	day/kg FW	[1]	7.13E-06	day/kg FW	[1]
591-50-4	Benzene, iodo-	1.04E-02	day/kg FW	[1]	5.96E-03	day/kg FW	[1]
591-78-6	2-Hexanone	7.49E-04	day/kg FW	[1]	4.28E-04	day/kg FW	[1]
593-60-2	Bromoethene (Vinyl bromide)	1.05E-03	day/kg FW	[1]	6.01E-04	day/kg FW	[1]
593-74-8	Dimethyl Mercury						
60-11-7	Dimethyl aminoazobenzene	2.57E-02	day/kg FW	[1]	1.47E-02	day/kg FW	[1]
60-29-7	Ethyl ether	2.88E-04	day/kg FW	[1]	1.65E-04	day/kg FW	[1]
60-35-5	Acetamide	6.68E-06	day/kg FW	[1]	3.82E-06	day/kg FW	[1]
602-87-9	5-Nitroacenaphthene	1.79E-02	day/kg FW	[6]	1.02E-02	day/kg FW	[6]
606-20-2	2,6-Dinitrotoluene	1.36E-03	day/kg FW	[2]	7.77E-04	day/kg FW	[2]

Table 4-2 Biotransfer Factors for Chicken and Eggs

CAS Registry Number	Constituent Name	Biotransfer Factor in Chicken ($Ba_{chicken}$)	Units for Biotransfer Factor in Chicken	Reference	Biotransfer Factor in Eggs (Ba_{eggs})	Units for Biotransfer Factor in Eggs	Reference
608-93-5	Pentachlorobenzene	2.96E-02	day/kg FW	[2]	1.69E-02	day/kg FW	[2]
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	1.68E-02	day/kg FW	[2]	9.60E-03	day/kg FW	[2]
61626-71-9	Dichloropentadiene	4.00E-03	day/kg FW	[1]	2.28E-03	day/kg FW	[1]
62-50-0	Ethyl methanesulfonate	4.37E-05	day/kg FW	[2]	2.50E-05	day/kg FW	[2]
62-53-3	Aniline	2.94E-04	day/kg FW	[2]	1.68E-04	day/kg FW	[2]
62-75-9	N-Nitroso-N,N-dimethylamine	8.79E-06	day/kg FW	[1]	5.02E-06	day/kg FW	[1]
621-64-7	N-Nitroso-di-n-propylamine	7.21E-04	day/kg FW	[2]	4.12E-04	day/kg FW	[2]
624-83-9	Methyl isocyanate	7.04E-05	day/kg FW	[7]	4.02E-05	day/kg FW	[7]
628-73-9	Hexanenitrile	1.23E-03	day/kg FW	[1]	7.02E-04	day/kg FW	[1]
630-08-0	Carbon monoxide						
630-20-6	1,1,1,2-Tetrachloroethane	8.30E-03	day/kg FW	[2]	4.75E-03	day/kg FW	[2]
64-18-6	Formic acid (methanoic acid)	3.78E-05	day/kg FW	[2]	2.16E-05	day/kg FW	[2]
65-85-0	Benzoic acid	4.16E-05	day/kg FW	[2]	2.38E-05	day/kg FW	[2]
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	1.53E-02	day/kg FW	[1]	8.76E-03	day/kg FW	[1]
67-56-1	Methyl alcohol	6.68E-06	day/kg FW	[2]	3.82E-06	day/kg FW	[2]
67-63-0	2-Propyl alcohol	4.36E-05	day/kg FW	[1]	2.49E-05	day/kg FW	[1]
67-64-1	2-Propanone (Acetone)	2.11E-05	day/kg FW	[2]	1.20E-05	day/kg FW	[2]
67-66-3	Chloroform	2.14E-03	day/kg FW	[2]	1.22E-03	day/kg FW	[2]
67-72-1	Hexachloroethane	1.83E-02	day/kg FW	[2]	1.05E-02	day/kg FW	[2]
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	1.21E-02	day/kg FW	[2]	6.92E-03	day/kg FW	[2]
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	1.00E-02	day/kg FW	[1]	5.71E-03	day/kg FW	[1]
70-30-4	Hexachlorophene	1.06E-02	day/kg FW	[2]	6.06E-03	day/kg FW	[2]
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	1.53E-02	day/kg FW	[1]	8.76E-03	day/kg FW	[1]
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	1.68E-02	day/kg FW	[2]	9.60E-03	day/kg FW	[2]
71-36-3	n-Butyl alcohol	2.83E-04	day/kg FW	[1]	1.61E-04	day/kg FW	[1]
71-43-2	Benzene	2.49E-03	day/kg FW	[2]	1.42E-03	day/kg FW	[2]
71-55-6	1,1,1-Trichloroethane	4.39E-03	day/kg FW	[2]	2.51E-03	day/kg FW	[2]
72-43-5	Methoxychlor	2.76E-02	day/kg FW	[2]	1.58E-02	day/kg FW	[2]
72-55-9	4,4-DDE	2.94E-02	day/kg FW	[2]	1.68E-02	day/kg FW	[2]
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	1.68E-02	day/kg FW	[2]	9.60E-03	day/kg FW	[2]
74-83-9	Bromomethane	5.24E-04	day/kg FW	[2]	2.99E-04	day/kg FW	[2]
74-87-3	Chloromethane	3.01E-04	day/kg FW	[2]	1.72E-04	day/kg FW	[2]

Table 4-2 Biotransfer Factors for Chicken and Eggs

CAS Registry Number	Constituent Name	Biotransfer Factor in Chicken ($Ba_{chicken}$)	Units for Biotransfer Factor in Chicken	Reference	Biotransfer Factor in Eggs (Ba_{eggs})	Units for Biotransfer Factor in Eggs	Reference
74-88-4	Iodomethane	9.46E-04	day/kg FW	[1]	5.41E-04	day/kg FW	[1]
74-95-3	Methylene bromide	9.79E-04	day/kg FW	[2]	5.59E-04	day/kg FW	[2]
74-97-5	Bromochloromethane	7.91E-04	day/kg FW	[1]	4.52E-04	day/kg FW	[1]
7429-90-5	Aluminum						
7439-89-6	Iron	1.00E+00	day/kg FW	[4]	1.00E+00	day/kg FW	[4]
7439-92-1	Lead	8.00E-01	day/kg FW	[4]	1.00E+00	day/kg FW	[4]
7439-93-2	Lithium						
7439-95-4	Magnesium	3.00E-02	day/kg FW	[4]	2.00E+00	day/kg FW	[4]
7439-96-5	Manganese	5.00E-02	day/kg FW	[4]	6.00E-02	day/kg FW	[4]
7439-97-6	Mercury	0.00E+00	day/kg FW	[2]	0.00E+00	day/kg FW	[2]
7439-98-7	Molybdenum	1.80E-01	day/kg FW	[4]	9.00E-01	day/kg FW	[4]
7440-02-0	Nickel	1.00E-03	day/kg FW	[4]	1.00E-01	day/kg FW	[4]
7440-16-6	Rhodium	2.00E+00	day/kg FW	[4]	1.00E-01	day/kg FW	[4]
7440-22-4	Silver	2.00E+00	day/kg FW	[4]	5.00E-01	day/kg FW	[4]
7440-23-5	Sodium	1.00E-02	day/kg FW	[4]	6.00E+00	day/kg FW	[4]
7440-24-6	Strontium (total)	8.00E-02	day/kg FW	[4]	2.00E-01	day/kg FW	[4]
7440-25-7	Tantalum	3.00E-04	day/kg FW	[4]	1.00E-03	day/kg FW	[4]
7440-28-0	Thallium	8.00E-01	day/kg FW	[4]	1.00E+00	day/kg FW	[4]
7440-29-1	Thorium-232	6.00E-03	day/kg FW	[4]	4.00E-03	day/kg FW	[4]
7440-31-5	Tin	8.00E-01	day/kg FW	[4]	1.00E+00	day/kg FW	[4]
7440-33-7	Tungsten	2.00E-01	day/kg FW	[4]	9.00E-01	day/kg FW	[4]
7440-36-0	Antimony	6.00E-03	day/kg FW	[4]	7.00E-02	day/kg FW	[4]
7440-38-2	Arsenic	8.30E-01	day/kg FW	[4]	2.60E-01	day/kg FW	[4]
7440-39-3	Barium	9.00E-03	day/kg FW	[4]	9.00E-01	day/kg FW	[4]
7440-41-7	Beryllium						
7440-43-9	Cadmium	1.06E-01	day/kg FW	[2]	2.50E-03	day/kg FW	[2]
7440-47-3	Chromium						
7440-48-4	Cobalt	2.00E+00	day/kg FW	[4]	1.00E-01	day/kg FW	[4]
7440-50-8	Copper	5.00E-01	day/kg FW	[4]	5.00E-01	day/kg FW	[4]
7440-61-1	Uranium	1.00E+00	day/kg FW	[4]	1.00E+00	day/kg FW	[4]
7440-61-1R	Uranium-238	1.00E+00	day/kg FW	[3]	1.00E+00	day/kg FW	[3]
7440-62-2	Vanadium						
7440-65-5	Yttrium	1.00E-02	day/kg FW	[4]	2.00E-03	day/kg FW	[4]

Table 4-2 Biotransfer Factors for Chicken and Eggs

CAS Registry Number	Constituent Name	Biotransfer Factor in Chicken ($Ba_{chicken}$)	Units for Biotransfer Factor in Chicken	Reference	Biotransfer Factor in Eggs (Ba_{eggs})	Units for Biotransfer Factor in Eggs	Reference
7440-66-6	Zinc	8.75E-03	day/kg FW	[2]	8.75E-03	day/kg FW	[2]
7440-67-7	Zirconium	6.00E-05	day/kg FW	[4]	2.00E-04	day/kg FW	[4]
7446-09-5	Sulfur dioxide						
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	1.70E-02	day/kg FW	[1]	9.74E-03	day/kg FW	[1]
7487-94-7	Mercuric chloride (HgCl2)	2.39E-02	day/kg FW	[2]	2.39E-02	day/kg FW	[2]
75-00-3	Chloroethane	7.76E-04	day/kg FW	[2]	4.44E-04	day/kg FW	[2]
75-01-4	1-Chloroethene	7.76E-04	day/kg FW	[2]	4.44E-04	day/kg FW	[2]
75-02-5	Fluoroethene (vinyl fluoride)	5.24E-04	day/kg FW	[1]	2.99E-04	day/kg FW	[1]
75-05-8	Acetonitrile	1.63E-05	day/kg FW	[2]	9.29E-06	day/kg FW	[2]
75-07-0	Acetaldehyde	2.22E-05	day/kg FW	[2]	1.27E-05	day/kg FW	[2]
75-09-2	Dichloromethane (Methylene Chloride)	6.45E-04	day/kg FW	[2]	3.69E-04	day/kg FW	[2]
75-15-0	Carbon disulfide	2.89E-03	day/kg FW	[2]	1.65E-03	day/kg FW	[2]
75-21-8	Ethylene oxide (Oxirane)	1.80E-05	day/kg FW	[2]	1.03E-05	day/kg FW	[2]
75-25-2	Bromoform	3.68E-03	day/kg FW	[2]	2.10E-03	day/kg FW	[2]
75-27-4	Bromodichloromethane	2.49E-03	day/kg FW	[2]	1.42E-03	day/kg FW	[2]
75-29-6	2-Chloropropane	1.83E-03	day/kg FW	[1]	1.04E-03	day/kg FW	[1]
75-34-3	1,1-Dichloroethane	1.55E-03	day/kg FW	[2]	8.88E-04	day/kg FW	[2]
75-35-4	1,1-Dichloroethene	2.49E-03	day/kg FW	[2]	1.42E-03	day/kg FW	[2]
75-44-5	Phosgene (hydrogen phosphide)	1.83E-03	day/kg FW	[12]	1.04E-03	day/kg FW	[12]
75-45-6	Chlorodifluoromethane	4.23E-04	day/kg FW	[2]	2.42E-04	day/kg FW	[2]
75-50-3	Trimethylamine	5.69E-05	day/kg FW	[1]	3.25E-05	day/kg FW	[1]
75-69-4	Trichlorofluoromethane	4.39E-03	day/kg FW	[2]	2.51E-03	day/kg FW	[2]
75-71-8	Dichlorodifluoromethane	2.73E-03	day/kg FW	[2]	1.56E-03	day/kg FW	[2]
76-01-7	Pentachloroethane	1.01E-02	day/kg FW	[1]	5.78E-03	day/kg FW	[1]
76-13-1	1,2,2-Trichlorotrifluoroethane	9.52E-03	day/kg FW	[1]	5.44E-03	day/kg FW	[1]
76-44-8	Heptachlor	2.27E-02	day/kg FW	[2]	1.30E-02	day/kg FW	[2]
764-41-0	1,4-Dichloro-2-butene	5.00E-03	day/kg FW	[1]	2.86E-03	day/kg FW	[1]
7647-01-0	Hydrogen chloride	3.86E-05	day/kg FW	[2]	2.20E-05	day/kg FW	[2]
765-34-4	Glycidylaldehyde	2.86E-05	day/kg FW	[1]	1.63E-05	day/kg FW	[1]
7664-39-3	Hydrogen Fluoride						
7664-41-7	Ammonia/Ammonium						
77-47-4	Hexachlorocyclopentadiene	2.91E-02	day/kg FW	[2]	1.66E-02	day/kg FW	[2]

Table 4-2 Biotransfer Factors for Chicken and Eggs

CAS Registry Number	Constituent Name	Biotransfer Factor in Chicken ($Ba_{chicken}$)	Units for Biotransfer Factor in Chicken	Reference	Biotransfer Factor in Eggs (Ba_{eggs})	Units for Biotransfer Factor in Eggs	Reference
77-78-1	Dimethyl sulfate	4.94E-04	day/kg FW	[1]	2.83E-04	day/kg FW	[1]
7704-34-9	Total Sulfur (thermodynamically stable)						
7723-14-0	Phosphorus	1.90E-01	day/kg FW	[4]	1.00E+00	day/kg FW	[4]
7782-41-4	Fluorine gas F2						
7782-49-2	Selenium	1.13E+00	day/kg FW	[2]	1.13E+00	day/kg FW	[2]
7782-50-5	Chlorine	2.66E-04	day/kg FW	[2]	1.52E-04	day/kg FW	[2]
78-83-1	2-Methylpropyl alcohol	2.20E-04	day/kg FW	[1]	1.26E-04	day/kg FW	[1]
78-87-5	1,2-Dichloropropane	2.14E-03	day/kg FW	[2]	1.22E-03	day/kg FW	[2]
78-93-3	2-Butanone	7.73E-05	day/kg FW	[2]	4.42E-05	day/kg FW	[2]
79-00-5	1,1,2-Trichloroethane	2.14E-03	day/kg FW	[2]	1.22E-03	day/kg FW	[2]
79-01-6	1,1,2-Trichloroethylene	3.84E-03	day/kg FW	[2]	2.19E-03	day/kg FW	[2]
79-10-7	2-Propenoic acid	8.88E-05	day/kg FW	[1]	5.08E-05	day/kg FW	[1]
79-34-5	1,1,2,2-Tetrachloroethane	3.84E-03	day/kg FW	[2]	2.19E-03	day/kg FW	[2]
79-46-9	2-Nitropropane	3.13E-04	day/kg FW	[1]	1.79E-04	day/kg FW	[1]
80-62-6	Methyl methacrylate	7.49E-04	day/kg FW	[1]	4.28E-04	day/kg FW	[1]
82-68-8	Pentachloronitrobenzene (PCNB)	2.63E-02	day/kg FW	[2]	1.50E-02	day/kg FW	[2]
822-06-0	Hexamethylene-1,5-diisocyanate	9.92E-03	day/kg FW	[1]	5.67E-03	day/kg FW	[1]
823-40-5	Toluene-2,6-diamine	5.69E-05	day/kg FW	[1]	3.25E-05	day/kg FW	[1]
83-32-9	Acenaphthene	1.79E-02	day/kg FW	[2]	1.02E-02	day/kg FW	[2]
832-69-9	1-Methylphenanthrene	2.93E-02	day/kg FW	[1]	1.67E-02	day/kg FW	[1]
84-66-2	Diethyl phthalate	4.39E-03	day/kg FW	[2]	2.51E-03	day/kg FW	[2]
84-74-2	Di-n-butylphthalate	2.68E-02	day/kg FW	[2]	1.53E-02	day/kg FW	[2]
85-01-8	Phenanthrene	2.49E-02	day/kg FW	[2]	1.42E-02	day/kg FW	[2]
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	7.67E-06	day/kg FW	[2]	4.38E-06	day/kg FW	[2]
85-68-7	Butylbenzylphthalate	2.83E-02	day/kg FW	[2]	1.62E-02	day/kg FW	[2]
86-73-7	Fluorene	2.16E-02	day/kg FW	[2]	1.23E-02	day/kg FW	[2]
87-61-6	1,2,3-Trichlorobenzene	1.98E-02	day/kg FW	[2]	1.13E-02	day/kg FW	[2]
87-68-3	Hexachlorobutadiene	2.76E-02	day/kg FW	[2]	1.58E-02	day/kg FW	[2]
87-86-5	Pentachlorophenol	4.88E-05	day/kg FW	[2]	2.79E-05	day/kg FW	[2]
88-06-2	2,4,6-Trichlorophenol	9.51E-05	day/kg FW	[2]	5.44E-05	day/kg FW	[2]
88-74-4	o-Nitroaniline (2-nitroaniline)	1.69E-03	day/kg FW	[2]	9.63E-04	day/kg FW	[2]
88-75-5	2-Nitrophenol	1.53E-03	day/kg FW	[2]	8.73E-04	day/kg FW	[2]

Table 4-2 Biotransfer Factors for Chicken and Eggs

CAS Registry Number	Constituent Name	Biotransfer Factor in Chicken ($Ba_{chicken}$)	Units for Biotransfer Factor in Chicken	Reference	Biotransfer Factor in Eggs (Ba_{eggs})	Units for Biotransfer Factor in Eggs	Reference
90-04-0	o-Anisidine	5.14E-04	day/kg FW	[1]	2.94E-04	day/kg FW	[1]
90-12-0	1-Methylnaphthalene	1.76E-02	day/kg FW	[1]	1.00E-02	day/kg FW	[1]
91-20-3	Naphthalene	1.09E-02	day/kg FW	[2]	6.25E-03	day/kg FW	[2]
91-22-5	Quinoline	2.24E-03	day/kg FW	[1]	1.28E-03	day/kg FW	[1]
91-57-6	2-Methylnaphthalene	1.74E-02	day/kg FW	[1]	9.96E-03	day/kg FW	[1]
91-58-7	2-Chloronaphthalene	1.18E-02	day/kg FW	[2]	6.74E-03	day/kg FW	[2]
91-94-1	3,3'-Dichlorobenzidine	1.32E-02	day/kg FW	[2]	7.57E-03	day/kg FW	[2]
92-52-4	1,1`-Biphenyl	1.93E-02	day/kg FW	[1]	1.10E-02	day/kg FW	[1]
924-16-3	N-Nitroso-di-n-Buetylamine	1.89E-03	day/kg FW	[2]	1.08E-03	day/kg FW	[2]
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	5.39E-03	day/kg FW	[2]	3.08E-03	day/kg FW	[2]
94-75-7	2,4-D	6.47E-03	day/kg FW	[1]	3.70E-03	day/kg FW	[1]
95-48-7	o-Cresol	1.97E-03	day/kg FW	[2]	1.13E-03	day/kg FW	[2]
95-49-8	o-Chlorotoluene	1.22E-02	day/kg FW	[1]	6.99E-03	day/kg FW	[1]
95-50-1	1,2-Dichlorobenzene	1.18E-02	day/kg FW	[2]	6.74E-03	day/kg FW	[2]
95-53-4	o-Toluidine	6.70E-04	day/kg FW	[2]	3.83E-04	day/kg FW	[2]
95-57-8	2-Chlorophenol	2.47E-03	day/kg FW	[2]	1.41E-03	day/kg FW	[2]
95-63-6	1,2,4-Trimethyl benzene	1.46E-02	day/kg FW	[1]	8.37E-03	day/kg FW	[1]
95-94-3	1,2,4,5-Tetrachlorobenzene	2.76E-02	day/kg FW	[2]	1.58E-02	day/kg FW	[2]
95-95-4	2,4,5-Trichlorophenol	1.46E-03	day/kg FW	[2]	8.33E-04	day/kg FW	[2]
96-12-8	1,2-Dibromo-3-chloropropane	3.34E-03	day/kg FW	[2]	1.91E-03	day/kg FW	[2]
96-18-4	1,2,3-Trichloropropane	2.14E-03	day/kg FW	[2]	1.22E-03	day/kg FW	[2]
96-45-7	Ethylene thiourea	6.87E-06	day/kg FW	[1]	3.92E-06	day/kg FW	[1]
97-63-2	Ethyl methacrylate	1.95E-03	day/kg FW	[2]	1.11E-03	day/kg FW	[2]
98-01-1	Furfural	1.02E-04	day/kg FW	[1]	5.82E-05	day/kg FW	[1]
98-06-6	tert-Butyl benzene	2.05E-02	day/kg FW	[1]	1.17E-02	day/kg FW	[1]
98-07-7	Benzotrichloride	1.79E-02	day/kg FW	[1]	1.02E-02	day/kg FW	[1]
98-82-8	Cumene	1.55E-02	day/kg FW	[2]	8.85E-03	day/kg FW	[2]
98-83-9	Methyl styrene (mixed isomers)	1.29E-02	day/kg FW	[1]	7.37E-03	day/kg FW	[1]
98-86-2	Acetophenone	1.07E-03	day/kg FW	[2]	6.12E-04	day/kg FW	[2]
98-95-3	Nitrobenzene	1.69E-03	day/kg FW	[2]	9.63E-04	day/kg FW	[2]
99-35-4	1,3,5-Trinitrobenzene	5.34E-04	day/kg FW	[2]	3.05E-04	day/kg FW	[2]

Table 4-2 Biotransfer Factors for Chicken and Eggs

CAS Registry Number	Constituent Name	Biotransfer Factor in Chicken ($Ba_{chicken}$)	Units for Biotransfer Factor in Chicken	Reference	Biotransfer Factor in Eggs (Ba_{eggs})	Units for Biotransfer Factor in Eggs	Reference
99-65-0	1,3-Dinitrobenzene	9.30E-04	day/kg FW	[2]	5.31E-04	day/kg FW	[2]
99-87-6	p-Cymene	2.04E-02	day/kg FW	[1]	1.16E-02	day/kg FW	[1]

Reference	Reference (source) for Biotransfer Factor in Chicken
[1]	Calculated value per Eqs. A-2-21 and A-2-27 in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm).
[2]	EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013).
[3]	ORNL. *The Risk Assessment Information System (RAIS) Database*. Copyright © 2013 Oak Ridge National Laboratory and The University of Tennessee, Oak Ridge, TN (http://rais.ornl.gov, accessed April 2014).
[4]	Staven LH, Rhoads K, Napier BA, Strenge DL, *A Compendium of Transfer Factors for Agricultural and Animal Products*, PNNL-13421, Pacific Northwest National Laboratory, Richland, WA. June 2003.
[5]	Surrogate value from 2,4-Dinitrotoluene.
[6]	Surrogate value from Acenaphthene.
[7]	Surrogate value from Acrylonitrile.
[8]	Surrogate value from Benzo(a)pyrene.
[9]	Surrogate value from Chrysene.
[10]	Surrogate value from Dibenz[a,h]anthracene.
[11]	Surrogate value from Trichlorofluoromethane.
[12]	Surrogate value from cis-1,2-Dichloroethene.

Reference	Reference (source) for Biotransfer Factor in Eggs
[1]	Calculated value per Eqs. A-2-21 and A-2-28 in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm).
[2]	EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013).
[3]	ORNL. *The Risk Assessment Information System (RAIS) Database*. Copyright © 2013 Oak Ridge National Laboratory and The University of Tennessee, Oak Ridge, TN (http://rais.ornl.gov, accessed April 2014).
[4]	Staven LH, Rhoads K, Napier BA, Strenge DL, *A Compendium of Transfer Factors for Agricultural and Animal Products*, PNNL-13421, Pacific Northwest National Laboratory, Richland, WA. June 2003.
[5]	Surrogate value from 2,4-Dinitrotoluene.
[6]	Surrogate value from Acenaphthene.
[7]	Surrogate value from Acrylonitrile.
[8]	Surrogate value from Benzo(a)pyrene.

Reference	Reference (source) for Biotransfer Factor in Eggs
[9]	Surrogate value from Chrysene.
[10]	Surrogate value from Dibenz[a,h]anthracene.
[11]	Surrogate value from Trichlorofluoromethane.
[12]	Surrogate value from cis-1,2-Dichloroethene.

Table 4-3 identifies constituents for which dose assessment is performed using the toxicity equivalency approach. For dioxins and furans, and polycyclic aromatic hydrocarbons, exposure concentrations are converted to equivalent concentrations of 2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD) and benzo[a]pyrene (BaP), respectively, by multiplying the concentration by the appropriate toxicity equivalency factor (TEF). This approach results in toxicity equivalent concentrations of each carcinogen which can then be estimated using the cancer slope factor of the parent consistuent (TCDD or BaP, refer to Sections 7.2.2.5 and 7.2.2.6 of the RAWP). Blank entries in the table indicate where data are not available.

Table 4-3 Toxicity Equivalency Factors and Bioaccumulation Equivalency Factors

CAS Registry Number	Constituent Name	Toxicity Equivalence Factor Group	Value of Toxicity Equivalence Factor (*TEF*)	Reference	Bioaccumulation Equivalency Factor (*BEF*)	Reference
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	TCDD	1	[1]	1	[1]
189-55-9	Dibenzo[a,i]pyrene	PAH	10	[1]		
189-64-0	Dibenzo[a,h]pyrene	PAH	10	[1]		
191-30-0	Dibenzo(a,l)pyrene	PAH	10	[1]		
192-65-4	Dibenzo[a,e]pyrene	PAH	1	[1]		
193-39-5	Indeno(1,2,3-cd)pyrene	PAH	0.1	[1]		
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	TCDD	0.1	[1]	0.14	[1]
205-82-3	Benzo[j]fluoranthene	PAH	0.1	[1]		
205-99-2	Benzo(b)fluoranthene	PAH	0.1	[1]		
207-08-9	Benzo(k)fluoranthene	PAH	0.1	[1]		
218-01-9	Chrysene	PAH	0.01	[1]		
224-42-0	Dibenz[a,j]acridine	PAH	0.1	[1]		
226-36-8	Dibenz[a,h]acridine	PAH	0.1	[1]		
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	PCB	0.00003	[1]		
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	PCB	0.0001	[1]		
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	PCB	0.00003	[1]		
3268-87-9	Octachlorodibenzo(p)dioxin	TCDD	0.0003	[1]	0.012	[1]
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	PCB	0.03	[1]		
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	TCDD	0.01	[1]	0.051	[1]
3697-24-3	5-Methylchrysene	PAH	1	[1]		
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	PCB	0.00003	[1]		
39001-02-0	Octachlorodibenzofuran	TCDD	0.0003	[1]	0.016	[1]
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	TCDD	0.1	[1]	0.31	[1]
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	PCB	0.00003	[1]		

Table 4-3 Toxicity Equivalency Factors and Bioaccumulation Equivalency Factors

CAS Registry Number	Constituent Name	Toxicity Equivalence Factor Group	Value of Toxicity Equivalence Factor (*TEF*)	Reference	Bioaccumulation Equivalency Factor (*BEF*)	Reference
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	TCDD	1	[1]	0.92	[1]
50-32-8	Benzo(a)pyrene	PAH	1	[1]		
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	TCDD	0.1	[1]	0.8	[1]
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	PCB	0.00003	[1]		
53-70-3	Dibenz[a,h]anthracene	PAH	0.1	[1]		
5385-75-1	Dibenzo(a,e)fluoranthene	PAH	10	[2]		
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	TCDD	0.01	[1]	0.39	[1]
56-49-5	3-Methylcholanthrene	PAH	1	[1]		
56-55-3	Benzo(a)anthracene	PAH	0.1	[1]		
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	TCDD	0.3	[1]	1.6	[1]
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	TCDD	0.03	[1]	0.22	[1]
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	TCDD	0.1	[1]	0.19	[1]
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	PCB	0.1	[1]		
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	TCDD	0.1	[1]	0.12	[1]
602-87-9	5-Nitroacenaphthene	PAH	0.01	[1]		
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	TCDD	0.1	[1]	0.67	[1]
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	PCB	0.00003	[1]		
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	TCDD	0.01	[1]	0.011	[1]
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	PCB	0.00003	[1]		
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	PCB	0.0003	[1]		
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	TCDD	0.1	[1]	0.076	[1]
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	TCDD	0.1	[1]	0.63	[1]

Reference **Reference (source) for Toxicity Equivalence Factor**

[1] WAC 173-340-900. *Tables*, Washington Administrative Code, effective 12 November 2007.

[2] Surrogate value from Dibenzo[a,i]pyrene.

Reference **Reference (source) for Bioaccumulation Equivalency Factor**

[1] EPA. 2003. *Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds, NAS Review Draft*, EPA/600/P-00/001 Cb (Part 1, Vol. 2, Table 2-10), Exposure Assessment and Risk Characterization Group National Center for Environmental Assessment - Washington Office Office of Research and Development, Washington, DC. (www.epa.gov/ncea/dioxin)

Table 4-4 provides data for fish bioconcentration and bioaccumulation. The bioconcentration factor (BCF) for fish is the ratio of the contaminant concentration in fish to the contaminant concentration in the water column where the fish is exposed. The bioaccumulation factor (BAF) is the ratio of the contaminant concentration in fish to the contaminant concentration in the water body (including dissolved and suspended sediment) where the fish are exposed. BCF is used to assess the impact of exposure to certain metals and contaminants with log K_{ow} values less than 4.0, while the BAF is generally used for assessing exposures to water contaminants with with log K_{ow} values greater than 4.0, with the exception of PCBs, dioxins, and furans. Refer to Section 7.1.7.5 of the RAWP for additional details. Blank entries in the table indicate where data are not available.

Table 4-4 Bioconcentration and Bioaccumulation Factors for Fish

CAS Registry Number	Constituent Name	Bioconcentration Factor for fish (*BCF*)	Units for Bioconcentration Factor for fish	Reference	Bioaccumulation Factor for fish (*BAF*)	Units for Bioaccumulation Factor for fish	Reference
100-02-7	p-Nitrophenol	3.16E+00	L/kg	[9]			
100-21-0	Phthalic acid	3.16E+00	L/kg	[9]			
100-25-4	1,4-Dinitrobenzene	2.66E+00	L/kg	[7]			
100-40-3	4-Ethenylcyclohexene	2.12E+02	L/kg	[7]			
100-41-4	Ethyl benzene	4.86E+01	L/kg	[7]			
100-42-5	Styrene	4.07E+01	L/kg	[7]			
100-44-7	Benzyl chloride	1.18E+01	L/kg	[7]			
100-47-0	Benzonitrile	3.17E+00	L/kg	[7]			
100-51-6	Benzyl alcohol	1.40E+00	L/kg	[7]			
100-52-7	Benzaldehyde	2.75E+00	L/kg	[7]			
10028-15-6	Ozone	3.16E+00	L/kg	[6]			
10028-17-8	Tritium	3.16E+00	L/kg	[6]	1.00E+00	L/kg	[7]
10045-97-3	Cesium-137				2.00E+03	L/kg	[5]
10061-01-5	cis-1,3-Dichloropropene	7.69E+00	L/kg	[7]			
10061-02-6	trans-1,3-Dichloropropene	7.30E+00	L/kg	[7]			
10098-91-6	Yttrium-90				3.00E+01	L/kg	[5]
10098-97-2	Strontium-90				6.00E+01	L/kg	[5]
101-55-3	4-Bromophenylphenyl ether	2.17E+03	L/kg	[7]	1.04E+04	L/kg	[6]
101-77-9	4,4-Methylenedianiline	3.34E+00	L/kg	[7]			
10102-44-0	Nitrogen dioxide	1.50E+05	L/kg	[4]	1.50E+05	L/kg	[3]
10198-40-0	Cobalt-60				3.00E+02	L/kg	[7]
103-33-3	Azobenzene	1.74E+02	L/kg	[7]			
103-65-1	n-Propyl benzene (Isocumene)	1.38E+02	L/kg	[7]			

Table 4-4 Bioconcentration and Bioaccumulation Factors for Fish

CAS Registry Number	Constituent Name	Bioconcentration Factor for fish (*BCF*)	Units for Bioconcentration Factor for fish	Reference	Bioaccumulation Factor for fish (*BAF*)	Units for Bioaccumulation Factor for fish	Reference
104-51-8	n-Butylbenzene	4.71E+02	L/kg	[7]			
104-76-7	2-Ethyl-1-hexanol	2.52E+01	L/kg	[7]			
105-67-9	2,4-Dimethylphenol	3.16E+00	L/kg	[9]			
10595-95-6	n-Nitrosomethylethylamine	3.16E+00	L/kg	[9]			
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	7.31E+01	L/kg	[7]			
106-44-5	p-Cresol (4-methyl phenol)	5.79E+00	L/kg	[7]			
106-46-7	1,4-Dichlorobenzene	9.89E+01	L/kg	[7]			
106-47-8	p-Chloroaniline	5.12E+00	L/kg	[7]			
106-49-0	p-Toluidine	2.35E+00	L/kg	[7]			
106-51-4	Quinone	5.00E+01	L/kg	[13]			
106-88-7	1,2-Epoxybutane	3.16E+00	L/kg	[6]			
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	3.16E+00	L/kg	[6]			
106-93-4	Ethylene dibromide	6.92E+00	L/kg	[7]			
106-99-0	1,3-Butadiene	6.80E+00	L/kg	[7]			
107-02-8	Acrolein	3.16E+00	L/kg	[6]			
107-05-1	3-Chloropropene	6.11E+00	L/kg	[7]			
107-06-2	1,2-Dichloroethane	2.85E+00	L/kg	[7]			
107-12-0	Propionitrile	3.16E+00	L/kg	[6]			
107-13-1	Acrylonitrile	3.16E+00	L/kg	[10]			
107-19-7	Propargyl alcohol	3.16E+00	L/kg	[6]			
107-21-1	Ethylene glycol (1,2-ethanediol)	3.16E+00	L/kg	[6]			
107-98-2	Propylene glycol monomethyl ether	3.16E+00	L/kg	[6]			
108-05-4	Acetic acid vinyl ester	3.16E+00	L/kg	[6]			
108-10-1	4-Methyl-2-pentanone	1.67E+00	L/kg	[7]			
108-39-4	m-Cresol	6.44E+00	L/kg	[7]			
108-60-1	bis (2-Chloroisopropyl)ether	1.62E+01	L/kg	[7]			
108-67-8	1,3,5-Trimethylbenzene	8.58E+01	L/kg	[7]			
108-86-1	Bromobenzene (Phenyl bromide)	4.00E+01	L/kg	[7]			
108-87-2	Methylcyclohexane	1.20E+02	L/kg	[7]			
108-88-3	Toluene	2.39E+01	L/kg	[7]			

Table 4-4 Bioconcentration and Bioaccumulation Factors for Fish

CAS Registry Number	Constituent Name	Bioconcentration Factor for fish (*BCF*)	Units for Bioconcentration Factor for fish	Reference	Bioaccumulation Factor for fish (*BAF*)	Units for Bioaccumulation Factor for fish	Reference
108-90-7	Chlorobenzene	2.86E+01	L/kg	[7]			
108-94-1	Cyclohexanone	3.16E+00	L/kg	[6]			
108-95-2	Phenol	3.16E+00	L/kg	[9]			
109-74-0	n-Butanenitrile	3.16E+00	L/kg	[6]			
109-75-1	3-Butenenitrile	3.16E+00	L/kg	[6]			
109-77-3	Malononitrile	3.16E+00	L/kg	[6]			
109-86-4	2-Methoxyethanol	3.16E+00	L/kg	[6]			
109-99-9	Tetrahydrofuran	3.16E+00	L/kg	[6]			
110-00-9	Furan	2.15E+00	L/kg	[7]			
110-54-3	n-Hexane	2.01E+02	L/kg	[7]			
110-59-8	Pentanenitrile	1.45E+00	L/kg	[7]			
110-80-5	2-Ethoxyethanol	3.16E+00	L/kg	[6]			
110-82-7	Cyclohexane	8.89E+01	L/kg	[7]			
110-83-8	Cyclohexene	3.18E+01	L/kg	[7]			
110-86-1	Pyridine	3.16E+00	L/kg	[6]			
111-15-9	Ethylene glycol monoethyl ether acetate	3.16E+00	L/kg	[6]			
111-44-4	Bis(2-chloroethyl)ether	1.96E+00	L/kg	[7]			
111-65-9	n-Octane	1.94E+03	L/kg	[7]			
111-76-2	2-Butoxyethanol	3.16E+00	L/kg	[6]			
111-84-2	n-Nonane	4.47E+03	L/kg	[7]			
111-91-1	Bis(2-chloroethoxy)methane	2.00E+00	L/kg	[7]			
112-30-1	1-Decanol	6.59E+02	L/kg	[7]			
112-31-2	Decanal	1.57E+02	L/kg	[7]			
112-40-3	Dodecane	9.93E+03	L/kg	[7]			
1120-21-4	Undecane	5.25E+03	L/kg	[7]			
1120-71-4	1,3-Propane sultone	3.16E+00	L/kg	[6]			
117-81-7	Bis(2-ethylhexyl) phthalate	5.33E+01	L/kg	[10]	1.94E+02	L/kg	[6]
117-84-0	Di-n-octylphthalate	6.35E+01	L/kg	[10]	4.62E+02	L/kg	[6]
118-74-1	Hexachlorobenzene	2.40E+03	L/kg	[10]	1.15E+04	L/kg	[6]
119-90-4	3,3'-Dimethoxybenzidine	4.94E+00	L/kg	[7]			

Table 4-4 Bioconcentration and Bioaccumulation Factors for Fish

CAS Registry Number	Constituent Name	Bioconcentration Factor for fish (*BCF*)	Units for Bioconcentration Factor for fish	Reference	Bioaccumulation Factor for fish (*BAF*)	Units for Bioaccumulation Factor for fish	Reference
120-12-7	Anthracene	5.82E+02	L/kg	[7]	1.03E+03	L/kg	[6]
120-82-1	1,2,4-Trichlorobenzene	2.40E+02	L/kg	[7]			
120-83-2	2,4-Dichlorophenol	3.16E+00	L/kg	[9]			
121-14-2	2,4-Dinitrotoluene	6.68E+00	L/kg	[10]			
122-39-4	N,N-Diphenylamine	3.16E+00	L/kg	[9]			
122-66-7	1,2-Diphenylhydrazine	3.41E+01	L/kg	[7]			
123-33-1	Maleic hydrazide	3.16E+00	L/kg	[6]			
123-38-6	Propionaldehyde	3.16E+00	L/kg	[6]			
123-72-8	Butanal	3.16E+00	L/kg	[6]			
123-91-1	1,4-Dioxan	3.16E+00	L/kg	[6]			
124-18-5	Decane	1.44E+03	L/kg	[7]			
124-38-9	Carbon dioxide	3.16E+00	L/kg	[6]			
124-48-1	Chlorodibromomethane	1.04E+01	L/kg	[7]			
126-73-8	Tributyl phosphate	2.40E+02	L/kg	[7]			
126-98-7	2-Methyl-2-propenenitrile	3.16E+00	L/kg	[6]			
127-18-4	1,1,2,2-Tetrachloroethene	8.28E+01	L/kg	[7]			
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	5.62E+00	L/kg	[9]			
129-00-0	Pyrene	1.18E+03	L/kg	[7]	3.29E+03	L/kg	[6]
131-11-3	Dimethyl Phthalate	3.17E+00	L/kg	[7]			
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	3.16E+00	L/kg	[9]			
132-64-9	Dibenzofuran	2.97E+02	L/kg	[7]			
133-06-2	Captan	2.86E+01	L/kg	[7]			
1330-20-7	Xylenes (mixed isomers)	5.41E+01	L/kg	[7]			
1336-36-3	Polychlorinated biphenyls	1.39E+04	L/kg	[7]			
134-32-7	alpha-Naphthylamine	3.16E+00	L/kg	[9]			
135-98-8	sec-Butylbenzene	6.59E+02	L/kg	[7]			
13966-29-5	Uranium-234				1.00E+01	L/kg	[5]
13967-48-1	Ruthenium-106				1.00E+01	L/kg	[5]
13967-70-9	Cesium-134				2.00E+03	L/kg	[5]
13968-55-3	Uranium-233				1.00E+01	L/kg	[5]
13981-15-2	Curium-244				3.00E+01	L/kg	[5]

Table 4-4 Bioconcentration and Bioaccumulation Factors for Fish

CAS Registry Number	Constituent Name	Bioconcentration Factor for fish (*BCF*)	Units for Bioconcentration Factor for fish	Reference	Bioaccumulation Factor for fish (*BAF*)	Units for Bioaccumulation Factor for fish	Reference
13981-16-3	Plutonium-238				3.00E+01	L/kg	[5]
13981-37-8	Nickel-63	1.00E+02	L/kg	[13]	1.00E+02	L/kg	[5]
13982-10-0	Plutonium-242				3.00E+01	L/kg	[5]
13982-63-3	Radium-226				5.00E+01	L/kg	[5]
13982-70-2	Uranium-236				1.00E+01	L/kg	[5]
13994-20-2	Neptunium-237				3.00E+01	L/kg	[5]
141-78-6	Acetic acid ethyl ester	3.16E+00	L/kg	[9]			
14119-32-5	Plutonium-241				3.00E+01	L/kg	[5]
14119-33-6	Plutonium-240				3.00E+01	L/kg	[5]
14133-76-7	Technetium-99				2.00E+01	L/kg	[5]
14158-29-3	Uranium-232				1.00E+01	L/kg	[5]
14234-35-6	Antimony-125	1.00E+02	L/kg	[13]	1.00E+02	L/kg	[5]
14265-44-2	Phosphate						
14331-85-2	Protactinium-231				1.00E+01	L/kg	[5]
14336-70-0	Nickel-59	1.00E+02	L/kg	[13]	1.00E+02	L/kg	[5]
14391-16-3	Europium-155				5.00E+01	L/kg	[5]
145-73-3	Endothall	5.90E+00	L/kg	[7]			
14596-10-2	Americium-241				3.00E+01	L/kg	[5]
14683-23-9	Europium-152				5.00E+01	L/kg	[5]
14762-75-5	Carbon-14				5.00E+04		[5]
14797-55-8	Nitrate	1.50E+05	L/kg	[2]	1.50E+05	L/kg	[3]
14797-65-0	Nitrite	1.50E+05	L/kg	[2]	1.50E+05	L/kg	[3]
14808-79-8	Sulfate	1.00E+03	L/kg	[3]	1.00E+03	L/kg	[2]
14952-40-0	Actinium-227				1.50E+01	L/kg	[5]
14993-75-0	Americium-243				3.00E+01	L/kg	[5]
15046-84-1	Iodine-129				4.00E+01	L/kg	[5]
15117-48-3	Plutonium-239				3.00E+01	L/kg	[5]
15117-96-1	Uranium-235				1.00E+01	L/kg	[5]
15262-20-1	Radium-228				5.00E+01	L/kg	[5]
15510-73-3	Curium-242				3.00E+01	L/kg	[5]
15585-10-1	Europium-154				5.00E+01	L/kg	[5]

Table 4-4 Bioconcentration and Bioaccumulation Factors for Fish

CAS Registry Number	Constituent Name	Bioconcentration Factor for fish (*BCF*)	Units for Bioconcentration Factor for fish	Reference	Bioaccumulation Factor for fish (*BAF*)	Units for Bioaccumulation Factor for fish	Reference
15594-54-4	Thorium-229				1.00E+02	L/kg	[5]
156-59-2	cis-1,2-Dichloroethene	5.79E+00	L/kg	[7]			
156-60-5	1,2-trans-Dichloroethene	8.26E+00	L/kg	[7]			
15715-94-3	Samarium-151				2.50E+01		[5]
15751-77-6	Zirconium-93				3.00E+02	L/kg	[5]
15757-87-6	Curium-243				3.00E+01	L/kg	[5]
15758-45-9	Selenium-79	1.70E+02	L/kg	[13]	2.00E+02	L/kg	[5]
15832-50-5	Tin-126				3.00E+03	L/kg	[5]
1634-04-4	Methyl tert-butyl ether	3.16E+00	L/kg	[6]			
16887-00-6	Chloride	5.00E+01	L/kg	[12]	1.00E+03	L/kg	[5]
16984-48-8	Fluoride	1.00E+01	L/kg	[12]	1.00E+01		[5]
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	3.44E+04	L/kg	[10]			
18540-29-9	Chromium(VI)	3.16E+00	L/kg	[10]	2.00E+02	L/kg	[5]
189-55-9	Dibenzo[a,i]pyrene	8.32E+03	L/kg	[16]	1.33E+05	L/kg	[9]
189-64-0	Dibenzo[a,h]pyrene	2.67E+04	L/kg	[8]			
191-24-2	Benzo(g,h,i)perylene	2.54E+04	L/kg	[7]			
191-30-0	Dibenzo(a,l)pyrene	6.88E+03	L/kg	[8]			
192-65-4	Dibenzo[a,e]pyrene	2.67E+04	L/kg	[8]			
192-97-2	Benzo(e)pyrene	1.81E+04	L/kg	[7]			
193-39-5	Indeno(1,2,3-cd)pyrene	2.41E+04	L/kg	[10]	6.18E+05	L/kg	[6]
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	2.51E+04	L/kg	[10]			
205-82-3	Benzo[j]fluoranthene	1.01E+04	L/kg	[7]			
205-99-2	Benzo(b)fluoranthene	1.04E+04	L/kg	[10]	2.06E+05	L/kg	[6]
206-44-0	Fluoranthene	1.41E+03	L/kg	[7]	4.49E+03	L/kg	[6]
207-08-9	Benzo(k)fluoranthene	9.93E+03	L/kg	[10]	1.77E+05	L/kg	[6]
208-96-8	Acenaphthylene	2.16E+02	L/kg	[7]			
218-01-9	Chrysene	4.89E+03	L/kg	[10]	4.99E+04	L/kg	[6]
224-42-0	Dibenz[a,j]acridine	2.02E+04	L/kg	[18]	4.97E+05	L/kg	[11]
2245-38-7	2,3,5-Trimethylnaphthalene	1.01E+03	L/kg	[7]			

Table 4-4 Bioconcentration and Bioaccumulation Factors for Fish

CAS Registry Number	Constituent Name	Bioconcentration Factor for fish (*BCF*)	Units for Bioconcentration Factor for fish	Reference	Bioaccumulation Factor for fish (*BAF*)	Units for Bioaccumulation Factor for fish	Reference
226-36-8	Dibenz[a,h]acridine	3.50E+03	L/kg	[1]	4.97E+05	L/kg	[11]
22967-92-6	Methyl mercury				6.80E+06	L/kg	[6]
23950-58-5	Pronamide	8.73E+01	L/kg	[7]			
24959-67-9	Bromide	4.20E+02	L/kg	[12]	4.20E+02		[5]
27154-33-2	Trichlorofluoroethane	1.68E+01	L/kg	[7]			
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	4.42E+04	L/kg	[8]	1.41E+08		[1]
319-84-6	alpha-BHC	1.68E+02	L/kg	[7]			
319-85-7	beta-BHC	1.68E+02	L/kg	[7]			
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	2.54E+04	L/kg	[7]	1.41E+08		[8]
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	3.38E+04	L/kg	[7]	1.34E+08		[1]
3268-87-9	Octachlorodibenzo(p)dioxin	1.47E+03	L/kg	[10]			
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	1.77E+04	L/kg	[8]			
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	2.75E+03	L/kg	[10]			
3697-24-3	5-Methylchrysene	4.89E+03	L/kg	[17]	4.99E+04	L/kg	[10]
378253-40-8	Barium-137m				4.00E+00	L/kg	[5]
378253-44-2	Cadmium-113m				2.00E+02	L/kg	[5]
378782-82-2	Niobium-93m				3.00E+02	L/kg	[5]
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	9.73E+03	L/kg	[8]			
39001-02-0	Octachlorodibenzofuran	2.75E+03	L/kg	[10]			
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	5.18E+03	L/kg	[10]			
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	1.18E+03	L/kg	[8]			
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	2.59E+04	L/kg	[10]			
4170-30-3	Crotonaldehyde (Propylene aldehyde)	3.16E+00	L/kg	[6]			
41851-50-7	Chlorocyclopentadiene	1.48E+01	L/kg	[7]			

Table 4-4 Bioconcentration and Bioaccumulation Factors for Fish

CAS Registry Number	Constituent Name	Bioconcentration Factor for fish (*BCF*)	Units for Bioconcentration Factor for fish	Reference	Bioaccumulation Factor for fish (*BAF*)	Units for Bioaccumulation Factor for fish	Reference
460-19-5	Cyanogen (oxalonitrile)	3.16E+00	L/kg	[6]	1.50E+05	L/kg	[3]
4786-20-3	2-Butenenitrile	3.16E+00	L/kg	[6]			
50-00-0	Formaldehyde	3.16E+00	L/kg	[6]			
50-32-8	Benzo(a)pyrene	8.32E+03	L/kg	[10]	1.33E+05	L/kg	[6]
506-68-3	Cyanogen bromide (bromocyanide)	3.16E+00	L/kg	[6]	4.20E+02		[5]
506-77-4	Cyanogen chloride	3.16E+00	L/kg	[6]	1.00E+03		[3]
51-28-5	2,4-Dinitrophenol	3.16E+00	L/kg	[9]			
51-79-6	Ethyl carbamate (urethane)	3.16E+00	L/kg	[6]			
510-15-6	Chlorobenzilate	4.54E+02	L/kg	[7]	7.33E+02	L/kg	[6]
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	9.93E+03	L/kg	[10]			
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	1.33E+04	L/kg	[8]			
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	3.99E+00	L/kg	[7]			
53-70-3	Dibenz[a,h]anthracene	2.02E+04	L/kg	[10]	4.97E+05	L/kg	[6]
532-27-4	2-Chloroacetophenone	6.11E+00	L/kg	[7]			
534-52-1	4,6-Dinitro-o-cresol	8.71E+00	L/kg	[7]			
5385-75-1	Dibenzo(a,e)fluoranthene	2.67E+04	L/kg	[8]			
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	6.92E+00	L/kg	[7]			
540-73-8	1,2-Dimethylhydrazine	3.16E+00	L/kg	[6]			
540-84-1	2,2,4-Trimethylpentane	2.81E+02	L/kg	[7]			
541-73-1	1,3-Dichlorobenzene	1.18E+02	L/kg	[7]			
542-75-6	1,3-Dichloropropene	3.40E+00	L/kg	[7]			
542-88-1	Bis(chloromethyl)ether	3.16E+00	L/kg	[6]			
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	1.83E+04	L/kg	[10]			
56-23-5	Carbon tetrachloride	2.86E+01	L/kg	[10]			
56-49-5	3-Methylcholanthrene	1.75E+04	L/kg	[7]			
56-55-3	Benzo(a)anthracene	4.89E+03	L/kg	[10]	4.99E+04	L/kg	[6]
57-12-5	Cyanide	3.16E+00	L/kg	[6]			
57-24-9	Strychnine	6.11E+00	L/kg	[7]			

Table 4-4 Bioconcentration and Bioaccumulation Factors for Fish

CAS Registry Number	Constituent Name	Bioconcentration Factor for fish (*BCF*)	Units for Bioconcentration Factor for fish	Reference	Bioaccumulation Factor for fish (*BAF*)	Units for Bioaccumulation Factor for fish	Reference
57-74-9	Chlordane	1.10E+04	L/kg	[7]	2.43E+04	L/kg	[6]
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	2.02E+04	L/kg	[10]			
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	3.38E+04	L/kg	[10]			
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	4.90E+04	L/kg	[10]			
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	4.42E+04	L/kg	[8]	1.41E+08		[8]
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	2.51E+04	L/kg	[10]			
58-89-9	gamma-BHC (Lindane)	3.07E+02	L/kg	[7]			
58-90-2	2,3,4,6-Tetrachlorophenol	3.16E+00	L/kg	[9]	3.75E+02	L/kg	[6]
581-42-0	2,6-Dimethylnaphthalene	4.16E+02	L/kg	[7]			
584-84-9	2,4-Toluene diisocyanate	6.68E+00	L/kg	[14]			
589-38-8	3-Hexanone	1.80E+00	L/kg	[7]			
59-50-7	4-Chloro-3-methylphenol	3.16E+00	L/kg	[9]			
59-89-2	N-Nitrosomorpholine	3.16E+00	L/kg	[6]			
591-50-4	Benzene, iodo-	6.35E+01	L/kg	[7]			
591-78-6	2-Hexanone	2.30E+00	L/kg	[7]			
593-60-2	Bromoethene (Vinyl bromide)	3.23E+00	L/kg	[7]			
593-74-8	Dimethyl Mercury	1.97E+01	L/kg	[7]			
60-11-7	Dimethyl aminoazobenzene	6.71E+02	L/kg	[7]			
60-29-7	Ethyl ether	3.16E+00	L/kg	[6]			
60-35-5	Acetamide	3.16E+00	L/kg	[6]			
602-87-9	5-Nitroacenaphthene	1.84E+02	L/kg	[7]			
606-20-2	2,6-Dinitrotoluene	4.21E+00	L/kg	[10]			
608-93-5	Pentachlorobenzene	1.91E+03	L/kg	[10]	8.00E+03	L/kg	[6]
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	4.90E+04	L/kg	[10]			
61626-71-9	Dichloropentadiene	1.48E+01	L/kg	[7]			
62-50-0	Ethyl methanesulfonate	3.16E+00	L/kg	[6]			
62-53-3	Aniline	3.16E+00	L/kg	[6]			
62-75-9	N-Nitroso-N,N-dimethylamine	2.60E-02	L/kg	[11]			
621-64-7	N-Nitroso-di-n-propylamine	3.16E+00	L/kg	[9]			

Table 4-4 Bioconcentration and Bioaccumulation Factors for Fish

CAS Registry Number	Constituent Name	Bioconcentration Factor for fish (*BCF*)	Units for Bioconcentration Factor for fish	Reference	Bioaccumulation Factor for fish (*BAF*)	Units for Bioaccumulation Factor for fish	Reference
624-83-9	Methyl isocyanate	3.16E+00	L/kg	[15]			
628-73-9	Hexanenitrile	3.79E+00	L/kg	[7]			
630-08-0	Carbon monoxide	4.68E+00	L/kg	[7]			
630-20-6	1,1,1,2-Tetrachloroethane	4.30E+01	L/kg	[7]			
64-18-6	Formic acid (methanoic acid)	3.16E+00	L/kg	[9]			
65-85-0	Benzoic acid	3.16E+00	L/kg	[9]			
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	4.42E+04	L/kg	[8]	1.41E+08		[8]
67-56-1	Methyl alcohol	3.16E+00	L/kg	[6]			
67-63-0	2-Propyl alcohol	3.16E+00	L/kg	[6]			
67-64-1	2-Propanone (Acetone)	3.16E+00	L/kg	[6]			
67-66-3	Chloroform	6.92E+00	L/kg	[10]			
67-72-1	Hexachloroethane	2.12E+02	L/kg	[7]			
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	1.83E+04	L/kg	[10]			
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	3.76E+04	L/kg	[1]			
70-30-4	Hexachlorophene	4.68E+03	L/kg	[10]	7.84E+04	L/kg	[6]
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	4.42E+04	L/kg	[8]	1.41E+08		[8]
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	4.90E+04	L/kg	[10]			
71-36-3	n-Butyl alcohol	3.16E+00	L/kg	[6]			
71-43-2	Benzene	8.26E+00	L/kg	[7]			
71-55-6	1,1,1-Trichloroethane	1.68E+01	L/kg	[7]			
72-43-5	Methoxychlor	9.91E+02	L/kg	[7]	2.43E+03	L/kg	[6]
72-55-9	4,4-DDE	4.89E+03	L/kg	[10]	4.99E+04	L/kg	[6]
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	4.90E+04	L/kg	[10]			
74-83-9	Bromomethane	1.65E+00	L/kg	[7]			
74-87-3	Chloromethane	3.16E+00	L/kg	[6]			
74-88-4	Iodomethane	2.90E+00	L/kg	[7]			
74-95-3	Methylene bromide	3.00E+00	L/kg	[7]			
74-97-5	Bromochloromethane	2.43E+00	L/kg	[7]			

Table 4-4 Bioconcentration and Bioaccumulation Factors for Fish

CAS Registry Number	Constituent Name	Bioconcentration Factor for fish (*BCF*)	Units for Bioconcentration Factor for fish	Reference	Bioaccumulation Factor for fish (*BAF*)	Units for Bioaccumulation Factor for fish	Reference
7429-90-5	Aluminum				5.00E+02	L/kg	[5]
7439-89-6	Iron				2.00E+02	L/kg	[5]
7439-92-1	Lead	9.00E-02	L/kg	[10]	3.00E+02	L/kg	[5]
7439-93-2	Lithium						
7439-95-4	Magnesium						
7439-96-5	Manganese				4.00E+02	L/kg	[5]
7439-97-6	Mercury				1.00E+03	L/kg	[5]
7439-98-7	Molybdenum				1.00E+01	L/kg	[5]
7440-02-0	Nickel	7.80E+01	L/kg	[10]	1.00E+02	L/kg	[5]
7440-16-6	Rhodium				1.00E+01		[5]
7440-22-4	Silver	8.77E+01	L/kg	[10]	5.00E+00	L/kg	[5]
7440-23-5	Sodium				2.00E+01	L/kg	[5]
7440-24-6	Strontium (total)	3.16E+00	L/kg	[6]	6.00E+01	L/kg	[5]
7440-25-7	Tantalum				1.00E+02		[5]
7440-28-0	Thallium	1.00E+04	L/kg	[10]	1.00E+04	L/kg	[5]
7440-29-1	Thorium-232				1.00E+01	L/kg	[5]
7440-31-5	Tin				3.00E+03	L/kg	[5]
7440-33-7	Tungsten				1.20E+03	L/kg	[5]
7440-36-0	Antimony	4.00E+01	L/kg	[10]	1.00E+02	L/kg	[5]
7440-38-2	Arsenic	1.14E+02	L/kg	[10]	3.00E+02	L/kg	[5]
7440-39-3	Barium	3.16E+00	L/kg	[6]	4.00E+00	L/kg	[5]
7440-41-7	Beryllium	6.20E+01	L/kg	[10]	1.00E+02	L/kg	[5]
7440-43-9	Cadmium	9.07E+02	L/kg	[10]	2.00E+02	L/kg	[5]
7440-47-3	Chromium	3.16E+00	L/kg	[6]			
7440-48-4	Cobalt				3.00E+02	L/kg	[5]
7440-50-8	Copper	2.00E+02	L/kg	[13]	2.00E+02	L/kg	[5]
7440-61-1	Uranium				1.00E+01	L/kg	[5]
7440-61-1R	Uranium-238				1.30E+02	L/kg	[7]
7440-62-2	Vanadium						
7440-65-5	Yttrium				3.00E+01		[5]
7440-66-6	Zinc	2.06E+03	L/kg	[10]	1.00E+03	L/kg	[5]

Table 4-4 Bioconcentration and Bioaccumulation Factors for Fish

CAS Registry Number	Constituent Name	Bioconcentration Factor for fish (*BCF*)	Units for Bioconcentration Factor for fish	Reference	Bioaccumulation Factor for fish (*BAF*)	Units for Bioaccumulation Factor for fish	Reference
7440-67-7	Zirconium				3.00E+02	L/kg	[5]
7446-09-5	Sulfur dioxide	3.16E+00	L/kg	[6]			
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	4.73E+04	L/kg	[7]	1.41E+08		[8]
7487-94-7	Mercuric chloride (HgCl2)				0.00E+00	L/kg	[6]
75-00-3	Chloroethane	2.39E+00	L/kg	[7]			
75-01-4	1-Chloroethene	2.39E+00	L/kg	[7]			
75-02-5	Fluoroethene (vinyl fluoride)	1.65E+00	L/kg	[7]			
75-05-8	Acetonitrile	3.16E+00	L/kg	[6]			
75-07-0	Acetaldehyde	3.16E+00	L/kg	[6]			
75-09-2	Dichloromethane (Methylene Chloride)	2.00E+00	L/kg	[7]			
75-15-0	Carbon disulfide	9.86E+00	L/kg	[7]			
75-21-8	Ethylene oxide (Oxirane)	3.16E+00	L/kg	[6]			
75-25-2	Bromoform	1.33E+01	L/kg	[7]			
75-27-4	Bromodichloromethane	8.26E+00	L/kg	[7]			
75-29-6	2-Chloropropane	5.79E+00	L/kg	[7]			
75-34-3	1,1-Dichloroethane	4.85E+00	L/kg	[7]			
75-35-4	1,1-Dichloroethene	8.26E+00	L/kg	[7]			
75-44-5	Phosgene (hydrogen phosphide)	3.16E+00	L/kg	[6]			
75-45-6	Chlorodifluoromethane	1.35E+00	L/kg	[7]			
75-50-3	Trimethylamine	3.16E+00	L/kg	[9]			
75-69-4	Trichlorofluoromethane	1.68E+01	L/kg	[7]			
75-71-8	Dichlorodifluoromethane	9.19E+00	L/kg	[7]			
76-01-7	Pentachloroethane	6.02E+01	L/kg	[7]			
76-13-1	1,2,2-Trichlorotrifluoroethane	5.41E+01	L/kg	[7]			
76-44-8	Heptachlor	4.08E+02	L/kg	[10]	6.09E+02	L/kg	[6]
764-41-0	1,4-Dichloro-2-butene	2.00E+01	L/kg	[7]			
7647-01-0	Hydrogen chloride	3.16E+00	L/kg	[10]	1.00E+03	L/kg	[4]
765-34-4	Glycidylaldehyde	3.16E+00	L/kg	[6]			
7664-39-3	Hydrogen Fluoride	3.16E+00	L/kg	[6]			

Table 4-4 Bioconcentration and Bioaccumulation Factors for Fish

CAS Registry Number	Constituent Name	Bioconcentration Factor for fish (*BCF*)	Units for Bioconcentration Factor for fish	Reference	Bioaccumulation Factor for fish (*BAF*)	Units for Bioaccumulation Factor for fish	Reference
7664-41-7	Ammonia/Ammonium	3.16E+00	L/kg	[6]			
77-47-4	Hexachlorocyclopentadiene	1.52E+03	L/kg	[10]	5.52E+03	L/kg	[6]
77-78-1	Dimethyl sulfate	1.56E+00	L/kg	[7]			
7704-34-9	Total Sulfur (thermodynamically stable)	1.00E+03	L/kg	[5]			
7723-14-0	Phosphorus	3.16E+00	L/kg	[6]	5.00E+04	L/kg	[2]
7782-41-4	Fluorine gas F2	1.00E+01	L/kg	[5]	1.00E+01	L/kg	[2]
7782-49-2	Selenium	1.29E+02	L/kg	[10]	2.00E+02	L/kg	[2]
7782-50-5	Chlorine	3.16E+00	L/kg	[6]	1.00E+03		[5]
78-83-1	2-Methylpropyl alcohol	3.16E+00	L/kg	[6]			
78-87-5	1,2-Dichloropropane	6.92E+00	L/kg	[7]			
78-93-3	2-Butanone	3.16E+00	L/kg	[6]			
79-00-5	1,1,2-Trichloroethane	6.92E+00	L/kg	[7]			
79-01-6	1,1,2-Trichloroethylene	1.41E+01	L/kg	[7]			
79-10-7	2-Propenoic acid	3.16E+00	L/kg	[9]			
79-34-5	1,1,2,2-Tetrachloroethane	1.41E+01	L/kg	[7]			
79-46-9	2-Nitropropane	3.16E+00	L/kg	[6]			
80-62-6	Methyl methacrylate	2.30E+00	L/kg	[7]			
82-68-8	Pentachloronitrobenzene (PCNB)	7.46E+02	L/kg	[10]	1.62E+03	L/kg	[6]
822-06-0	Hexamethylene-1,5-diisocyanate	5.81E+01	L/kg	[7]			
823-40-5	Toluene-2,6-diamine	3.16E+00	L/kg	[9]			
83-32-9	Acenaphthene	2.01E+02	L/kg	[7]			
832-69-9	1-Methylphenanthrene	1.63E+03	L/kg	[7]			
84-66-2	Diethyl phthalate	1.68E+01	L/kg	[7]			
84-74-2	Di-n-butylphthalate	8.30E+02	L/kg	[7]	1.80E+03	L/kg	[6]
85-01-8	Phenanthrene	5.82E+02	L/kg	[7]	1.03E+03	L/kg	[6]
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	3.16E+00	L/kg	[6]			
85-68-7	Butylbenzylphthalate	1.18E+03	L/kg	[7]	3.29E+03	L/kg	[6]
86-73-7	Fluorene	3.42E+02	L/kg	[7]	4.72E+02	L/kg	[6]
87-61-6	1,2,3-Trichlorobenzene	2.62E+02	L/kg	[7]	3.45E+02	L/kg	[6]

Table 4-4 Bioconcentration and Bioaccumulation Factors for Fish

CAS Registry Number	Constituent Name	Bioconcentration Factor for fish (*BCF*)	Units for Bioconcentration Factor for fish	Reference	Bioaccumulation Factor for fish (*BAF*)	Units for Bioaccumulation Factor for fish	Reference
87-68-3	Hexachlorobutadiene	9.91E+02	L/kg	[10]	2.43E+03	L/kg	[6]
87-86-5	Pentachlorophenol	6.71E+02	L/kg	[10]	2.45E+03	L/kg	[6]
88-06-2	2,4,6-Trichlorophenol	3.16E+00	L/kg	[9]			
88-74-4	o-Nitroaniline (2-nitroaniline)	5.30E+00	L/kg	[7]			
88-75-5	2-Nitrophenol	3.16E+00	L/kg	[9]			
90-04-0	o-Anisidine	1.62E+00	L/kg	[7]			
90-12-0	1-Methylnaphthalene	1.91E+02	L/kg	[7]			
91-20-3	Naphthalene	6.93E+01	L/kg	[7]			
91-22-5	Quinoline	7.30E+00	L/kg	[7]			
91-57-6	2-Methylnaphthalene	1.87E+02	L/kg	[7]			
91-58-7	2-Chloronaphthalene	7.99E+01	L/kg	[7]			
91-94-1	3,3'-Dichlorobenzidine	1.01E+02	L/kg	[7]			
92-52-4	1,1`-Biphenyl	2.44E+02	L/kg	[7]			
924-16-3	N-Nitroso-di-n-Buetylamine	3.16E+00	L/kg	[9]			
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	2.23E+01	L/kg	[7]			
94-75-7	2,4-D	2.91E+01	L/kg	[7]			
95-48-7	o-Cresol	6.33E+00	L/kg	[7]			
95-49-8	o-Chlorotoluene	8.58E+01	L/kg	[7]			
95-50-1	1,2-Dichlorobenzene	7.99E+01	L/kg	[7]			
95-53-4	o-Toluidine	2.07E+00	L/kg	[7]			
95-57-8	2-Chlorophenol	3.16E+00	L/kg	[9]			
95-63-6	1,2,4-Trimethyl benzene	1.24E+02	L/kg	[7]			
95-94-3	1,2,4,5-Tetrachlorobenzene	9.91E+02	L/kg	[7]	2.43E+03	L/kg	[6]
95-95-4	2,4,5-Trichlorophenol	3.16E+00	L/kg	[9]			
96-12-8	1,2-Dibromo-3-chloropropane	1.18E+01	L/kg	[7]			
96-18-4	1,2,3-Trichloropropane	6.92E+00	L/kg	[7]			
96-45-7	Ethylene thiourea	3.16E+00	L/kg	[6]			
97-63-2	Ethyl methacrylate	6.22E+00	L/kg	[7]			
98-01-1	Furfural	3.16E+00	L/kg	[6]			
98-06-6	tert-Butyl benzene	2.92E+02	L/kg	[7]			

Table 4-4 Bioconcentration and Bioaccumulation Factors for Fish

CAS Registry Number	Constituent Name	Bioconcentration Factor for fish (*BCF*)	Units for Bioconcentration Factor for fish	Reference	Bioaccumulation Factor for fish (*BAF*)	Units for Bioaccumulation Factor for fish	Reference
98-07-7	Benzotrichloride	2.01E+02	L/kg	[7]			
98-82-8	Cumene	1.41E+02	L/kg	[7]			
98-83-9	Methyl styrene (mixed isomers)	9.54E+01	L/kg	[7]			
98-86-2	Acetophenone	3.29E+00	L/kg	[7]			
98-95-3	Nitrobenzene	5.30E+00	L/kg	[10]			
99-35-4	1,3,5-Trinitrobenzene	1.67E+00	L/kg	[7]			
99-65-0	1,3-Dinitrobenzene	2.85E+00	L/kg	[10]			
99-87-6	p-Cymene	2.86E+02	L/kg	[7]			

Reference **Reference (source) for Bioconcentration Factor for Fish**

[1] 64 FR 688. 1999. "40 CFR Part 372: Persistent Bioaccumulative Toxic (PBT) Chemicals; Proposed Rule," Federal Register, Vol 64, No. 2, January 5, 1999.

[2] ANL. 2001. *User's Manual for RESRAD Version 6*, ANL/EAD-4, Environmental Assessment Division, Argonne National Laboratory, Argonne, IL (elemental nitrogen).

[3] ANL. 2001. *User's Manual for RESRAD Version 6*, ANL/EAD-4, Environmental Assessment Division, Argonne National Laboratory, Argonne, IL (elemental sulfur).

[4] ANL. 2001. *User's Manual for RESRAD Version 6*, ANL/EAD-4, Environmental Assessment Division, Argonne National Laboratory, Argonne, IL (nitrogen only).

[5] ANL. 2001. *User's Manual for RESRAD Version 6*, ANL/EAD-4, Environmental Assessment Division, Argonne National Laboratory, Argonne, IL.

[6] Calculated value per Eq. A-2-27 in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm).

[7] Calculated value per Eq. A-2-28 in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm).

[8] Calculated value per Eq. A-2-29 in EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm).

[9] EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, Final, EPA/530/R-05/006. US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm, calculated value per Eq. A-2-3).

[10] EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013).

Reference	Reference (source) for Bioconcentration Factor for Fish
[11]	Ecology. *Cleanup Levels and Risk Calculations (CLARC) database* (https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx, accessed May 2014).
[12]	NRC. 1992. *Residual Radioactive Contamination from Decomissioning - Technical Basis for Translating Contamination Levels to Annual Total Effective Dose Equivalant: Final Report*, NUREG/CR-5512V1, PNL 7994, Pacific Northwest Laboratory, Richland, Washington.
[13]	Staven LH, Rhoads K, Napier BA, Strenge DL. 2003. *A Compendium of Transfer Factors for Agricultural and Animal Products*, PNNL-13421, Pacific Northwest National Laboratory, Richland, WA.
[14]	Surrogate value from 2,4-Dinitrotoluene.
[15]	Surrogate value from Acrylonitrile.
[16]	Surrogate value from Benzo(a)pyrene.
[17]	Surrogate value from Chrysene.
[18]	Surrogate value from Dibenz[a,h]anthracene.

Reference	Reference (source) for bioaccum. factor for analyte in fish
[1]	64 FR 688. 1999. "40 CFR Part 372: Persistent Bioaccumulative Toxic (PBT) Chemicals; Proposed Rule," Federal Register, Vol 64, No. 2, January 5, 1999.
[2]	ANL. 2001. *User's Manual for RESRAD Version 6*, ANL/EAD-4, Environmental Assessment Division, Argonne National Laboratory, Argonne, IL (Table D-5).
[3]	ANL. 2001. *User's Manual for RESRAD Version 6*, ANL/EAD-4, Environmental Assessment Division, Argonne National Laboratory, Argonne, IL (Table D-5, elemental nitrogen).
[4]	ANL. 2001. *User's Manual for RESRAD Version 6*, ANL/EAD-4, Environmental Assessment Division, Argonne National Laboratory, Argonne, IL (elemental chlorine).
[5]	ANL. 2001. *User's Manual for RESRAD Version 6*, ANL/EAD-4, Environmental Assessment Division, Argonne National Laboratory, Argonne, IL.
[6]	EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013).
[7]	ORNL. *The Risk Assessment Information System (RAIS) Database*. Copyright © 2013 Oak Ridge National Laboratory and The University of Tennessee, Oak Ridge, TN (http://rais.ornl.gov, accessed April 2014).
[8]	Surrogate value from 2,3',4,4',5-Pentachlorobiphenyl (PCB 118).
[9]	Surrogate value from Benzo(a)pyrene.
[10]	Surrogate value from Chrysene.
[11]	Surrogate value from Dibenz[a,h]anthracene.

Table 4-5 provides data for fish biota-sediment accumulation factor (BSAF) as used for the transfer of lipophilic contaminants (PCBs, dioxins, and furans in river sediment) from the bottom sediment to the lipid in fish. The BSAF is the ratio of concentration of the contaminant in lipid tissue to the concentration in the river sediment (which yields a unitless parameter). Refer to Section 7.1.7.5 of the RAWP for additional details. Blank entries in the table indicate where data are not available.

Table 4-5 Biota-Sediment Accumulation Factor for Fish

CAS Registry Number	Constituent Name	Toxicity Equivalence Factor group	Biota-sediment accumulation factor (*BSAF*)	Units for Biota-sediment Accumulation factor	Reference
1336-36-3	Polychlorinated biphenyls		3.00E+01	L/kg	[2]
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	TCDD	9.00E-02	L/kg	[1]
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	TCDD	4.00E-02	L/kg	[1]
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	PCB	1.90E+02	L/kg	[2]
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	PCB	2.20E+01	L/kg	[2]
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	PCB	1.30E+02	L/kg	[2]
3268-87-9	Octachlorodibenzo(p)dioxin	TCDD	1.00E-04	L/kg	[1]
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	PCB	3.90E+01	L/kg	[2]
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	TCDD	5.00E-03	L/kg	[1]
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	PCB	2.19E+02	L/kg	[2]
39001-02-0	Octachlorodibenzofuran	TCDD	1.00E-04	L/kg	[1]
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	TCDD	4.00E-02	L/kg	[1]
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	PCB	6.20E+01	L/kg	[2]
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	TCDD	9.00E-02	L/kg	[1]
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	TCDD	9.00E-02	L/kg	[1]
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	PCB	2.28E+02	L/kg	[2]
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	TCDD	5.00E-03	L/kg	[1]
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	TCDD	9.00E-02	L/kg	[1]
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	TCDD	9.00E-02	L/kg	[1]
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	TCDD	4.00E-02	L/kg	[1]
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	PCB	7.10E+01	L/kg	[2]
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	TCDD	4.00E-02	L/kg	[1]
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	TCDD	4.00E-02	L/kg	[1]
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	PCB	2.83E+02	L/kg	[2]
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	TCDD	5.00E-03	L/kg	[1]
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	PCB	1.67E+02	L/kg	[2]
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	PCB	2.70E+01	L/kg	[2]
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	TCDD	4.00E-02	L/kg	[1]

Table 4-5 Biota-Sediment Accumulation Factor for Fish

CAS Registry Number	Constituent Name	Toxicity Equivalence Factor group	Biota-sediment accumulation factor (*BSAF*)	Units for Biota-sediment Accumulation factor	Reference
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	TCDD	4.00E-02	L/kg	[1]
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	PCB	2.67E+02	L/kg	[2]

Reference	Reference (source) for biota-sediment accumulation factor
[1]	Default value from Section A2-2.13.4.3 of EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA/530/R-05/006, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/risk.htm).
[2]	*U.S. Army Corps of Engineers BSAF database*, U.S. Army Engineer Research and Development Center, Waterways Experiment Station, Environmental Laboratory (CEERD-EP-R), Vicksburg, MS (http://el.erdc.usace.army.mil/bsaf/bsaf.html, accessed July 2006) (max BSAF value reported for congener).

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5 Human Toxicological Data

Table 5-1 provides the Inhalation Chronic Reference Concentration (RfC) and Oral Chronic Reference Dose (RfD_o) for assessment of the non-cancer toxic effects due to the inhalation or ingestion of contaminants, respectively. Note that the comparison of the exposure concentration to the inhalation unit risk (Table 5-3) is the preferred method of assessing inhalation risks over the use of the RfC. Blank entries in the table indicate where data are not available.

Table 5-1 Inhalation Reference Concentration and Oral Reference Dose

CAS Registry Number	Constituent Name	Inhalation Chronic Reference Concentration (*RfC*)	Units for Inhalation Chronic Reference Concentration	Reference	Oral Chronic Reference Dose (RfD_o)	Units for Oral Chronic Reference Dose	Reference
100-02-7	p-Nitrophenol				8.00E-03	mg/(kg·d)	[3]
100-21-0	Phthalic acid				1.00E+00	mg/(kg·d)	[6]
100-25-4	1,4-Dinitrobenzene				1.00E-04	mg/(kg·d)	[6]
100-40-3	4-Ethenylcyclohexene						
100-41-4	Ethyl benzene	1.00E+00	mg/m^3	[4]	1.00E-01	mg/(kg·d)	[6]
100-42-5	Styrene	1.00E+00	mg/m^3	[4]	2.00E-01	mg/(kg·d)	[6]
100-44-7	Benzyl chloride	1.00E-03	mg/m^3	[4]	2.00E-03	mg/(kg·d)	[6]
100-47-0	Benzonitrile						
100-51-6	Benzyl alcohol				1.00E-01	mg/(kg·d)	[6]
100-52-7	Benzaldehyde				1.00E-01	mg/(kg·d)	[6]
10028-15-6	Ozone						
10061-01-5	cis-1,3-Dichloropropene				2.00E-03	mg/(kg·d)	[17]
10061-02-6	trans-1,3-Dichloropropene						
101-55-3	4-Bromophenylphenyl ether						
101-77-9	4,4-Methylenedianiline	2.00E-02	mg/m^3	[4]			
10102-44-0	Nitrogen dioxide						
103-65-1	n-Propyl benzene (Isocumene)	1.00E+00	mg/m^3	[4]	1.00E-01	mg/(kg·d)	[6]
104-51-8	n-Butylbenzene				5.00E-02	mg/(kg·d)	[6]
104-76-7	2-Ethyl-1-hexanol						
105-67-9	2,4-Dimethylphenol				2.00E-02	mg/(kg·d)	[6]
106-43-4	4-Chlorotoluene (p-Tolyl chloride)				2.00E-02	mg/(kg·d)	[6]
106-44-5	p-Cresol (4-methyl phenol)	6.00E-01	mg/m^3	[4]	1.00E-01	mg/(kg·d)	[6]

Table 5-1 Inhalation Reference Concentration and Oral Reference Dose

CAS Registry Number	Constituent Name	Inhalation Chronic Reference Concentration (*RfC*)	Units for Inhalation Chronic Reference Concentration	Reference	Oral Chronic Reference Dose (RfD_o)	Units for Oral Chronic Reference Dose	Reference
106-46-7	1,4-Dichlorobenzene	8.00E-01	mg/m^3	[4]	7.00E-02	mg/(kg·d)	[6]
106-47-8	p-Chloroaniline				4.00E-03	mg/(kg·d)	[6]
106-51-4	Quinone						
106-88-7	1,2-Epoxybutane	2.00E-02	mg/m^3	[4]			
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	1.00E-03	mg/m^3	[4]	6.00E-03	mg/(kg·d)	[6]
106-93-4	Ethylene dibromide	9.00E-03	mg/m^3	[4]	9.00E-03	mg/(kg·d)	[6]
106-99-0	1,3-Butadiene	2.00E-03	mg/m^3	[4]			
107-02-8	Acrolein	2.00E-05	mg/m^3	[4]	5.00E-04	mg/(kg·d)	[6]
107-05-1	3-Chloropropene	1.00E-03	mg/m^3	[4]			
107-06-2	1,2-Dichloroethane	7.00E-03	mg/m^3	[4]	6.00E-03	mg/(kg·d)	[6]
107-12-0	Propionitrile						
107-13-1	Acrylonitrile	2.00E-03	mg/m^3	[4]	4.00E-02	mg/(kg·d)	[6]
107-19-7	Propargyl alcohol				2.00E-03	mg/(kg·d)	[6]
107-21-1	Ethylene glycol (1,2-ethanediol)	4.00E-01	mg/m^3	[4]	2.00E+00	mg/(kg·d)	[6]
107-98-2	Propylene glycol monomethyl ether	2.00E+00	mg/m^3	[4]	7.00E-01	mg/(kg·d)	[6]
108-05-4	Acetic acid vinyl ester	2.00E-01	mg/m^3	[4]	1.00E+00	mg/(kg·d)	[6]
108-10-1	4-Methyl-2-pentanone	3.00E+00	mg/m^3	[4]	8.00E-02	mg/(kg·d)	[5]
108-39-4	m-Cresol	6.00E-01	mg/m^3	[4]	5.00E-02	mg/(kg·d)	[6]
108-60-1	bis (2-Chloroisopropyl)ether				4.00E-02	mg/(kg·d)	[6]
108-67-8	1,3,5-Trimethylbenzene	6.00E-03	mg/m^3	[6]	1.00E-02	mg/(kg·d)	[6]
108-86-1	Bromobenzene (Phenyl bromide)	6.00E-02	mg/m^3	[4]	8.00E-03	mg/(kg·d)	[6]
108-87-2	Methylcyclohexane	3.00E+00	mg/m^3	[6]			
108-88-3	Toluene	5.00E+00	mg/m^3	[4]	8.00E-02	mg/(kg·d)	[6]
108-90-7	Chlorobenzene	5.00E-02	mg/m^3	[4]	2.00E-02	mg/(kg·d)	[6]
108-94-1	Cyclohexanone	7.00E-01	mg/m^3	[4]	5.00E+00	mg/(kg·d)	[6]
108-95-2	Phenol	2.00E-01	mg/m^3	[4]	3.00E-01	mg/(kg·d)	[6]
109-74-0	n-Butanenitrile						
109-75-1	3-Butenenitrile						
109-77-3	Malononitrile				1.00E-04	mg/(kg·d)	[6]

Table 5-1 Inhalation Reference Concentration and Oral Reference Dose

CAS Registry Number	Constituent Name	Inhalation Chronic Reference Concentration (*RfC*)	Units for Inhalation Chronic Reference Concentration	Reference	Oral Chronic Reference Dose (RfD_o)	Units for Oral Chronic Reference Dose	Reference
109-86-4	2-Methoxyethanol	2.00E-02	mg/m^3	[4]	5.00E-03	mg/(kg·d)	[6]
109-99-9	Tetrahydrofuran	2.00E+00	mg/m^3	[4]	9.00E-01	mg/(kg·d)	[6]
110-00-9	Furan				1.00E-03	mg/(kg·d)	[6]
110-54-3	n-Hexane	7.00E-01	mg/m^3	[4]	6.00E-02	mg/(kg·d)	[5]
110-59-8	Pentanenitrile						
110-80-5	2-Ethoxyethanol	2.00E-01	mg/m^3	[4]	9.00E-02	mg/(kg·d)	[6]
110-82-7	Cyclohexane	6.00E+00	mg/m^3	[4]			
110-83-8	Cyclohexene	1.00E+00	mg/m^3	[4]	5.00E-03	mg/(kg·d)	[6]
110-86-1	Pyridine				1.00E-03	mg/(kg·d)	[6]
111-15-9	Ethylene glycol monoethyl ether acetate	6.00E-02	mg/m^3	[4]	1.00E-01	mg/(kg·d)	[6]
111-65-9	n-Octane				3.00E-02	mg/(kg·d)	[10]
111-76-2	2-Butoxyethanol	1.60E+00	mg/m^3	[4]	1.00E-01	mg/(kg·d)	[6]
111-84-2	n-Nonane	2.00E-02	mg/m^3	[4]	3.00E-04	mg/(kg·d)	[6]
111-91-1	Bis(2-chloroethoxy)methane				3.00E-03	mg/(kg·d)	[6]
112-30-1	1-Decanol						
112-31-2	Decanal						
112-40-3	Dodecane						
1120-21-4	Undecane						
117-81-7	Bis(2-ethylhexyl) phthalate				2.00E-02	mg/(kg·d)	[6]
117-84-0	Di-n-octylphthalate				1.00E-02	mg/(kg·d)	[6]
118-74-1	Hexachlorobenzene				8.00E-04	mg/(kg·d)	[6]
120-12-7	Anthracene				3.00E-01	mg/(kg·d)	[6]
120-82-1	1,2,4-Trichlorobenzene	2.00E-03	mg/m^3	[4]	1.00E-02	mg/(kg·d)	[6]
120-83-2	2,4-Dichlorophenol				3.00E-03	mg/(kg·d)	[6]
121-14-2	2,4-Dinitrotoluene				2.00E-03	mg/(kg·d)	[6]
122-39-4	N,N-Diphenylamine				2.50E-02	mg/(kg·d)	[6]
123-33-1	Maleic hydrazide				5.00E-01	mg/(kg·d)	[6]
123-38-6	Propionaldehyde	8.00E-03	mg/m^3	[4]	5.70E+00	mg/(kg·d)	[9]
123-72-8	Butanal						
123-91-1	1,4-Dioxan	3.00E-02	mg/m^3	[4]	3.00E-02	mg/(kg·d)	[6]

Table 5-1 Inhalation Reference Concentration and Oral Reference Dose

CAS Registry Number	Constituent Name	Inhalation Chronic Reference Concentration (*RfC*)	Units for Inhalation Chronic Reference Concentration	Reference	Oral Chronic Reference Dose (RfD_o)	Units for Oral Chronic Reference Dose	Reference
124-18-5	Decane						
124-38-9	Carbon dioxide						
124-48-1	Chlorodibromomethane				2.00E-02	mg/(kg·d)	[6]
126-73-8	Tributyl phosphate				1.00E-02	mg/(kg·d)	[6]
126-98-7	2-Methyl-2-propenenitrile	3.00E-02	mg/m^3	[4]	1.00E-04	mg/(kg·d)	[6]
127-18-4	1,1,2,2-Tetrachloroethene	4.00E-02	mg/m^3	[4]	6.00E-03	mg/(kg·d)	[6]
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol				3.00E-01	mg/(kg·d)	[6]
129-00-0	Pyrene				3.00E-02	mg/(kg·d)	[6]
131-11-3	Dimethyl Phthalate						
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol				2.00E-03	mg/(kg·d)	[6]
132-64-9	Dibenzofuran				1.00E-03	mg/(kg·d)	[6]
133-06-2	Captan				1.30E-01	mg/(kg·d)	[6]
1330-20-7	Xylenes (mixed isomers)	1.00E-01	mg/m^3	[4]	2.00E-01	mg/(kg·d)	[6]
1336-36-3	Polychlorinated biphenyls				2.00E-05	mg/(kg·d)	[14]
134-32-7	alpha-Naphthylamine						
135-98-8	sec-Butylbenzene				1.00E-01	mg/(kg·d)	[6]
141-78-6	Acetic acid ethyl ester	7.00E-02	mg/m^3	[4]	9.00E-01	mg/(kg·d)	[6]
14265-44-2	Phosphate						
145-73-3	Endothall				2.00E-02	mg/(kg·d)	[6]
14797-55-8	Nitrate				1.60E+00	mg/(kg·d)	[6]
14797-65-0	Nitrite				1.00E-01	mg/(kg·d)	[6]
14808-79-8	Sulfate						
156-59-2	cis-1,2-Dichloroethene				2.00E-03	mg/(kg·d)	[6]
156-60-5	1,2-trans-Dichloroethene	6.00E-02	mg/m^3	[3]	2.00E-02	mg/(kg·d)	[6]
1634-04-4	Methyl tert-butyl ether	3.00E+00	mg/m^3	[4]			
16887-00-6	Chloride						
16984-48-8	Fluoride	1.30E-02	mg/m^3	[4]	4.00E-02	mg/(kg·d)	[6]
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	4.00E-08	mg/m^3	[4]	7.00E-10	mg/(kg·d)	[6]
18540-29-9	Chromium(VI)	1.00E-04	mg/m^3	[4]	3.00E-03	mg/(kg·d)	[6]

Table 5-1 Inhalation Reference Concentration and Oral Reference Dose

CAS Registry Number	Constituent Name	Inhalation Chronic Reference Concentration (*RfC*)	Units for Inhalation Chronic Reference Concentration	Reference	Oral Chronic Reference Dose (RfD_o)	Units for Oral Chronic Reference Dose	Reference
191-24-2	Benzo(g,h,i)perylene						
192-97-2	Benzo(e)pyrene						
206-44-0	Fluoranthene				4.00E-02	mg/(kg·d)	[6]
208-96-8	Acenaphthylene						
2245-38-7	2,3,5-Trimethylnaphthalene						
22967-92-6	Methyl mercury				1.00E-04	mg/(kg·d)	[6]
23950-58-5	Pronamide				7.50E-02	mg/(kg·d)	[6]
24959-67-9	Bromide						
27154-33-2	Trichlorofluoroethane	7.00E-01	mg/m^3	[8]	3.00E-01	mg/(kg·d)	[16]
319-84-6	alpha-BHC				8.00E-03	mg/(kg·d)	[6]
4170-30-3	Crotonaldehyde (Propylene aldehyde)						
41851-50-7	Chlorocyclopentadiene						
460-19-5	Cyanogen (oxalonitrile)				1.00E-03	mg/(kg·d)	[6]
4786-20-3	2-Butenenitrile						
50-00-0	Formaldehyde	9.80E-03	mg/m^3	[4]	2.00E-01	mg/(kg·d)	[6]
506-68-3	Cyanogen bromide (bromocyanide)				9.00E-02	mg/(kg·d)	[6]
506-77-4	Cyanogen chloride				5.00E-02	mg/(kg·d)	[6]
51-28-5	2,4-Dinitrophenol				2.00E-03	mg/(kg·d)	[6]
510-15-6	Chlorobenzilate				2.00E-02	mg/(kg·d)	[6]
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)				1.00E-04	mg/(kg·d)	[6]
532-27-4	2-Chloroacetophenone	3.00E-05	mg/m^3	[4]			
534-52-1	4,6-Dinitro-o-cresol				8.00E-05	mg/(kg·d)	[6]
5385-75-1	Dibenzo(a,e)fluoranthene						
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)				9.00E-03	mg/(kg·d)	[5]
540-84-1	2,2,4-Trimethylpentane						
541-73-1	1,3-Dichlorobenzene				9.00E-04	mg/(kg·d)	[3]
542-75-6	1,3-Dichloropropene	2.00E-02	mg/m^3	[4]	3.00E-02	mg/(kg·d)	[6]
56-23-5	Carbon tetrachloride	1.00E-01	mg/m^3	[4]	4.00E-03	mg/(kg·d)	[6]
57-12-5	Cyanide	8.00E-04	mg/m^3	[4]	6.00E-04	mg/(kg·d)	[6]

Table 5-1 Inhalation Reference Concentration and Oral Reference Dose

CAS Registry Number	Constituent Name	Inhalation Chronic Reference Concentration (*RfC*)	Units for Inhalation Chronic Reference Concentration	Reference	Oral Chronic Reference Dose (RfD_o)	Units for Oral Chronic Reference Dose	Reference
57-24-9	Strychnine				3.00E-04	mg/(kg·d)	[6]
57-74-9	Chlordane	7.00E-04	mg/m^3	[5]	5.00E-04	mg/(kg·d)	[7]
58-89-9	gamma-BHC (Lindane)				3.00E-04	mg/(kg·d)	[6]
58-90-2	2,3,4,6-Tetrachlorophenol				3.00E-02	mg/(kg·d)	[6]
581-42-0	2,6-Dimethylnaphthalene						
584-84-9	2,4-Toluene diisocyanate	8.00E-06	mg/m^3	[4]	2.00E-03	mg/(kg·d)	[12]
589-38-8	3-Hexanone						
59-50-7	4-Chloro-3-methylphenol				1.00E-01	mg/(kg·d)	[6]
591-50-4	Benzene, iodo-						
591-78-6	2-Hexanone	3.00E-02	mg/m^3	[4]	5.00E-03	mg/(kg·d)	[6]
593-60-2	Bromoethene (Vinyl bromide)	3.00E-03	mg/m^3	[4]			
593-74-8	Dimethyl Mercury	1.40E-04	mg/m^3	[7]	1.00E-04	mg/(kg·d)	[15]
60-29-7	Ethyl ether				2.00E-01	mg/(kg·d)	[6]
60-35-5	Acetamide						
606-20-2	2,6-Dinitrotoluene				3.00E-04	mg/(kg·d)	[6]
608-93-5	Pentachlorobenzene				8.00E-04	mg/(kg·d)	[6]
61626-71-9	Dichloropentadiene						
62-50-0	Ethyl methanesulfonate						
62-53-3	Aniline	1.00E-03	mg/m^3	[4]	7.00E-03	mg/(kg·d)	[6]
62-75-9	N-Nitroso-N,N-dimethylamine	4.00E-05	mg/m^3	[4]	8.00E-06	mg/(kg·d)	[6]
624-83-9	Methyl isocyanate	1.00E-03	mg/m^3	[4]	4.00E-02	mg/(kg·d)	[13]
628-73-9	Hexanenitrile						
630-08-0	Carbon monoxide						
630-20-6	1,1,1,2-Tetrachloroethane				3.00E-02	mg/(kg·d)	[6]
64-18-6	Formic acid (methanoic acid)	3.00E-04	mg/m^3	[4]	9.00E-01	mg/(kg·d)	[6]
65-85-0	Benzoic acid				4.00E+00	mg/(kg·d)	[6]
67-56-1	Methyl alcohol	2.00E+01	mg/m^3	[4]	2.00E+00	mg/(kg·d)	[6]
67-63-0	2-Propyl alcohol	2.00E-01	mg/m^3	[4]	2.00E+00	mg/(kg·d)	[6]
67-64-1	2-Propanone (Acetone)	3.10E+01	mg/m^3	[4]	9.00E-01	mg/(kg·d)	[6]
67-66-3	Chloroform	9.80E-02	mg/m^3	[4]	1.00E-02	mg/(kg·d)	[6]

Table 5-1 Inhalation Reference Concentration and Oral Reference Dose

CAS Registry Number	Constituent Name	Inhalation Chronic Reference Concentration (*RfC*)	Units for Inhalation Chronic Reference Concentration	Reference	Oral Chronic Reference Dose (RfD_o)	Units for Oral Chronic Reference Dose	Reference
67-72-1	Hexachloroethane	3.00E-02	mg/m^3	[4]	7.00E-04	mg/(kg·d)	[6]
70-30-4	Hexachlorophene				3.00E-04	mg/(kg·d)	[6]
71-36-3	n-Butyl alcohol				1.00E-01	mg/(kg·d)	[6]
71-43-2	Benzene	3.00E-02	mg/m^3	[4]	4.00E-03	mg/(kg·d)	[6]
71-55-6	1,1,1-Trichloroethane	5.00E+00	mg/m^3	[4]	2.00E+00	mg/(kg·d)	[6]
72-43-5	Methoxychlor				5.00E-03	mg/(kg·d)	[6]
74-83-9	Bromomethane	5.00E-03	mg/m^3	[4]	1.40E-03	mg/(kg·d)	[6]
74-87-3	Chloromethane	9.00E-02	mg/m^3	[4]			
74-88-4	Iodomethane						
74-95-3	Methylene bromide	4.00E-03	mg/m^3	[4]	1.00E-02	mg/(kg·d)	[5]
74-97-5	Bromochloromethane	4.00E-02	mg/m^3	[4]			
7429-90-5	Aluminum	5.00E-03	mg/m^3	[4]	1.00E+00	mg/(kg·d)	[6]
7439-89-6	Iron				7.00E-01	mg/(kg·d)	[6]
7439-92-1	Lead	1.50E-03	mg/m^3	[2]			
7439-93-2	Lithium				2.00E-03	mg/(kg·d)	[6]
7439-95-4	Magnesium						
7439-96-5	Manganese	5.00E-05	mg/m^3	[4]	1.40E-01	mg/(kg·d)	[6]
7439-97-6	Mercury	3.00E-04	mg/m^3	[4]			
7439-98-7	Molybdenum				5.00E-03	mg/(kg·d)	[6]
7440-02-0	Nickel	9.00E-05	mg/m^3	[4]	2.00E-02	mg/(kg·d)	[6]
7440-16-6	Rhodium						
7440-22-4	Silver				5.00E-03	mg/(kg·d)	[6]
7440-23-5	Sodium						
7440-24-6	Strontium (total)				6.00E-01	mg/(kg·d)	[6]
7440-25-7	Tantalum						
7440-28-0	Thallium				1.00E-05	mg/(kg·d)	[6]
7440-31-5	Tin				6.00E-01	mg/(kg·d)	[6]
7440-33-7	Tungsten				8.00E-04	mg/(kg·d)	[6]
7440-36-0	Antimony				4.00E-04	mg/(kg·d)	[6]
7440-38-2	Arsenic	1.50E-05	mg/m^3	[4]	3.00E-04	mg/(kg·d)	[6]

Table 5-1 Inhalation Reference Concentration and Oral Reference Dose

CAS Registry Number	Constituent Name	Inhalation Chronic Reference Concentration (*RfC*)	Units for Inhalation Chronic Reference Concentration	Reference	Oral Chronic Reference Dose (RfD_o)	Units for Oral Chronic Reference Dose	Reference
7440-39-3	Barium	5.00E-04	mg/m^3	[4]	2.00E-01	mg/(kg·d)	[6]
7440-41-7	Beryllium	2.00E-05	mg/m^3	[4]	2.00E-03	mg/(kg·d)	[6]
7440-43-9	Cadmium	1.00E-05	mg/m^3	[4]	1.00E-03	mg/(kg·d)	[6]
7440-47-3	Chromium				1.50E+00	mg/(kg·d)	[7]
7440-48-4	Cobalt	6.00E-06	mg/m^3	[4]	3.00E-04	mg/(kg·d)	[6]
7440-50-8	Copper				4.00E-02	mg/(kg·d)	[6]
7440-61-1	Uranium	8.00E-04	mg/m^3	[1]	6.00E-04	mg/(kg·d)	[2]
7440-62-2	Vanadium	1.00E-04	mg/m^3	[4]	5.00E-03	mg/(kg·d)	[6]
7440-65-5	Yttrium						
7440-66-6	Zinc				3.00E-01	mg/(kg·d)	[6]
7440-67-7	Zirconium				8.00E-05	mg/(kg·d)	[6]
7446-09-5	Sulfur dioxide						
7487-94-7	Mercuric chloride (HgCl2)	3.00E-04	mg/m^3	[4]	3.00E-04	mg/(kg·d)	[6]
75-00-3	Chloroethane	1.00E+01	mg/m^3	[4]	4.00E-01	mg/(kg·d)	[3]
75-01-4	1-Chloroethene	1.00E-01	mg/m^3	[4]	3.00E-03	mg/(kg·d)	[6]
75-02-5	Fluoroethene (vinyl fluoride)						
75-05-8	Acetonitrile	6.00E-02	mg/m^3	[4]			
75-07-0	Acetaldehyde	9.00E-03	mg/m^3	[4]	4.00E-02	mg/(kg·d)	[3]
75-09-2	Dichloromethane (Methylene Chloride)	6.00E-01	mg/m^3	[4]	6.00E-03	mg/(kg·d)	[6]
75-15-0	Carbon disulfide	7.00E-01	mg/m^3	[4]	1.00E-01	mg/(kg·d)	[6]
75-25-2	Bromoform				2.00E-02	mg/(kg·d)	[6]
75-27-4	Bromodichloromethane				2.00E-02	mg/(kg·d)	[6]
75-29-6	2-Chloropropane	1.00E-01	mg/m^3	[6]			
75-34-3	1,1-Dichloroethane	5.00E-01	mg/m^3	[2]	2.00E-01	mg/(kg·d)	[6]
75-35-4	1,1-Dichloroethene	2.00E-01	mg/m^3	[4]	5.00E-02	mg/(kg·d)	[6]
75-44-5	Phosgene (hydrogen phosphide)	3.00E-04	mg/m^3	[4]	2.00E-03	mg/(kg·d)	[17]
75-45-6	Chlorodifluoromethane	5.00E+01	mg/m^3	[4]			
75-50-3	Trimethylamine						
75-69-4	Trichlorofluoromethane	7.00E-01	mg/m^3	[3]	3.00E-01	mg/(kg·d)	[6]
75-71-8	Dichlorodifluoromethane	1.00E-01	mg/m^3	[4]	2.00E-01	mg/(kg·d)	[6]

Table 5-1 Inhalation Reference Concentration and Oral Reference Dose

CAS Registry Number	Constituent Name	Inhalation Chronic Reference Concentration (*RfC*)	Units for Inhalation Chronic Reference Concentration	Reference	Oral Chronic Reference Dose (RfD_o)	Units for Oral Chronic Reference Dose	Reference
76-01-7	Pentachloroethane				5.70E+00	mg/(kg·d)	[9]
76-13-1	1,2,2-Trichlorotrifluoroethane	3.00E+01	mg/m^3	[4]	3.00E+01	mg/(kg·d)	[6]
76-44-8	Heptachlor				5.00E-04	mg/(kg·d)	[6]
7647-01-0	Hydrogen chloride	2.00E-02	mg/m^3	[4]			
765-34-4	Glycidylaldehyde	1.00E-03	mg/m^3	[4]	4.00E-04	mg/(kg·d)	[6]
7664-39-3	Hydrogen Fluoride	1.40E-02	mg/m^3	[4]	4.00E-02	mg/(kg·d)	[6]
7664-41-7	Ammonia/Ammonium	1.00E-01	mg/m^3	[4]	3.40E+01	mg/(kg·d)	[11]
77-47-4	Hexachlorocyclopentadiene	2.00E-04	mg/m^3	[4]	6.00E-03	mg/(kg·d)	[6]
77-78-1	Dimethyl sulfate						
7704-34-9	Total Sulfur (thermodynamically stable)						
7723-14-0	Phosphorus				2.00E-05	mg/(kg·d)	[6]
7782-41-4	Fluorine gas F2	1.30E-02	mg/m^3	[4]	6.00E-02	mg/(kg·d)	[6]
7782-49-2	Selenium	2.00E-02	mg/m^3	[4]	5.00E-03	mg/(kg·d)	[6]
7782-50-5	Chlorine	1.50E-04	mg/m^3	[4]	1.00E-01	mg/(kg·d)	[6]
78-83-1	2-Methylpropyl alcohol				3.00E-01	mg/(kg·d)	[6]
78-87-5	1,2-Dichloropropane	4.00E-03	mg/m^3	[4]	9.00E-02	mg/(kg·d)	[6]
78-93-3	2-Butanone	5.00E+00	mg/m^3	[4]	6.00E-01	mg/(kg·d)	[6]
79-00-5	1,1,2-Trichloroethane	2.00E-04	mg/m^3	[4]	4.00E-03	mg/(kg·d)	[6]
79-01-6	1,1,2-Trichloroethylene	2.00E-03	mg/m^3	[4]	5.00E-04	mg/(kg·d)	[6]
79-10-7	2-Propenoic acid	1.00E-03	mg/m^3	[4]	5.00E-01	mg/(kg·d)	[6]
79-34-5	1,1,2,2-Tetrachloroethane				2.00E-02	mg/(kg·d)	[6]
79-46-9	2-Nitropropane	2.00E-02	mg/m^3	[4]			
80-62-6	Methyl methacrylate	7.00E-01	mg/m^3	[4]	1.40E+00	mg/(kg·d)	[6]
82-68-8	Pentachloronitrobenzene (PCNB)				3.00E-03	mg/(kg·d)	[6]
822-06-0	Hexamethylene-1,5-diisocyanate	1.00E-05	mg/m^3	[4]	1.00E-05	mg/(kg·d)	[1]
823-40-5	Toluene-2,6-diamine				3.00E-02	mg/(kg·d)	[4]
83-32-9	Acenaphthene				6.00E-02	mg/(kg·d)	[6]
832-69-9	1-Methylphenanthrene						
84-66-2	Diethyl phthalate				8.00E-01	mg/(kg·d)	[6]
84-74-2	Di-n-butylphthalate				1.00E-01	mg/(kg·d)	[6]

Table 5-1 Inhalation Reference Concentration and Oral Reference Dose

CAS Registry Number	Constituent Name	Inhalation Chronic Reference Concentration (*RfC*)	Units for Inhalation Chronic Reference Concentration	Reference	Oral Chronic Reference Dose (RfD_o)	Units for Oral Chronic Reference Dose	Reference
85-01-8	Phenanthrene						
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	2.00E-02	mg/m^3	[4]	2.00E+00	mg/(kg·d)	[6]
85-68-7	Butylbenzylphthalate				2.00E-01	mg/(kg·d)	[6]
86-73-7	Fluorene				4.00E-02	mg/(kg·d)	[6]
87-61-6	1,2,3-Trichlorobenzene				8.00E-04	mg/(kg·d)	[6]
87-68-3	Hexachlorobutadiene				1.00E-03	mg/(kg·d)	[6]
87-86-5	Pentachlorophenol				5.00E-03	mg/(kg·d)	[6]
88-74-4	o-Nitroaniline (2-nitroaniline)	5.00E-05	mg/m^3	[4]	1.00E-02	mg/(kg·d)	[6]
88-75-5	2-Nitrophenol						
90-12-0	1-Methylnaphthalene				7.00E-02	mg/(kg·d)	[6]
91-20-3	Naphthalene	3.00E-03	mg/m^3	[4]	2.00E-02	mg/(kg·d)	[6]
91-57-6	2-Methylnaphthalene				4.00E-03	mg/(kg·d)	[6]
91-58-7	2-Chloronaphthalene				8.00E-02	mg/(kg·d)	[6]
92-52-4	1,1`-Biphenyl	4.00E-04	mg/m^3	[4]	5.00E-01	mg/(kg·d)	[6]
94-75-7	2,4-D				1.00E-02	mg/(kg·d)	[6]
95-48-7	o-Cresol	6.00E-01	mg/m^3	[4]	5.00E-02	mg/(kg·d)	[6]
95-49-8	o-Chlorotoluene				2.00E-02	mg/(kg·d)	[6]
95-50-1	1,2-Dichlorobenzene	2.00E-01	mg/m^3	[4]	9.00E-02	mg/(kg·d)	[6]
95-57-8	2-Chlorophenol				5.00E-03	mg/(kg·d)	[6]
95-63-6	1,2,4-Trimethyl benzene	7.00E-03	mg/m^3	[4]	5.00E-02	mg/(kg·d)	[11]
95-94-3	1,2,4,5-Tetrachlorobenzene				3.00E-04	mg/(kg·d)	[6]
95-95-4	2,4,5-Trichlorophenol				1.00E-01	mg/(kg·d)	[6]
96-12-8	1,2-Dibromo-3-chloropropane	2.00E-04	mg/m^3	[4]	2.00E-04	mg/(kg·d)	[6]
96-18-4	1,2,3-Trichloropropane	3.00E-04	mg/m^3	[4]	4.00E-03	mg/(kg·d)	[6]
96-45-7	Ethylene thiourea				8.00E-05	mg/(kg·d)	[6]
97-63-2	Ethyl methacrylate	3.00E-01	mg/m^3	[4]	9.00E-02	mg/(kg·d)	[5]
98-01-1	Furfural	5.00E-02	mg/m^3	[4]	3.00E-03	mg/(kg·d)	[6]
98-06-6	tert-Butyl benzene				1.00E-01	mg/(kg·d)	[6]
98-82-8	Cumene	4.00E-01	mg/m^3	[4]	1.00E-01	mg/(kg·d)	[6]

Table 5-1 Inhalation Reference Concentration and Oral Reference Dose

CAS Registry Number	Constituent Name	Inhalation Chronic Reference Concentration (*RfC*)	Units for Inhalation Chronic Reference Concentration	Reference	Oral Chronic Reference Dose (RfD_o)	Units for Oral Chronic Reference Dose	Reference
98-83-9	Methyl styrene (mixed isomers)	4.00E-02	mg/m^3	[6]	7.00E-02	mg/(kg·d)	[6]
98-86-2	Acetophenone				1.00E-01	mg/(kg·d)	[6]
98-95-3	Nitrobenzene	9.00E-03	mg/m^3	[4]	2.00E-03	mg/(kg·d)	[6]
99-35-4	1,3,5-Trinitrobenzene				3.00E-02	mg/(kg·d)	[6]
99-65-0	1,3-Dinitrobenzene				1.00E-04	mg/(kg·d)	[6]
99-87-6	p-Cymene				8.50E-02	mg/(kg·d)	[8]

Reference **Reference (source) for Inhalation Reference Concentration**

[1] ATSDR. 2012. "Minimal Risk Levels (MRLs) for Hazardous Substances, December 2012", Agency for Toxic Substances and Disease Registry, U.S. Department of Health and Human Services, Atlanta, GA. (available at http://www.atsdr.cdc.gov/mrls/mrllist.asp#210tag, accessed January 2013)

[2] EPA. 2005. The Hazardous Waste Companion Database. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013)

[3] EPA. 2013. Regional Screening Levels for Chemical Contaminants at Superfund Sites, Region 3, US Environmental Protection Agency, Washington, DC. (available at http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm, accessed November 2013)

[4] EPA. 2016. Regional Screening Levels for Chemical Contaminants at Superfund Sites, Region 3, US Environmental Protection Agency, Washington, DC. (available at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-may-2016, accessed May 2017)

[5] EPA. Integrated Risk Information System (IRIS) On-line Database of Toxicity Measures. US Environmental Protection Agency, Office of Research and Development, Environmental Criteria and Assessment Office, Cincinnati, OH. Values updated monthly on line at http://www.epa.gov/iris/. Accessed November 2012

[6] ORNL. The Risk Assessment Information System (RAIS) Database. Copyright © 2013 Oak Ridge National Laboratory and The University of Tennessee, Oak Ridge, TN (http://rais.ornl.gov, accessed April 2014)

[7] Surrogate value from Methyl mercury

[8] Surrogate value from Trichlorofluoromethane

Reference **Reference (source) for Oral Reference Dose**

[1] ATSDR. 2012. "Minimal Risk Levels (MRLs) for Hazardous Substances, December 2012", Agency for Toxic Substances and Disease Registry, U.S. Department of Health and Human Services, Atlanta, GA. (available at http://www.atsdr.cdc.gov/mrls/mrllist.asp#210tag, accessed January 2013)

[2] EPA. 2000. Soil Screening Guidance for Radionuclides: User's Guide, EPA/540-R-00-007, Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC (Sect. 1.2, p. 1-6)

Reference	Reference (source) for Oral Reference Dose
[3]	EPA. 2005. The Hazardous Waste Companion Database. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013)
[4]	EPA. 2012. Provisional Peer Reviewed Toxicity Values for Superfund (PPRTV), PPRTV Assessments Electronic Library, Office of Superfund Remediation and Technology Innovation, U.S. Environmental Protection Agency, Washington, DC 20460 (available at http://hhpprtv.ornl.gov/index.html, accessed December 2012)
[5]	EPA. 2013. Regional Screening Levels for Chemical Contaminants at Superfund Sites, Region 3, US Environmental Protection Agency, Washington, DC. (available at http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm, accessed November 2013)
[6]	EPA. 2016. Regional Screening Levels for Chemical Contaminants at Superfund Sites, Region 3, US Environmental Protection Agency, Washington, DC. (available at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-may-2016, accessed May 2017)
[7]	EPA. Integrated Risk Information System (IRIS) On-line Database of Toxicity Measures. US Environmental Protection Agency, Office of Research and Development, Environmental Criteria and Assessment Office, Cincinnati, OH. Values updated monthly on line at http://www.epa.gov/iris/. Accessed November 2012
[8]	Ecology. 2001. CLARC v3.1 part IV, Pub. 94-145. "Table: Recommended Reference Doses for Petroleum Fractions and Individual Hazardous Substances" (Aliphatic EC10 to EC12)
[9]	Ecology. 2001. CLARC v3.1 part IV, Pub. 94-145. "Table: Recommended Reference Doses for Petroleum Fractions and Individual Hazardous Substances" (Aliphatic EC5 to EC6)
[10]	Ecology. 2001. CLARC v3.1 part IV, Pub. 94-145. "Table: Recommended Reference Doses for Petroleum Fractions and Individual Hazardous Substances" (Aliphatic EC8 to EC10)
[11]	ORNL. The Risk Assessment Information System (RAIS) Database. Copyright © 2013 Oak Ridge National Laboratory and The University of Tennessee, Oak Ridge, TN (http://rais.ornl.gov, accessed April 2014)
[12]	Surrogate value from 2,4-Dinitrotoluene
[13]	Surrogate value from Acrylonitrile
[14]	Surrogate value from Aroclor-1254
[15]	Surrogate value from Methyl mercury
[16]	Surrogate value from Trichlorofluoromethane
[17]	Surrogate value from cis-1,2-Dichloroethene

Table 5-2 provides the Gastro-intestinal Absorption (GAF) used to estimate the dermal toxicity factors from oral toxicity factors, along with corresponding Dermal Chronic Reference Doses (RfD_{dermal}). The RfD_{dermal} is used for assessment of the non-cancer toxic effects due to dermal adsorption of contaminants. Blank entries in the table indicate where data are not available.

Table 5-2 Percent Gastrointestinal Absorption and Dermal Chronic Reference Dose

CAS Registry Number	Constituent Name	Gastro-intestinal Absorption (*GAF*)	Units for Gastro-intestinal Absorption	Reference	Dermal Chronic Reference Dose (RfD_{dermal})	Units for Dermal Chronic Reference Dose	Reference
100-02-7	p-Nitrophenol	1.00E+00	unitless	[3]	8.00E-03	mg/(kg/d)	[1]
100-21-0	Phthalic acid	1.00E+00	unitless	[5]	1.00E+00	mg/(kg/d)	[1]
100-25-4	1,4-Dinitrobenzene	1.00E+00	unitless	[5]	1.00E-04	mg/(kg/d)	[1]
100-40-3	4-Ethenylcyclohexene	8.00E-01	unitless	[2]			
100-41-4	Ethyl benzene	1.00E+00	unitless	[5]	1.00E-01	mg/(kg/d)	[1]
100-42-5	Styrene	1.00E+00	unitless	[5]	2.00E-01	mg/(kg/d)	[1]
100-44-7	Benzyl chloride	1.00E+00	unitless	[5]	2.00E-03	mg/(kg/d)	[1]
100-47-0	Benzonitrile	8.00E-01	unitless	[2]			
100-51-6	Benzyl alcohol	1.00E+00	unitless	[5]	1.00E-01	mg/(kg/d)	[1]
100-52-7	Benzaldehyde	1.00E+00	unitless	[5]	1.00E-01	mg/(kg/d)	[1]
10028-15-6	Ozone	1.00E+00	unitless	[3]			
10061-01-5	cis-1,3-Dichloropropene	1.00E+00	unitless	[3]	2.00E-03	mg/(kg/d)	[1]
10061-02-6	trans-1,3-Dichloropropene	1.00E+00	unitless	[3]			
101-55-3	4-Bromophenylphenyl ether	1.00E+00	unitless	[3]			
101-77-9	4,4-Methylenedianiline	1.00E+00	unitless	[5]			
10102-44-0	Nitrogen dioxide	1.00E+00	unitless	[3]			
103-65-1	n-Propyl benzene (Isocumene)	1.00E+00	unitless	[5]	1.00E-01	mg/(kg/d)	[1]
104-51-8	n-Butylbenzene	1.00E+00	unitless	[5]	5.00E-02	mg/(kg/d)	[1]
104-76-7	2-Ethyl-1-hexanol	8.00E-01	unitless	[2]			
105-67-9	2,4-Dimethylphenol	1.00E+00	unitless	[5]	2.00E-02	mg/(kg/d)	[1]
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	1.00E+00	unitless	[5]	2.00E-02	mg/(kg/d)	[1]
106-44-5	p-Cresol (4-methyl phenol)	1.00E+00	unitless	[5]	1.00E-01	mg/(kg/d)	[1]
106-46-7	1,4-Dichlorobenzene	1.00E+00	unitless	[5]	7.00E-02	mg/(kg/d)	[1]
106-47-8	p-Chloroaniline	1.00E+00	unitless	[5]	4.00E-03	mg/(kg/d)	[1]
106-51-4	Quinone	1.00E+00	unitless	[3]			
106-88-7	1,2-Epoxybutane	1.00E+00	unitless	[5]			
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	1.00E+00	unitless	[5]	6.00E-03	mg/(kg/d)	[1]
106-93-4	Ethylene dibromide	1.00E+00	unitless	[5]	9.00E-03	mg/(kg/d)	[1]

Table 5-2 Percent Gastrointestinal Absorption and Dermal Chronic Reference Dose

CAS Registry Number	Constituent Name	Gastro-intestinal Absorption (*GAF*)	Units for Gastro-intestinal Absorption	Reference	Dermal Chronic Reference Dose (RfD_{dermal})	Units for Dermal Chronic Reference Dose	Reference
106-99-0	1,3-Butadiene	1.00E+00	unitless	[5]			
107-02-8	Acrolein	1.00E+00	unitless	[5]	5.00E-04	mg/(kg/d)	[1]
107-05-1	3-Chloropropene	1.00E+00	unitless	[5]			
107-06-2	1,2-Dichloroethane	1.00E+00	unitless	[5]	6.00E-03	mg/(kg/d)	[1]
107-12-0	Propionitrile	1.00E+00	unitless	[3]			
107-13-1	Acrylonitrile	1.00E+00	unitless	[5]	4.00E-02	mg/(kg/d)	[1]
107-19-7	Propargyl alcohol	1.00E+00	unitless	[5]	2.00E-03	mg/(kg/d)	[1]
107-21-1	Ethylene glycol (1,2-ethanediol)	1.00E+00	unitless	[5]	2.00E+00	mg/(kg/d)	[1]
107-98-2	Propylene glycol monomethyl ether	1.00E+00	unitless	[5]	7.00E-01	mg/(kg/d)	[1]
108-05-4	Acetic acid vinyl ester	1.00E+00	unitless	[5]	1.00E+00	mg/(kg/d)	[1]
108-10-1	4-Methyl-2-pentanone	1.00E+00	unitless	[5]	8.00E-02	mg/(kg/d)	[1]
108-39-4	m-Cresol	1.00E+00	unitless	[5]	5.00E-02	mg/(kg/d)	[1]
108-60-1	bis (2-Chloroisopropyl)ether	1.00E+00	unitless	[5]	4.00E-02	mg/(kg/d)	[1]
108-67-8	1,3,5-Trimethylbenzene	1.00E+00	unitless	[5]	1.00E-02	mg/(kg/d)	[1]
108-86-1	Bromobenzene (Phenyl bromide)	1.00E+00	unitless	[5]	8.00E-03	mg/(kg/d)	[1]
108-87-2	Methylcyclohexane	1.00E+00	unitless	[3]			
108-88-3	Toluene	1.00E+00	unitless	[5]	8.00E-02	mg/(kg/d)	[1]
108-90-7	Chlorobenzene	1.00E+00	unitless	[5]	2.00E-02	mg/(kg/d)	[1]
108-94-1	Cyclohexanone	1.00E+00	unitless	[5]	5.00E+00	mg/(kg/d)	[1]
108-95-2	Phenol	1.00E+00	unitless	[5]	3.00E-01	mg/(kg/d)	[1]
109-74-0	n-Butanenitrile	8.00E-01	unitless	[2]			
109-75-1	3-Butenenitrile	8.00E-01	unitless	[2]			
109-77-3	Malononitrile	1.00E+00	unitless	[5]	1.00E-04	mg/(kg/d)	[1]
109-86-4	2-Methoxyethanol	1.00E+00	unitless	[5]	5.00E-03	mg/(kg/d)	[1]
109-99-9	Tetrahydrofuran	1.00E+00	unitless	[5]	9.00E-01	mg/(kg/d)	[1]
110-00-9	Furan	1.00E+00	unitless	[5]	1.00E-03	mg/(kg/d)	[1]
110-54-3	n-Hexane	1.00E+00	unitless	[5]	6.00E-02	mg/(kg/d)	[1]
110-59-8	Pentanenitrile	8.00E-01	unitless	[2]			
110-80-5	2-Ethoxyethanol	1.00E+00	unitless	[5]	9.00E-02	mg/(kg/d)	[1]
110-82-7	Cyclohexane	1.00E+00	unitless	[5]			
110-83-8	Cyclohexene	1.00E+00	unitless	[5]	5.00E-03	mg/(kg/d)	[1]
110-86-1	Pyridine	1.00E+00	unitless	[5]	1.00E-03	mg/(kg/d)	[1]

Table 5-2 Percent Gastrointestinal Absorption and Dermal Chronic Reference Dose

CAS Registry Number	Constituent Name	Gastro-intestinal Absorption (*GAF*)	Units for Gastro-intestinal Absorption	Reference	Dermal Chronic Reference Dose (RfD_{dermal})	Units for Dermal Chronic Reference Dose	Reference
111-15-9	Ethylene glycol monoethyl ether acetate	1.00E+00	unitless	[5]	1.00E-01	mg/(kg/d)	[1]
111-65-9	n-Octane	1.00E+00	unitless	[3]	3.00E-02	mg/(kg/d)	[1]
111-76-2	2-Butoxyethanol	1.00E+00	unitless	[5]	1.00E-01	mg/(kg/d)	[1]
111-84-2	n-Nonane	1.00E+00	unitless	[5]	3.00E-04	mg/(kg/d)	[1]
111-91-1	Bis(2-chloroethoxy)methane	1.00E+00	unitless	[5]	3.00E-03	mg/(kg/d)	[1]
112-30-1	1-Decanol	1.00E+00	unitless	[3]			
112-31-2	Decanal	8.00E-01	unitless	[2]			
112-40-3	Dodecane	8.00E-01	unitless	[2]			
1120-21-4	Undecane	8.00E-01	unitless	[2]			
117-81-7	Bis(2-ethylhexyl) phthalate	1.00E+00	unitless	[5]	2.00E-02	mg/(kg/d)	[1]
117-84-0	Di-n-octylphthalate	1.00E+00	unitless	[5]	1.00E-02	mg/(kg/d)	[1]
118-74-1	Hexachlorobenzene	1.00E+00	unitless	[5]	8.00E-04	mg/(kg/d)	[1]
120-12-7	Anthracene	1.00E+00	unitless	[5]	3.00E-01	mg/(kg/d)	[1]
120-82-1	1,2,4-Trichlorobenzene	1.00E+00	unitless	[5]	1.00E-02	mg/(kg/d)	[1]
120-83-2	2,4-Dichlorophenol	1.00E+00	unitless	[5]	3.00E-03	mg/(kg/d)	[1]
121-14-2	2,4-Dinitrotoluene	1.00E+00	unitless	[5]	2.00E-03	mg/(kg/d)	[1]
122-39-4	N,N-Diphenylamine	1.00E+00	unitless	[5]	2.50E-02	mg/(kg/d)	[1]
123-33-1	Maleic hydrazide	1.00E+00	unitless	[5]	5.00E-01	mg/(kg/d)	[1]
123-38-6	Propionaldehyde	1.00E+00	unitless	[5]	5.70E+00	mg/(kg/d)	[1]
123-72-8	Butanal	5.00E-01	unitless	[1]			
123-91-1	1,4-Dioxan	1.00E+00	unitless	[5]	3.00E-02	mg/(kg/d)	[1]
124-18-5	Decane	1.00E+00	unitless	[3]			
124-38-9	Carbon dioxide						
124-48-1	Chlorodibromomethane	1.00E+00	unitless	[5]	2.00E-02	mg/(kg/d)	[1]
126-73-8	Tributyl phosphate	1.00E+00	unitless	[5]	1.00E-02	mg/(kg/d)	[1]
126-98-7	2-Methyl-2-propenenitrile	1.00E+00	unitless	[5]	1.00E-04	mg/(kg/d)	[1]
127-18-4	1,1,2,2-Tetrachloroethene	1.00E+00	unitless	[5]	6.00E-03	mg/(kg/d)	[1]
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	1.00E+00	unitless	[5]	3.00E-01	mg/(kg/d)	[1]
129-00-0	Pyrene	1.00E+00	unitless	[5]	3.00E-02	mg/(kg/d)	[1]
131-11-3	Dimethyl Phthalate	1.00E+00	unitless	[3]			
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	1.00E+00	unitless	[5]	2.00E-03	mg/(kg/d)	[1]
132-64-9	Dibenzofuran	1.00E+00	unitless	[5]	1.00E-03	mg/(kg/d)	[1]

Table 5-2 Percent Gastrointestinal Absorption and Dermal Chronic Reference Dose

CAS Registry Number	Constituent Name	Gastro-intestinal Absorption (*GAF*)	Units for Gastro-intestinal Absorption	Reference	Dermal Chronic Reference Dose (RfD_{dermal})	Units for Dermal Chronic Reference Dose	Reference
133-06-2	Captan	1.00E+00	unitless	[5]	1.30E-01	mg/(kg/d)	[1]
1330-20-7	Xylenes (mixed isomers)	1.00E+00	unitless	[5]	2.00E-01	mg/(kg/d)	[1]
1336-36-3	Polychlorinated biphenyls	1.00E+00	unitless	[5]	2.00E-05	mg/(kg/d)	[1]
134-32-7	alpha-Naphthylamine	1.00E+00	unitless	[3]			
135-98-8	sec-Butylbenzene	1.00E+00	unitless	[5]	1.00E-01	mg/(kg/d)	[1]
141-78-6	Acetic acid ethyl ester	1.00E+00	unitless	[5]	9.00E-01	mg/(kg/d)	[1]
14265-44-2	Phosphate	1.00E+00	unitless	[3]			
145-73-3	Endothall	1.00E+00	unitless	[5]	2.00E-02	mg/(kg/d)	[1]
14797-55-8	Nitrate	1.00E+00	unitless	[5]	1.60E+00	mg/(kg/d)	[1]
14797-65-0	Nitrite	1.00E+00	unitless	[5]	1.00E-01	mg/(kg/d)	[1]
14808-79-8	Sulfate	1.00E+00	unitless	[3]			
156-59-2	cis-1,2-Dichloroethene	1.00E+00	unitless	[5]	2.00E-03	mg/(kg/d)	[1]
156-60-5	1,2-trans-Dichloroethene	1.00E+00	unitless	[5]	2.00E-02	mg/(kg/d)	[1]
1634-04-4	Methyl tert-butyl ether	1.00E+00	unitless	[5]			
16887-00-6	Chloride	1.00E+00	unitless	[3]			
16984-48-8	Fluoride	1.00E+00	unitless	[5]	4.00E-02	mg/(kg/d)	[1]
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1.00E+00	unitless	[5]	7.00E-10	mg/(kg/d)	[1]
18540-29-9	Chromium(VI)	2.50E-02	unitless	[5]	7.50E-05	mg/(kg/d)	[1]
191-24-2	Benzo(g,h,i)perylene	1.00E+00	unitless	[3]			
192-97-2	Benzo(e)pyrene	1.00E+00	unitless	[3]			
206-44-0	Fluoranthene	1.00E+00	unitless	[5]	4.00E-02	mg/(kg/d)	[1]
208-96-8	Acenaphthylene	1.00E+00	unitless	[3]			
2245-38-7	2,3,5-Trimethylnaphthalene	8.00E-01	unitless	[2]			
22967-92-6	Methyl mercury	1.00E+00	unitless	[5]	1.00E-04	mg/(kg/d)	[1]
23950-58-5	Pronamide	1.00E+00	unitless	[5]	7.50E-02	mg/(kg/d)	[1]
24959-67-9	Bromide	1.00E+00	unitless	[3]			
27154-33-2	Trichlorofluoroethane	8.00E-01	unitless	[2]	2.40E-01	mg/(kg/d)	[1]
319-84-6	alpha-BHC	1.00E+00	unitless	[5]	8.00E-03	mg/(kg/d)	[1]
4170-30-3	Crotonaldehyde (Propylene aldehyde)	1.00E+00	unitless	[3]			
41851-50-7	Chlorocyclopentadiene	1.00E+00	unitless	[3]			

Table 5-2 Percent Gastrointestinal Absorption and Dermal Chronic Reference Dose

CAS Registry Number	Constituent Name	Gastro-intestinal Absorption (*GAF*)	Units for Gastro-intestinal Absorption	Reference	Dermal Chronic Reference Dose (RfD_{dermal})	Units for Dermal Chronic Reference Dose	Reference
460-19-5	Cyanogen (oxalonitrile)	1.00E+00	unitless	[5]	1.00E-03	mg/(kg/d)	[1]
4786-20-3	2-Butenenitrile	8.00E-01	unitless	[2]			
50-00-0	Formaldehyde	1.00E+00	unitless	[5]	2.00E-01	mg/(kg/d)	[1]
506-68-3	Cyanogen bromide (bromocyanide)	1.00E+00	unitless	[5]	9.00E-02	mg/(kg/d)	[1]
506-77-4	Cyanogen chloride	1.00E+00	unitless	[5]	5.00E-02	mg/(kg/d)	[1]
51-28-5	2,4-Dinitrophenol	1.00E+00	unitless	[5]	2.00E-03	mg/(kg/d)	[1]
510-15-6	Chlorobenzilate	1.00E+00	unitless	[5]	2.00E-02	mg/(kg/d)	[1]
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	1.00E+00	unitless	[5]	1.00E-04	mg/(kg/d)	[1]
532-27-4	2-Chloroacetophenone	1.00E+00	unitless	[5]			
534-52-1	4,6-Dinitro-o-cresol	1.00E+00	unitless	[5]	8.00E-05	mg/(kg/d)	[1]
5385-75-1	Dibenzo(a,e)fluoranthene	8.90E-01	unitless	[3]			
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	1.00E+00	unitless	[4]	9.00E-03	mg/(kg/d)	[1]
540-84-1	2,2,4-Trimethylpentane	1.00E+00	unitless	[3]			
541-73-1	1,3-Dichlorobenzene	1.00E+00	unitless	[3]	9.00E-04	mg/(kg/d)	[1]
542-75-6	1,3-Dichloropropene	1.00E+00	unitless	[5]	3.00E-02	mg/(kg/d)	[1]
56-23-5	Carbon tetrachloride	1.00E+00	unitless	[5]	4.00E-03	mg/(kg/d)	[1]
57-12-5	Cyanide	1.00E+00	unitless	[5]	6.00E-04	mg/(kg/d)	[1]
57-24-9	Strychnine	1.00E+00	unitless	[5]	3.00E-04	mg/(kg/d)	[1]
57-74-9	Chlordane	5.00E-01	unitless	[6]	2.50E-04	mg/(kg/d)	[1]
58-89-9	gamma-BHC (Lindane)	1.00E+00	unitless	[5]	3.00E-04	mg/(kg/d)	[1]
58-90-2	2,3,4,6-Tetrachlorophenol	1.00E+00	unitless	[5]	3.00E-02	mg/(kg/d)	[1]
581-42-0	2,6-Dimethylnaphthalene	8.00E-01	unitless	[2]			
584-84-9	2,4-Toluene diisocyanate	1.00E+00	unitless	[5]	2.00E-03	mg/(kg/d)	[1]
589-38-8	3-Hexanone	8.00E-01	unitless	[2]			
59-50-7	4-Chloro-3-methylphenol	1.00E+00	unitless	[5]	1.00E-01	mg/(kg/d)	[1]
591-50-4	Benzene, iodo-	8.00E-01	unitless	[2]			
591-78-6	2-Hexanone	1.00E+00	unitless	[5]	5.00E-03	mg/(kg/d)	[1]
593-60-2	Bromoethene (Vinyl bromide)	1.00E+00	unitless	[5]			
593-74-8	Dimethyl Mercury	1.00E+00	unitless	[3]	1.00E-04	mg/(kg·d)	[2]
60-29-7	Ethyl ether	1.00E+00	unitless	[5]	2.00E-01	mg/(kg/d)	[1]
60-35-5	Acetamide	1.00E+00	unitless	[3]			

Table 5-2 Percent Gastrointestinal Absorption and Dermal Chronic Reference Dose

CAS Registry Number	Constituent Name	Gastro-intestinal Absorption (*GAF*)	Units for Gastro-intestinal Absorption	Reference	Dermal Chronic Reference Dose (RfD_{dermal})	Units for Dermal Chronic Reference Dose	Reference
606-20-2	2,6-Dinitrotoluene	1.00E+00	unitless	[5]	3.00E-04	mg/(kg/d)	[1]
608-93-5	Pentachlorobenzene	1.00E+00	unitless	[5]	8.00E-04	mg/(kg/d)	[1]
61626-71-9	Dichloropentadiene	1.00E+00	unitless	[3]			
62-50-0	Ethyl methanesulfonate	1.00E+00	unitless	[3]			
62-53-3	Aniline	1.00E+00	unitless	[5]	7.00E-03	mg/(kg/d)	[1]
62-75-9	N-Nitroso-N,N-dimethylamine	1.00E+00	unitless	[5]	8.00E-06	mg/(kg/d)	[1]
624-83-9	Methyl isocyanate	1.00E+00	unitless	[5]	4.00E-02	mg/(kg/d)	[1]
628-73-9	Hexanenitrile	8.00E-01	unitless	[2]			
630-08-0	Carbon monoxide	1.00E+00	unitless	[3]			
630-20-6	1,1,1,2-Tetrachloroethane	1.00E+00	unitless	[5]	3.00E-02	mg/(kg/d)	[1]
64-18-6	Formic acid (methanoic acid)	1.00E+00	unitless	[5]	9.00E-01	mg/(kg/d)	[1]
65-85-0	Benzoic acid	1.00E+00	unitless	[5]	4.00E+00	mg/(kg/d)	[1]
67-56-1	Methyl alcohol	1.00E+00	unitless	[5]	2.00E+00	mg/(kg/d)	[1]
67-63-0	2-Propyl alcohol	1.00E+00	unitless	[5]	2.00E+00	mg/(kg/d)	[1]
67-64-1	2-Propanone (Acetone)	1.00E+00	unitless	[5]	9.00E-01	mg/(kg/d)	[1]
67-66-3	Chloroform	1.00E+00	unitless	[5]	1.00E-02	mg/(kg/d)	[1]
67-72-1	Hexachloroethane	1.00E+00	unitless	[5]	7.00E-04	mg/(kg/d)	[1]
70-30-4	Hexachlorophene	1.00E+00	unitless	[5]	3.00E-04	mg/(kg/d)	[1]
71-36-3	n-Butyl alcohol	1.00E+00	unitless	[5]	1.00E-01	mg/(kg/d)	[1]
71-43-2	Benzene	1.00E+00	unitless	[5]	4.00E-03	mg/(kg/d)	[1]
71-55-6	1,1,1-Trichloroethane	1.00E+00	unitless	[5]	2.00E+00	mg/(kg/d)	[1]
72-43-5	Methoxychlor	1.00E+00	unitless	[5]	5.00E-03	mg/(kg/d)	[1]
74-83-9	Bromomethane	1.00E+00	unitless	[5]	1.40E-03	mg/(kg/d)	[1]
74-87-3	Chloromethane	1.00E+00	unitless	[5]			
74-88-4	Iodomethane	1.00E+00	unitless	[3]			
74-95-3	Methylene bromide	1.00E+00	unitless	[5]	1.00E-02	mg/(kg/d)	[1]
74-97-5	Bromochloromethane	1.00E+00	unitless	[5]			
7429-90-5	Aluminum	1.00E+00	unitless	[5]	1.00E+00	mg/(kg/d)	[1]
7439-89-6	Iron	1.00E+00	unitless	[5]	7.00E-01	mg/(kg/d)	[1]
7439-92-1	Lead	1.00E+00	unitless	[5]			
7439-93-2	Lithium	1.00E+00	unitless	[5]	2.00E-03	mg/(kg/d)	[1]
7439-95-4	Magnesium	1.00E+00	unitless	[3]			

Table 5-2 Percent Gastrointestinal Absorption and Dermal Chronic Reference Dose

CAS Registry Number	Constituent Name	Gastro-intestinal Absorption (*GAF*)	Units for Gastro-intestinal Absorption	Reference	Dermal Chronic Reference Dose (RfD_{dermal})	Units for Dermal Chronic Reference Dose	Reference
7439-96-5	Manganese	1.00E+00	unitless	[5]	1.40E-01	mg/(kg/d)	[1]
7439-97-6	Mercury	1.00E+00	unitless	[5]			
7439-98-7	Molybdenum	1.00E+00	unitless	[5]	5.00E-03	mg/(kg/d)	[1]
7440-02-0	Nickel	4.00E-02	unitless	[5]	8.00E-04	mg/(kg/d)	[1]
7440-16-6	Rhodium	1.00E+00	unitless	[3]			
7440-22-4	Silver	4.00E-02	unitless	[5]	2.00E-04	mg/(kg/d)	[1]
7440-23-5	Sodium	1.00E+00	unitless	[3]			
7440-24-6	Strontium (total)	1.00E+00	unitless	[5]	6.00E-01	mg/(kg/d)	[1]
7440-25-7	Tantalum	1.00E+00	unitless	[3]			
7440-28-0	Thallium	1.00E+00	unitless	[5]	1.00E-05	mg/(kg/d)	[1]
7440-31-5	Tin	1.00E+00	unitless	[5]	6.00E-01	mg/(kg/d)	[1]
7440-33-7	Tungsten	1.00E+00	unitless	[5]	8.00E-04	mg/(kg/d)	[1]
7440-36-0	Antimony	1.50E-01	unitless	[5]	6.00E-05	mg/(kg/d)	[1]
7440-38-2	Arsenic	1.00E+00	unitless	[5]	3.00E-04	mg/(kg/d)	[1]
7440-39-3	Barium	7.00E-02	unitless	[5]	1.40E-02	mg/(kg/d)	[1]
7440-41-7	Beryllium	7.00E-03	unitless	[5]	1.40E-05	mg/(kg/d)	[1]
7440-43-9	Cadmium	2.50E-02	unitless	[5]	2.50E-05	mg/(kg/d)	[1]
7440-47-3	Chromium	1.30E-02	unitless	[5]	1.95E-02	mg/(kg/d)	[1]
7440-48-4	Cobalt	1.00E+00	unitless	[5]	3.00E-04	mg/(kg/d)	[1]
7440-50-8	Copper	1.00E+00	unitless	[5]	4.00E-02	mg/(kg/d)	[1]
7440-61-1	Uranium	1.00E+00	unitless	[3]	6.00E-04	mg/(kg/d)	[1]
7440-62-2	Vanadium	2.60E-02	unitless	[5]	1.30E-04	mg/(kg/d)	[1]
7440-65-5	Yttrium	1.00E+00	unitless	[3]			
7440-66-6	Zinc	1.00E+00	unitless	[5]	3.00E-01	mg/(kg/d)	[1]
7440-67-7	Zirconium	1.00E+00	unitless	[5]	8.00E-05	mg/(kg/d)	[1]
7446-09-5	Sulfur dioxide	1.00E+00	unitless	[3]			
7487-94-7	Mercuric chloride (HgCl2)	7.00E-02	unitless	[5]	2.10E-05	mg/(kg/d)	[1]
75-00-3	Chloroethane	1.00E+00	unitless	[5]	4.00E-01	mg/(kg/d)	[1]
75-01-4	1-Chloroethene	1.00E+00	unitless	[5]	3.00E-03	mg/(kg/d)	[1]
75-02-5	Fluoroethene (vinyl fluoride)	5.00E-01	unitless	[1]			
75-05-8	Acetonitrile	1.00E+00	unitless	[5]			
75-07-0	Acetaldehyde	1.00E+00	unitless	[5]	4.00E-02	mg/(kg/d)	[1]

Table 5-2 Percent Gastrointestinal Absorption and Dermal Chronic Reference Dose

CAS Registry Number	Constituent Name	Gastro-intestinal Absorption (*GAF*)	Units for Gastro-intestinal Absorption	Reference	Dermal Chronic Reference Dose (RfD_{dermal})	Units for Dermal Chronic Reference Dose	Reference
75-09-2	Dichloromethane (Methylene Chloride)	1.00E+00	unitless	[5]	6.00E-03	mg/(kg/d)	[1]
75-15-0	Carbon disulfide	1.00E+00	unitless	[5]	1.00E-01	mg/(kg/d)	[1]
75-25-2	Bromoform	1.00E+00	unitless	[5]	2.00E-02	mg/(kg/d)	[1]
75-27-4	Bromodichloromethane	1.00E+00	unitless	[5]	2.00E-02	mg/(kg/d)	[1]
75-29-6	2-Chloropropane	1.00E+00	unitless	[3]			
75-34-3	1,1-Dichloroethane	1.00E+00	unitless	[5]	2.00E-01	mg/(kg/d)	[1]
75-35-4	1,1-Dichloroethene	1.00E+00	unitless	[5]	5.00E-02	mg/(kg/d)	[1]
75-44-5	Phosgene (hydrogen phosphide)	1.00E+00	unitless	[5]	2.00E-03	mg/(kg/d)	[1]
75-45-6	Chlorodifluoromethane	1.00E+00	unitless	[5]			
75-50-3	Trimethylamine	1.00E+00	unitless	[3]			
75-69-4	Trichlorofluoromethane	1.00E+00	unitless	[5]	3.00E-01	mg/(kg/d)	[1]
75-71-8	Dichlorodifluoromethane	1.00E+00	unitless	[5]	2.00E-01	mg/(kg/d)	[1]
76-01-7	Pentachloroethane	1.00E+00	unitless	[5]	5.70E+00	mg/(kg/d)	[1]
76-13-1	1,2,2-Trichlorotrifluoroethane	1.00E+00	unitless	[5]	3.00E+01	mg/(kg/d)	[1]
76-44-8	Heptachlor	1.00E+00	unitless	[5]	5.00E-04	mg/(kg/d)	[1]
7647-01-0	Hydrogen chloride	1.00E+00	unitless	[5]			
765-34-4	Glycidylaldehyde	1.00E+00	unitless	[5]	4.00E-04	mg/(kg/d)	[1]
7664-39-3	Hydrogen Fluoride	1.00E+00	unitless	[5]	4.00E-02	mg/(kg/d)	[1]
7664-41-7	Ammonia/Ammonium	1.00E+00	unitless	[5]	3.40E+01	mg/(kg/d)	[1]
77-47-4	Hexachlorocyclopentadiene	1.00E+00	unitless	[5]	6.00E-03	mg/(kg/d)	[1]
77-78-1	Dimethyl sulfate	1.00E+00	unitless	[3]			
7704-34-9	Total Sulfur (thermodynamically stable)	1.00E+00	unitless	[3]			
7723-14-0	Phosphorus	1.00E+00	unitless	[5]	2.00E-05	mg/(kg/d)	[1]
7782-41-4	Fluorine gas F2	1.00E+00	unitless	[5]	6.00E-02	mg/(kg/d)	[1]
7782-49-2	Selenium	1.00E+00	unitless	[5]	5.00E-03	mg/(kg/d)	[1]
7782-50-5	Chlorine	1.00E+00	unitless	[5]	1.00E-01	mg/(kg/d)	[1]
78-83-1	2-Methylpropyl alcohol	1.00E+00	unitless	[5]	3.00E-01	mg/(kg/d)	[1]
78-87-5	1,2-Dichloropropane	1.00E+00	unitless	[5]	9.00E-02	mg/(kg/d)	[1]
78-93-3	2-Butanone	1.00E+00	unitless	[5]	6.00E-01	mg/(kg/d)	[1]
79-00-5	1,1,2-Trichloroethane	1.00E+00	unitless	[5]	4.00E-03	mg/(kg/d)	[1]
79-01-6	1,1,2-Trichloroethylene	1.00E+00	unitless	[5]	5.00E-04	mg/(kg/d)	[1]

Table 5-2 Percent Gastrointestinal Absorption and Dermal Chronic Reference Dose

CAS Registry Number	Constituent Name	Gastro-intestinal Absorption (*GAF*)	Units for Gastro-intestinal Absorption	Reference	Dermal Chronic Reference Dose (RfD_{dermal})	Units for Dermal Chronic Reference Dose	Reference
79-10-7	2-Propenoic acid	1.00E+00	unitless	[5]	5.00E-01	mg/(kg/d)	[1]
79-34-5	1,1,2,2-Tetrachloroethane	1.00E+00	unitless	[5]	2.00E-02	mg/(kg/d)	[1]
79-46-9	2-Nitropropane	1.00E+00	unitless	[5]			
80-62-6	Methyl methacrylate	1.00E+00	unitless	[5]	1.40E+00	mg/(kg/d)	[1]
82-68-8	Pentachloronitrobenzene (PCNB)	1.00E+00	unitless	[5]	3.00E-03	mg/(kg/d)	[1]
822-06-0	Hexamethylene-1,5-diisocyanate	1.00E+00	unitless	[5]	1.00E-05	mg/(kg/d)	[1]
823-40-5	Toluene-2,6-diamine	1.00E+00	unitless	[3]	3.00E-02	mg/(kg/d)	[1]
83-32-9	Acenaphthene	1.00E+00	unitless	[5]	6.00E-02	mg/(kg/d)	[1]
832-69-9	1-Methylphenanthrene	8.00E-01	unitless	[2]			
84-66-2	Diethyl phthalate	1.00E+00	unitless	[5]	8.00E-01	mg/(kg/d)	[1]
84-74-2	Di-n-butylphthalate	1.00E+00	unitless	[5]	1.00E-01	mg/(kg/d)	[1]
85-01-8	Phenanthrene	1.00E+00	unitless	[3]			
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	1.00E+00	unitless	[5]	2.00E+00	mg/(kg/d)	[1]
85-68-7	Butylbenzylphthalate	1.00E+00	unitless	[5]	2.00E-01	mg/(kg/d)	[1]
86-73-7	Fluorene	1.00E+00	unitless	[5]	4.00E-02	mg/(kg/d)	[1]
87-61-6	1,2,3-Trichlorobenzene	1.00E+00	unitless	[5]	8.00E-04	mg/(kg/d)	[1]
87-68-3	Hexachlorobutadiene	1.00E+00	unitless	[5]	1.00E-03	mg/(kg/d)	[1]
87-86-5	Pentachlorophenol	1.00E+00	unitless	[5]	5.00E-03	mg/(kg/d)	[1]
88-74-4	o-Nitroaniline (2-nitroaniline)	1.00E+00	unitless	[5]	1.00E-02	mg/(kg/d)	[1]
88-75-5	2-Nitrophenol	1.00E+00	unitless	[3]			
90-12-0	1-Methylnaphthalene	1.00E+00	unitless	[5]	7.00E-02	mg/(kg/d)	[1]
91-20-3	Naphthalene	1.00E+00	unitless	[5]	2.00E-02	mg/(kg/d)	[1]
91-57-6	2-Methylnaphthalene	1.00E+00	unitless	[5]	4.00E-03	mg/(kg/d)	[1]
91-58-7	2-Chloronaphthalene	1.00E+00	unitless	[5]	8.00E-02	mg/(kg/d)	[1]
92-52-4	1,1`-Biphenyl	1.00E+00	unitless	[5]	5.00E-01	mg/(kg/d)	[1]
94-75-7	2,4-D	1.00E+00	unitless	[5]	1.00E-02	mg/(kg/d)	[1]
95-48-7	o-Cresol	1.00E+00	unitless	[5]	5.00E-02	mg/(kg/d)	[1]
95-49-8	o-Chlorotoluene	1.00E+00	unitless	[5]	2.00E-02	mg/(kg/d)	[1]
95-50-1	1,2-Dichlorobenzene	1.00E+00	unitless	[5]	9.00E-02	mg/(kg/d)	[1]
95-57-8	2-Chlorophenol	1.00E+00	unitless	[5]	5.00E-03	mg/(kg/d)	[1]

Reference	Source for Gastrointestinal Absorption
[1]	Default value for semivolatile compounds (e.g., boiling point higher than water, refer to EPA Fact Sheet "Semi-Volatile Organic Compounds", available at http://www.epa.gov/reg3hwmd/bf-lr/regional/analytical/semi-volatile.htm, and see RAWP Section 7.2.1.1)
[2]	Default value for volatile compounds (e.g., boiling point lower than water, refer to EPA Fact Sheet "Semi-Volatile Organic Compounds", available at http://www.epa.gov/reg3hwmd/bf-lr/regional/analytical/semi-volatile.htm, and see RAWP Section 7.2.1.1)
[3]	EPA. 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), Final, EPA/540/R/99/005, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/oswer/riskassessment/ragse/pdf/2004_1101_part_e.pdf)
[4]	EPA. 2013. Regional Screening Levels for Chemical Contaminants at Superfund Sites, Region 3, US Environmental Protection Agency, Washington, DC. (available at http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm, accessed November 2013)
[5]	EPA. 2016. Regional Screening Levels for Chemical Contaminants at Superfund Sites, Region 3, US Environmental Protection Agency, Washington, DC. (available at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-may-2016, accessed May 2017)
[6]	ORNL. The Risk Assessment Information System (RAIS) Database. Copyright © 2013 Oak Ridge National Laboratory and The University of Tennessee, Oak Ridge, TN (http://rais.ornl.gov, accessed April 2014)

Reference	Source for Dermal Reference Dose
[1]	EPA. 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), Final, EPA/540/R/99/005, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/oswer/riskassessment/ragse/pdf/2004_1101_part_e.pdf)
[2]	Surrogate value from Methyl mercury

Table 5-3 provides the Unit Risk Factor (URF) and Cancer Slope Factor (CSF_o) used for assessment of the potential increase in the probability of a cancer response due to the inhalation or ingestion of contaminants, respectively. Note that the URF, a term from the HHRAP, is synomous with the inhalation unit risk (IUR) which is used in EPA's Integrated Risk Information System and the Regional Screening Levels. Blank entries in the table indicate where data are not available.

Table 5-3 Inhalation Unit Risk Factor and Oral Cancer Slope Factors for COPCs

CAS Registry Number	Constituent Name	Unit Risk Factor (*URF*)	Units for Unit Risk Factor	Reference	Cancer Slope Factor (CSF_o)	Units for Cancer Slope Factor	Reference
100-41-4	Ethyl benzene	2.50E-03	m^3/mg	[5]	1.10E-02	(kg·d)/mg	[5]
100-42-5	Styrene						
100-44-7	Benzyl chloride	4.90E-02	m^3/mg	[5]	1.70E-01	(kg·d)/mg	[5]
101-77-9	4,4-Methylenedianiline	4.60E-01	m^3/mg	[5]	1.60E+00	(kg·d)/mg	[5]
103-33-3	Azobenzene	3.10E-02	m^3/mg	[5]	1.10E-01	(kg·d)/mg	[5]
10595-95-6	n-Nitrosomethylethylamine	6.30E+00	m^3/mg	[5]	2.20E+01	(kg·d)/mg	[5]
106-46-7	1,4-Dichlorobenzene	1.10E-02	m^3/mg	[5]	5.40E-03	(kg·d)/mg	[5]
106-47-8	p-Chloroaniline				2.00E-01	(kg·d)/mg	[5]
106-49-0	p-Toluidine				3.00E-02	(kg·d)/mg	[5]
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	1.20E-03	m^3/mg	[5]	9.90E-03	(kg·d)/mg	[5]
106-93-4	Ethylene dibromide	6.00E-01	m^3/mg	[5]	2.00E+00	(kg·d)/mg	[5]
106-99-0	1,3-Butadiene	3.00E-02	m^3/mg	[5]	3.40E+00	(kg·d)/mg	[5]
107-06-2	1,2-Dichloroethane	2.60E-02	m^3/mg	[5]	9.10E-02	(kg·d)/mg	[5]
107-13-1	Acrylonitrile	6.80E-02	m^3/mg	[5]	5.40E-01	(kg·d)/mg	[5]
108-60-1	bis (2-Chloroisopropyl)ether	1.00E-02	m^3/mg	[3]	7.00E-02	(kg·d)/mg	[3]
109-99-9	Tetrahydrofuran	1.90E-03	m^3/mg	[2]	7.60E-03	(kg·d)/mg	[2]
111-44-4	Bis(2-chloroethyl)ether	3.30E-01	m^3/mg	[5]	1.10E+00	(kg·d)/mg	[5]
1120-71-4	1,3-Propane sultone	6.90E-01	m^3/mg	[1]	2.40E+00	(kg·d)/mg	[7]
117-81-7	Bis(2-ethylhexyl) phthalate	2.40E-03	m^3/mg	[5]	1.40E-02	(kg·d)/mg	[5]
118-74-1	Hexachlorobenzene	4.60E-01	m^3/mg	[5]	1.60E+00	(kg·d)/mg	[5]
119-90-4	3,3'-Dimethoxybenzidine				1.60E+00	(kg·d)/mg	[5]
120-82-1	1,2,4-Trichlorobenzene				2.90E-02	(kg·d)/mg	[5]
121-14-2	2,4-Dinitrotoluene	8.90E-02	m^3/mg	[5]	3.10E-01	(kg·d)/mg	[5]
122-66-7	1,2-Diphenylhydrazine	2.20E-01	m^3/mg	[5]	8.00E-01	(kg·d)/mg	[5]
123-91-1	1,4-Dioxan	5.00E-03	m^3/mg	[5]	1.00E-01	(kg·d)/mg	[5]
124-48-1	Chlorodibromomethane	2.70E-02	m^3/mg	[3]	8.40E-02	(kg·d)/mg	[5]
126-73-8	Tributyl phosphate				9.00E-03	(kg·d)/mg	[5]
127-18-4	1,1,2,2-Tetrachloroethene	2.60E-04	m^3/mg	[5]	2.10E-03	(kg·d)/mg	[5]

Table 5-3 Inhalation Unit Risk Factor and Oral Cancer Slope Factors for COPCs

CAS Registry Number	Constituent Name	Unit Risk Factor (*URF*)	Units for Unit Risk Factor	Reference	Cancer Slope Factor (CSF_o)	Units for Cancer Slope Factor	Reference
133-06-2	Captan	6.60E-04	m^3/mg	[5]	2.30E-03	(kg·d)/mg	[5]
1336-36-3	Polychlorinated biphenyls	5.70E-01	m^3/mg	[5]	2.00E+00	(kg·d)/mg	[5]
1634-04-4	Methyl tert-butyl ether	2.60E-04	m^3/mg	[5]	1.80E-03	(kg·d)/mg	[5]
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	3.80E+04	m^3/mg	[5]	1.30E+05	(kg·d)/mg	[5]
18540-29-9	Chromium(VI)	8.40E+01	m^3/mg	[5]	5.00E-01	(kg·d)/mg	[5]
189-55-9	Dibenzo[a,i]pyrene	1.10E+01	m^3/mg	[1]	1.20E+02	(kg·d)/mg	[1]
189-64-0	Dibenzo[a,h]pyrene	1.10E+01	m^3/mg	[1]	1.20E+02	(kg·d)/mg	[1]
191-30-0	Dibenzo(a,l)pyrene	1.10E+01	m^3/mg	[1]	1.20E+02	(kg·d)/mg	[1]
192-65-4	Dibenzo[a,e]pyrene	1.10E+00	m^3/mg	[5]	1.20E+01	(kg·d)/mg	[5]
193-39-5	Indeno(1,2,3-cd)pyrene	1.10E-01	m^3/mg	[5]	7.30E-01	(kg·d)/mg	[5]
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	1.30E+03	m^3/mg	[4]	6.20E-03	(kg·d)/mg	[4]
205-82-3	Benzo[j]fluoranthene	1.10E-01	m^3/mg	[5]	1.20E+00	(kg·d)/mg	[5]
205-99-2	Benzo(b)fluoranthene	1.10E-01	m^3/mg	[5]	7.30E-01	(kg·d)/mg	[5]
207-08-9	Benzo(k)fluoranthene	1.10E-01	m^3/mg	[5]	7.30E-02	(kg·d)/mg	[5]
218-01-9	Chrysene	1.10E-02	m^3/mg	[5]	7.30E-03	(kg·d)/mg	[5]
224-42-0	Dibenz[a,j]acridine	1.10E-01	m^3/mg	[1]	1.20E+00	(kg·d)/mg	[1]
226-36-8	Dibenz[a,h]acridine	1.10E-01	m^3/mg	[1]	1.20E+00	(kg·d)/mg	[1]
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	1.10E+00	m^3/mg	[5]	3.90E+00	(kg·d)/mg	[5]
319-84-6	alpha-BHC	1.80E+00	m^3/mg	[5]	6.30E+00	(kg·d)/mg	[5]
319-85-7	beta-BHC	5.30E-01	m^3/mg	[5]	1.80E+00	(kg·d)/mg	[5]
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	3.80E+00	m^3/mg	[5]	1.30E+01	(kg·d)/mg	[5]
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	1.10E+00	m^3/mg	[5]	3.90E+00	(kg·d)/mg	[5]
3268-87-9	Octachlorodibenzo(p)dioxin	1.10E+01	m^3/mg	[1]	3.90E+01	(kg·d)/mg	[1]
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	1.10E+03	m^3/mg	[5]	3.90E+03	(kg·d)/mg	[5]
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	3.80E+02	m^3/mg	[1]	1.30E+03	(kg·d)/mg	[1]
3697-24-3	5-Methylchrysene	1.10E+00	m^3/mg	[1]	1.20E+01	(kg·d)/mg	[1]
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	1.10E+00	m^3/mg	[5]	3.90E+00	(kg·d)/mg	[5]

Table 5-3 Inhalation Unit Risk Factor and Oral Cancer Slope Factors for COPCs

CAS Registry Number	Constituent Name	Unit Risk Factor (*URF*)	Units for Unit Risk Factor	Reference	Cancer Slope Factor (CSF_o)	Units for Cancer Slope Factor	Reference
39001-02-0	Octachlorodibenzofuran	1.10E+01	m^3/mg	[1]	3.90E+01	(kg·d)/mg	[1]
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	3.80E+03	m^3/mg	[1]	1.30E+04	(kg·d)/mg	[1]
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	1.10E+00	m^3/mg	[5]	3.90E+00	(kg·d)/mg	[5]
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	3.80E+04	m^3/mg	[1]	1.30E+05	(kg·d)/mg	[1]
50-00-0	Formaldehyde	1.30E-02	m^3/mg	[5]			
50-32-8	Benzo(a)pyrene	1.10E+00	m^3/mg	[5]	7.30E+00	(kg·d)/mg	[5]
51-79-6	Ethyl carbamate (urethane)	2.90E-01	m^3/mg	[5]	1.00E+00	(kg·d)/mg	[5]
510-15-6	Chlorobenzilate	3.10E-02	m^3/mg	[5]	1.10E-01	(kg·d)/mg	[5]
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran						
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	1.10E+00	m^3/mg	[5]	3.90E+00	(kg·d)/mg	[5]
53-70-3	Dibenz[a,h]anthracene	1.20E+00	m^3/mg	[5]	7.30E+00	(kg·d)/mg	[5]
540-73-8	1,2-Dimethylhydrazine	1.60E+02	m^3/mg	[5]	5.50E+02	(kg·d)/mg	[5]
542-75-6	1,3-Dichloropropene	4.00E-03	m^3/mg	[5]	1.00E-01	(kg·d)/mg	[5]
542-88-1	Bis(chloromethyl)ether	6.20E+01	m^3/mg	[5]	2.20E+02	(kg·d)/mg	[5]
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	3.80E+02	m^3/mg	[1]	1.30E+03	(kg·d)/mg	[1]
56-23-5	Carbon tetrachloride	6.00E-03	m^3/mg	[5]	7.00E-02	(kg·d)/mg	[5]
56-49-5	3-Methylcholanthrene	6.30E+00	m^3/mg	[5]	2.20E+01	(kg·d)/mg	[5]
56-55-3	Benzo(a)anthracene	1.10E-01	m^3/mg	[5]	7.30E-01	(kg·d)/mg	[5]
57-74-9	Chlordane	1.00E-01	m^3/mg	[6]	3.50E-01	(kg·d)/mg	[6]
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	1.10E+04	m^3/mg	[1]	3.90E+04	(kg·d)/mg	[1]
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	1.10E+03	m^3/mg	[1]	3.90E+03	(kg·d)/mg	[1]
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	3.80E+03	m^3/mg	[1]	1.30E+04	(kg·d)/mg	[1]
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	3.80E+03	m^3/mg	[5]	1.30E+04	(kg·d)/mg	[5]
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	1.30E+03	m^3/mg	[6]	6.20E+03	(kg·d)/mg	[6]
58-89-9	gamma-BHC (Lindane)	3.10E-01	m^3/mg	[5]	1.10E+00	(kg·d)/mg	[5]
584-84-9	2,4-Toluene diisocyanate	1.10E-02	m^3/mg	[5]	3.10E-01	(kg·d)/mg	[8]
59-89-2	N-Nitrosomorpholine	1.90E+00	m^3/mg	[5]	6.70E+00	(kg·d)/mg	[5]

Table 5-3 Inhalation Unit Risk Factor and Oral Cancer Slope Factors for COPCs

CAS Registry Number	Constituent Name	Unit Risk Factor (*URF*)	Units for Unit Risk Factor	Reference	Cancer Slope Factor (CSF_o)	Units for Cancer Slope Factor	Reference
593-60-2	Bromoethene (Vinyl bromide)	3.20E-02	m^3/mg	[5]			
60-11-7	Dimethyl aminoazobenzene	1.30E+00	m^3/mg	[5]	4.60E+00	(kg·d)/mg	[5]
602-87-9	5-Nitroacenaphthene	3.70E-02	m^3/mg	[1]	1.30E-01	(kg·d)/mg	[1]
606-20-2	2,6-Dinitrotoluene				1.50E+00	(kg·d)/mg	[5]
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	3.80E+03	m^3/mg	[1]	1.30E+04	(kg·d)/mg	[1]
62-53-3	Aniline	1.60E-03	m^3/mg	[5]	5.70E-03	(kg·d)/mg	[5]
62-75-9	N-Nitroso-N,N-dimethylamine	1.40E+01	m^3/mg	[5]	5.10E+01	(kg·d)/mg	[5]
621-64-7	N-Nitroso-di-n-propylamine	2.00E+00	m^3/mg	[5]	7.00E+00	(kg·d)/mg	[5]
624-83-9	Methyl isocyanate	6.80E-02	m^3/mg	[8]	5.40E-01	(kg·d)/mg	[9]
630-20-6	1,1,1,2-Tetrachloroethane	7.40E-03	m^3/mg	[5]	2.60E-02	(kg·d)/mg	[5]
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	1.10E+00	m^3/mg	[5]	3.90E+00	(kg·d)/mg	[5]
67-66-3	Chloroform	2.30E-02	m^3/mg	[5]	3.10E-02	(kg·d)/mg	[5]
67-72-1	Hexachloroethane	1.10E-02	m^3/mg	[5]	4.00E-02	(kg·d)/mg	[5]
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	3.80E+02	m^3/mg	[1]	1.30E+03	(kg·d)/mg	[1]
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	1.10E+00	m^3/mg	[5]	3.90E+00	(kg·d)/mg	[5]
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	1.10E+01	m^3/mg	[5]	3.90E+01	(kg·d)/mg	[5]
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	3.80E+03	m^3/mg	[1]	1.30E+04	(kg·d)/mg	[1]
71-43-2	Benzene	7.80E-03	m^3/mg	[5]	5.50E-02	(kg·d)/mg	[5]
72-55-9	4,4-DDE	9.70E-02	m^3/mg	[5]	3.40E-01	(kg·d)/mg	[5]
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	3.80E+03	m^3/mg	[1]	1.30E+04	(kg·d)/mg	[1]
74-87-3	Chloromethane	1.80E-03	m^3/mg	[2]	1.30E-02	(kg·d)/mg	[2]
7439-92-1	Lead	1.20E-02	m^3/mg	[2]	8.50E-03	(kg·d)/mg	[2]
7440-02-0	Nickel	2.60E-01	m^3/mg	[5]			
7440-38-2	Arsenic	4.30E+00	m^3/mg	[5]	1.50E+00	(kg·d)/mg	[5]
7440-41-7	Beryllium	2.40E+00	m^3/mg	[5]			
7440-43-9	Cadmium	1.80E+00	m^3/mg	[5]	3.80E-01	(kg·d)/mg	[2]
7440-48-4	Cobalt	9.00E+00	m^3/mg	[5]			

Table 5-3 Inhalation Unit Risk Factor and Oral Cancer Slope Factors for COPCs

CAS Registry Number	Constituent Name	Unit Risk Factor (*URF*)	Units for Unit Risk Factor	Reference	Cancer Slope Factor (CSF_o)	Units for Cancer Slope Factor	Reference
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	1.10E+00	m^3/mg	[5]	3.90E+00	(kg·d)/mg	[5]
75-00-3	Chloroethane						
75-01-4	1-Chloroethene	4.40E-03	m^3/mg	[5]	7.20E-01	(kg·d)/mg	[5]
75-07-0	Acetaldehyde	2.20E-03	m^3/mg	[5]			
75-09-2	Dichloromethane (Methylene Chloride)	1.00E-05	m^3/mg	[5]	2.00E-03	(kg·d)/mg	[5]
75-21-8	Ethylene oxide (Oxirane)	8.80E-02	m^3/mg	[5]	3.10E-01	(kg·d)/mg	[5]
75-25-2	Bromoform	1.10E-03	m^3/mg	[5]	7.90E-03	(kg·d)/mg	[5]
75-27-4	Bromodichloromethane	3.70E-02	m^3/mg	[5]	6.20E-02	(kg·d)/mg	[5]
75-34-3	1,1-Dichloroethane	1.60E-03	m^3/mg	[5]	5.70E-03	(kg·d)/mg	[5]
75-35-4	1,1-Dichloroethene	5.00E-02	m^3/mg	[7]			
76-44-8	Heptachlor	1.30E+00	m^3/mg	[5]	4.50E+00	(kg·d)/mg	[5]
764-41-0	1,4-Dichloro-2-butene	4.20E+00	m^3/mg	[5]			
78-87-5	1,2-Dichloropropane	1.00E-02	m^3/mg	[5]	3.60E-02	(kg·d)/mg	[5]
79-00-5	1,1,2-Trichloroethane	1.60E-02	m^3/mg	[5]	5.70E-02	(kg·d)/mg	[5]
79-01-6	1,1,2-Trichloroethylene	4.10E-03	m^3/mg	[5]	4.60E-02	(kg·d)/mg	[5]
79-34-5	1,1,2,2-Tetrachloroethane	5.80E-02	m^3/mg	[5]	2.00E-01	(kg·d)/mg	[5]
79-46-9	2-Nitropropane	2.70E+00	m^3/mg	[5]			
82-68-8	Pentachloronitrobenzene (PCNB)				2.60E-01	(kg·d)/mg	[5]
85-68-7	Butylbenzylphthalate				1.90E-03	(kg·d)/mg	[5]
87-68-3	Hexachlorobutadiene	2.20E-02	m^3/mg	[5]	7.80E-02	(kg·d)/mg	[5]
87-86-5	Pentachlorophenol	5.10E-03	m^3/mg	[5]	4.00E-01	(kg·d)/mg	[5]
88-06-2	2,4,6-Trichlorophenol	3.10E-03	m^3/mg	[5]	1.10E-02	(kg·d)/mg	[5]
90-04-0	o-Anisidine	4.00E-02	m^3/mg	[7]	1.40E-01	(kg·d)/mg	[7]
91-22-5	Quinoline				3.00E+00	(kg·d)/mg	[5]
91-94-1	3,3'-Dichlorobenzidine	3.40E-01	m^3/mg	[5]	4.50E-01	(kg·d)/mg	[5]
924-16-3	N-Nitroso-di-n-Buetylamine	1.60E+00	m^3/mg	[5]	5.40E+00	(kg·d)/mg	[5]
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	6.30E-02	m^3/mg	[5]	2.20E-01	(kg·d)/mg	[5]
95-53-4	o-Toluidine	5.10E-02	m^3/mg	[5]	1.60E-02	(kg·d)/mg	[5]

Reference	Reference (source) for Unit Risk Factor
[1]	CalEPA. 2012. "Table 1: Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values," California Environmental Protection Agency, Air Resources Board and Office of Environmental Health Hazard Assessment, Sacramento, CA, May 3, 2012 (available at http://www.arb.ca.gov/toxics/healthval/contable.pdf, accessed January 2013)
[2]	EPA. 2005. The Hazardous Waste Companion Database. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013)
[3]	EPA. 2013. Regional Screening Levels for Chemical Contaminants at Superfund Sites, Region 3, US Environmental Protection Agency, Washington, DC. (available at http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm, accessed November 2013)
[4]	EPA. 2014. Integrated Risk Information System (IRIS). Values updated monthly on line at http://www.epa.gov/iris/. Accessed July 2014 for a mixture of 1,2,3,6,7,8-HxCDD and 1,2,3,7,8,9-HxCDD (CASRN 57653-85-7, 19408-74-3)
[5]	EPA. 2016. Regional Screening Levels for Chemical Contaminants at Superfund Sites, Region 3, US Environmental Protection Agency, Washington, DC. (available at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-may-2016, accessed May 2017)
[6]	EPA. Integrated Risk Information System (IRIS) On-line Database of Toxicity Measures. US Environmental Protection Agency, Office of Research and Development, Environmental Criteria and Assessment Office, Cincinnati, OH. Values updated monthly on line at http://www.epa.gov/iris/. Accessed November 2012
[7]	ORNL. The Risk Assessment Information System (RAIS) Database. Copyright © 2013 Oak Ridge National Laboratory and The University of Tennessee, Oak Ridge, TN (http://rais.ornl.gov, accessed April 2014)
[8]	Surrogate value from Acrylonitrile

Reference	Reference (source) for Oral Cancer Slope Factor
[1]	CalEPA. 2012. "Table 1: Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values," California Environmental Protection Agency, Air Resources Board and Office of Environmental Health Hazard Assessment, Sacramento, CA, May 3, 2012 (available at http://www.arb.ca.gov/toxics/healthval/contable.pdf, accessed January 2013)
[2]	EPA. 2005. The Hazardous Waste Companion Database. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013)
[3]	EPA. 2013. Regional Screening Levels for Chemical Contaminants at Superfund Sites, Region 3, US Environmental Protection Agency, Washington, DC. (available at http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm, accessed November 2013)
[4]	EPA. 2014. Integrated Risk Information System (IRIS). Values updated monthly on line at http://www.epa.gov/iris/. Accessed July 2014 for a mixture of 1,2,3,6,7,8-HxCDD and 1,2,3,7,8,9-HxCDD (CASRN 57653-85-7, 19408-74-3)
[5]	EPA. 2016. Regional Screening Levels for Chemical Contaminants at Superfund Sites, Region 3, US Environmental Protection Agency, Washington, DC. (available at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-may-2016, accessed May 2017)
[6]	EPA. Integrated Risk Information System (IRIS) On-line Database of Toxicity Measures. US Environmental Protection Agency, Office of Research and Development, Environmental Criteria and Assessment Office, Cincinnati, OH. Values updated monthly on line at http://www.epa.gov/iris/. Accessed November 2012
[7]	ORNL. The Risk Assessment Information System (RAIS) Database. Copyright © 2013 Oak Ridge National Laboratory and The University of Tennessee, Oak Ridge, TN (http://rais.ornl.gov, accessed April 2014)

Reference	Reference (source) for Oral Cancer Slope Factor
[8]	Surrogate value from 2,4-Dinitrotoluene
[9]	Surrogate value from Acrylonitrile

Table 5-4 provides the Gastro-intestinal Absorption Factor (GAF) used to estimate the dermal cancer slope from oral cancer slope factor (CSD_{dermal}). The CSD_{dermal} is used for assessment of the potential increase in the probability of a cancer response due to the adsorption of contaminants. Blank entries in the table indicate where data are not available.

Table 5-4 Percent Gastrointestinal Absorption and Dermal Cancer Slope Factor

CAS Registry Number	Constituent Name	Gastro-intestinal Absorption (*GAF*)	Units for Gastro-intestinal Absorption	Reference	Dermal Cancer Slope Factor (CSF_{dermal})	Units for Dermal Chronic Slope Factor	Reference
100-41-4	Ethyl benzene	1.00E+00	unitless	[2]	1.10E-02	(kg·d)/mg	[1]
100-42-5	Styrene	1.00E+00	unitless	[2]			
100-44-7	Benzyl chloride	1.00E+00	unitless	[2]	1.70E-01	(kg·d)/mg	[1]
101-77-9	4,4-Methylenedianiline	1.00E+00	unitless	[2]	1.60E+00	(kg·d)/mg	[1]
103-33-3	Azobenzene	1.00E+00	unitless	[2]	1.10E-01	(kg·d)/mg	[1]
10595-95-6	n-Nitrosomethylethylamine	1.00E+00	unitless	[2]	2.20E+01	(kg·d)/mg	[1]
106-46-7	1,4-Dichlorobenzene	1.00E+00	unitless	[2]	5.40E-03	(kg·d)/mg	[1]
106-47-8	p-Chloroaniline	1.00E+00	unitless	[2]	2.00E-01	(kg·d)/mg	[1]
106-49-0	p-Toluidine	1.00E+00	unitless	[2]	3.00E-02	(kg·d)/mg	[1]
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	1.00E+00	unitless	[2]	9.90E-03	(kg·d)/mg	[1]
106-93-4	Ethylene dibromide	1.00E+00	unitless	[2]	2.00E+00	(kg·d)/mg	[1]
106-99-0	1,3-Butadiene	1.00E+00	unitless	[2]	3.40E+00	(kg·d)/mg	[1]
107-06-2	1,2-Dichloroethane	1.00E+00	unitless	[2]	9.10E-02	(kg·d)/mg	[1]
107-13-1	Acrylonitrile	1.00E+00	unitless	[2]	5.40E-01	(kg·d)/mg	[1]
108-60-1	bis (2-Chloroisopropyl)ether	1.00E+00	unitless	[2]	7.00E-02	(kg·d)/mg	[1]
109-99-9	Tetrahydrofuran	1.00E+00	unitless	[2]	7.60E-03	(kg·d)/mg	[1]
111-44-4	Bis(2-chloroethyl)ether	1.00E+00	unitless	[2]	1.10E+00	(kg·d)/mg	[1]
1120-71-4	1,3-Propane sultone	1.00E+00	unitless	[1]	2.40E+00	(kg·d)/mg	[1]
117-81-7	Bis(2-ethylhexyl) phthalate	1.00E+00	unitless	[2]	1.40E-02	(kg·d)/mg	[1]
118-74-1	Hexachlorobenzene	1.00E+00	unitless	[2]	1.60E+00	(kg·d)/mg	[1]
119-90-4	3,3'-Dimethoxybenzidine	1.00E+00	unitless	[2]	1.60E+00	(kg·d)/mg	[1]
120-82-1	1,2,4-Trichlorobenzene	1.00E+00	unitless	[2]	2.90E-02	(kg·d)/mg	[1]
121-14-2	2,4-Dinitrotoluene	1.00E+00	unitless	[2]	3.10E-01	(kg·d)/mg	[1]
122-66-7	1,2-Diphenylhydrazine	1.00E+00	unitless	[2]	8.00E-01	(kg·d)/mg	[1]
123-91-1	1,4-Dioxan	1.00E+00	unitless	[2]	1.00E-01	(kg·d)/mg	[1]
124-48-1	Chlorodibromomethane	1.00E+00	unitless	[2]	8.40E-02	(kg·d)/mg	[1]
126-73-8	Tributyl phosphate	1.00E+00	unitless	[2]	9.00E-03	(kg·d)/mg	[1]
127-18-4	1,1,2,2-Tetrachloroethene	1.00E+00	unitless	[2]	2.10E-03	(kg·d)/mg	[1]

Table 5-4 Percent Gastrointestinal Absorption and Dermal Cancer Slope Factor

CAS Registry Number	Constituent Name	Gastro-intestinal Absorption (*GAF*)	Units for Gastro-intestinal Absorption	Reference	Dermal Cancer Slope Factor (CSF_{dermal})	Units for Dermal Chronic Slope Factor	Reference
133-06-2	Captan	1.00E+00	unitless	[2]	2.30E-03	(kg·d)/mg	[1]
1336-36-3	Polychlorinated biphenyls	1.00E+00	unitless	[2]	2.00E+00	(kg·d)/mg	[1]
1634-04-4	Methyl tert-butyl ether	1.00E+00	unitless	[2]	1.80E-03	(kg·d)/mg	[1]
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1.00E+00	unitless	[2]	1.30E+05	(kg·d)/mg	[1]
18540-29-9	Chromium(VI)	2.50E-02	unitless	[2]	2.00E+01	(kg·d)/mg	[1]
189-55-9	Dibenzo[a,i]pyrene	8.90E-01	unitless	[1]	1.35E+02	(kg·d)/mg	[1]
189-64-0	Dibenzo[a,h]pyrene	8.90E-01	unitless	[1]	1.35E+02	(kg·d)/mg	[1]
191-30-0	Dibenzo(a,l)pyrene	8.90E-01	unitless	[1]	1.35E+02	(kg·d)/mg	[1]
192-65-4	Dibenzo[a,e]pyrene	1.00E+00	unitless	[2]	1.20E+01	(kg·d)/mg	[1]
193-39-5	Indeno(1,2,3-cd)pyrene	1.00E+00	unitless	[2]	7.30E-01	(kg·d)/mg	[1]
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	1.00E+00	unitless	[1]	6.20E-03	(kg·d)/mg	[1]
205-82-3	Benzo[j]fluoranthene	1.00E+00	unitless	[2]	1.20E+00	(kg·d)/mg	[1]
205-99-2	Benzo(b)fluoranthene	1.00E+00	unitless	[2]	7.30E-01	(kg·d)/mg	[1]
207-08-9	Benzo(k)fluoranthene	1.00E+00	unitless	[2]	7.30E-02	(kg·d)/mg	[1]
218-01-9	Chrysene	1.00E+00	unitless	[2]	7.30E-03	(kg·d)/mg	[1]
224-42-0	Dibenz[a,j]acridine	8.90E-01	unitless	[1]	1.35E+00	(kg·d)/mg	[1]
226-36-8	Dibenz[a,h]acridine	8.90E-01	unitless	[1]	1.35E+00	(kg·d)/mg	[1]
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	1.00E+00	unitless	[2]	3.90E+00	(kg·d)/mg	[1]
319-84-6	alpha-BHC	1.00E+00	unitless	[2]	6.30E+00	(kg·d)/mg	[1]
319-85-7	beta-BHC	1.00E+00	unitless	[2]	1.80E+00	(kg·d)/mg	[1]
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	1.00E+00	unitless	[2]	1.30E+01	(kg·d)/mg	[1]
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	1.00E+00	unitless	[2]	3.90E+00	(kg·d)/mg	[1]
3268-87-9	Octachlorodibenzo(p)dioxin	1.00E+00	unitless	[1]	3.90E+01	(kg·d)/mg	[1]
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	1.00E+00	unitless	[2]	3.90E+03	(kg·d)/mg	[1]
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	1.00E+00	unitless	[1]	1.30E+03	(kg·d)/mg	[1]
3697-24-3	5-Methylchrysene	8.90E-01	unitless	[1]	1.35E+01	(kg·d)/mg	[1]

Table 5-4 Percent Gastrointestinal Absorption and Dermal Cancer Slope Factor

CAS Registry Number	Constituent Name	Gastro-intestinal Absorption (*GAF*)	Units for Gastro-intestinal Absorption	Reference	Dermal Cancer Slope Factor (CSF_{dermal})	Units for Dermal Chronic Slope Factor	Reference
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	1.00E+00	unitless	[2]	3.90E+00	(kg·d)/mg	[1]
39001-02-0	Octachlorodibenzofuran	1.00E+00	unitless	[1]	3.90E+01	(kg·d)/mg	[1]
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	1.00E+00	unitless	[1]	1.30E+04	(kg·d)/mg	[1]
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	1.00E+00	unitless	[2]	3.90E+00	(kg·d)/mg	[1]
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	1.00E+00	unitless	[1]	1.30E+05	(kg·d)/mg	[1]
50-00-0	Formaldehyde	1.00E+00	unitless	[2]			
50-32-8	Benzo(a)pyrene	1.00E+00	unitless	[2]	7.30E+00	(kg·d)/mg	[1]
51-79-6	Ethyl carbamate (urethane)	1.00E+00	unitless	[2]	1.00E+00	(kg·d)/mg	[1]
510-15-6	Chlorobenzilate	1.00E+00	unitless	[2]	1.10E-01	(kg·d)/mg	[1]
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	1.00E+00	unitless	[1]			
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	1.00E+00	unitless	[2]	3.90E+00	(kg·d)/mg	[1]
53-70-3	Dibenz[a,h]anthracene	1.00E+00	unitless	[2]	7.30E+00	(kg·d)/mg	[1]
540-73-8	1,2-Dimethylhydrazine	1.00E+00	unitless	[2]	5.50E+02	(kg·d)/mg	[1]
542-75-6	1,3-Dichloropropene	1.00E+00	unitless	[2]	1.00E-01	(kg·d)/mg	[1]
542-88-1	Bis(chloromethyl)ether	1.00E+00	unitless	[2]	2.20E+02	(kg·d)/mg	[1]
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	1.00E+00	unitless	[1]	1.30E+03	(kg·d)/mg	[1]
56-23-5	Carbon tetrachloride	1.00E+00	unitless	[2]	7.00E-02	(kg·d)/mg	[1]
56-49-5	3-Methylcholanthrene	1.00E+00	unitless	[2]	2.20E+01	(kg·d)/mg	[1]
56-55-3	Benzo(a)anthracene	1.00E+00	unitless	[2]	7.30E-01	(kg·d)/mg	[1]
57-74-9	Chlordane	5.00E-01	unitless	[3]	7.00E-01	(kg·d)/mg	[1]
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	1.00E+00	unitless	[1]	3.90E+04	(kg·d)/mg	[1]
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	1.00E+00	unitless	[1]	3.90E+03	(kg·d)/mg	[1]
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	1.00E+00	unitless	[1]	1.30E+04	(kg·d)/mg	[1]
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	1.00E+00	unitless	[2]	1.30E+04	(kg·d)/mg	[1]
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	1.00E+00	unitless	[1]	6.20E+03	(kg·d)/mg	[1]
58-89-9	gamma-BHC (Lindane)	1.00E+00	unitless	[2]	1.10E+00	(kg·d)/mg	[1]

Table 5-4 Percent Gastrointestinal Absorption and Dermal Cancer Slope Factor

CAS Registry Number	Constituent Name	Gastro-intestinal Absorption (*GAF*)	Units for Gastro-intestinal Absorption	Reference	Dermal Cancer Slope Factor (CSF_{dermal})	Units for Dermal Chronic Slope Factor	Reference
584-84-9	2,4-Toluene diisocyanate	1.00E+00	unitless	[2]	3.10E-01	(kg·d)/mg	[1]
59-89-2	N-Nitrosomorpholine	1.00E+00	unitless	[2]	6.70E+00	(kg·d)/mg	[1]
593-60-2	Bromoethene (Vinyl bromide)	1.00E+00	unitless	[2]			
60-11-7	Dimethyl aminoazobenzene	1.00E+00	unitless	[2]	4.60E+00	(kg·d)/mg	[1]
602-87-9	5-Nitroacenaphthene	1.00E+00	unitless	[1]	1.30E-01	(kg·d)/mg	[1]
606-20-2	2,6-Dinitrotoluene	1.00E+00	unitless	[2]	1.50E+00	(kg·d)/mg	[1]
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	1.00E+00	unitless	[1]	1.30E+04	(kg·d)/mg	[1]
62-53-3	Aniline	1.00E+00	unitless	[2]	5.70E-03	(kg·d)/mg	[1]
62-75-9	N-Nitroso-N,N-dimethylamine	1.00E+00	unitless	[2]	5.10E+01	(kg·d)/mg	[1]
621-64-7	N-Nitroso-di-n-propylamine	1.00E+00	unitless	[2]	7.00E+00	(kg·d)/mg	[1]
624-83-9	Methyl isocyanate	1.00E+00	unitless	[2]	5.40E-01	(kg·d)/mg	[1]
630-20-6	1,1,1,2-Tetrachloroethane	1.00E+00	unitless	[2]	2.60E-02	(kg·d)/mg	[1]
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	1.00E+00	unitless	[2]	3.90E+00	(kg·d)/mg	[1]
67-66-3	Chloroform	1.00E+00	unitless	[2]	3.10E-02	(kg·d)/mg	[1]
67-72-1	Hexachloroethane	1.00E+00	unitless	[2]	4.00E-02	(kg·d)/mg	[1]
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	1.00E+00	unitless	[1]	1.30E+03	(kg·d)/mg	[1]
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	1.00E+00	unitless	[2]	3.90E+00	(kg·d)/mg	[1]
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	1.00E+00	unitless	[2]	3.90E+01	(kg·d)/mg	[1]
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	1.00E+00	unitless	[1]	1.30E+04	(kg·d)/mg	[1]
71-43-2	Benzene	1.00E+00	unitless	[2]	5.50E-02	(kg·d)/mg	[1]
72-55-9	4,4-DDE	1.00E+00	unitless	[2]	3.40E-01	(kg·d)/mg	[1]
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	1.00E+00	unitless	[1]	1.30E+04	(kg·d)/mg	[1]
74-87-3	Chloromethane	1.00E+00	unitless	[2]	1.30E-02	(kg·d)/mg	[1]
7439-92-1	Lead	1.00E+00	unitless	[2]	8.50E-03	(kg·d)/mg	[1]
7440-02-0	Nickel	4.00E-02	unitless	[2]			
7440-38-2	Arsenic	1.00E+00	unitless	[2]	1.50E+00	(kg·d)/mg	[1]
7440-41-7	Beryllium	7.00E-03	unitless	[2]			

Table 5-4 Percent Gastrointestinal Absorption and Dermal Cancer Slope Factor

CAS Registry Number	Constituent Name	Gastro-intestinal Absorption (*GAF*)	Units for Gastro-intestinal Absorption	Reference	Dermal Cancer Slope Factor (CSF_{dermal})	Units for Dermal Chronic Slope Factor	Reference
7440-43-9	Cadmium	2.50E-02	unitless	[2]	1.52E+01	(kg·d)/mg	[1]
7440-48-4	Cobalt	1.00E+00	unitless	[2]			
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	1.00E+00	unitless	[2]	3.90E+00	(kg·d)/mg	[1]
75-00-3	Chloroethane	1.00E+00	unitless	[2]			
75-01-4	1-Chloroethene	1.00E+00	unitless	[2]	7.20E-01	(kg·d)/mg	[1]
75-07-0	Acetaldehyde	1.00E+00	unitless	[2]			
75-09-2	Dichloromethane (Methylene Chloride)	1.00E+00	unitless	[2]	2.00E-03	(kg·d)/mg	[1]
75-21-8	Ethylene oxide (Oxirane)	1.00E+00	unitless	[2]	3.10E-01	(kg·d)/mg	[1]
75-25-2	Bromoform	1.00E+00	unitless	[2]	7.90E-03	(kg·d)/mg	[1]
75-27-4	Bromodichloromethane	1.00E+00	unitless	[2]	6.20E-02	(kg·d)/mg	[1]
75-34-3	1,1-Dichloroethane	1.00E+00	unitless	[2]	5.70E-03	(kg·d)/mg	[1]
75-35-4	1,1-Dichloroethene	1.00E+00	unitless	[2]			
76-44-8	Heptachlor	1.00E+00	unitless	[2]	4.50E+00	(kg·d)/mg	[1]
764-41-0	1,4-Dichloro-2-butene	1.00E+00	unitless	[2]			
78-87-5	1,2-Dichloropropane	1.00E+00	unitless	[2]	3.60E-02	(kg·d)/mg	[1]
79-00-5	1,1,2-Trichloroethane	1.00E+00	unitless	[2]	5.70E-02	(kg·d)/mg	[1]
79-01-6	1,1,2-Trichloroethylene	1.00E+00	unitless	[2]	4.60E-02	(kg·d)/mg	[1]
79-34-5	1,1,2,2-Tetrachloroethane	1.00E+00	unitless	[2]	2.00E-01	(kg·d)/mg	[1]
79-46-9	2-Nitropropane	1.00E+00	unitless	[2]			
82-68-8	Pentachloronitrobenzene (PCNB)	1.00E+00	unitless	[2]	2.60E-01	(kg·d)/mg	[1]
85-68-7	Butylbenzylphthalate	1.00E+00	unitless	[2]	1.90E-03	(kg·d)/mg	[1]
87-68-3	Hexachlorobutadiene	1.00E+00	unitless	[2]	7.80E-02	(kg·d)/mg	[1]
87-86-5	Pentachlorophenol	1.00E+00	unitless	[2]	4.00E-01	(kg·d)/mg	[1]
88-06-2	2,4,6-Trichlorophenol	1.00E+00	unitless	[2]	1.10E-02	(kg·d)/mg	[1]
90-04-0	o-Anisidine	1.00E+00	unitless	[1]	1.40E-01	(kg·d)/mg	[1]
91-22-5	Quinoline	1.00E+00	unitless	[2]	3.00E+00	(kg·d)/mg	[1]
91-94-1	3,3'-Dichlorobenzidine	1.00E+00	unitless	[2]	4.50E-01	(kg·d)/mg	[1]
924-16-3	N-Nitroso-di-n-Buetylamine	1.00E+00	unitless	[2]	5.40E+00	(kg·d)/mg	[1]
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	1.00E+00	unitless	[2]	2.20E-01	(kg·d)/mg	[1]
95-53-4	o-Toluidine	1.00E+00	unitless	[2]	1.60E-02	(kg·d)/mg	[1]

Reference	Source for Gastrointestinal Absorption
[1]	EPA. 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), Final, EPA/540/R/99/005, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/oswer/riskassessment/ragse/pdf/2004_1101_part_e.pdf)
[2]	EPA. 2016. Regional Screening Levels for Chemical Contaminants at Superfund Sites, Region 3, US Environmental Protection Agency, Washington, DC. (available at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-may-2016, accessed May 2017)
[3]	ORNL. The Risk Assessment Information System (RAIS) Database. Copyright © 2013 Oak Ridge National Laboratory and The University of Tennessee, Oak Ridge, TN (http://rais.ornl.gov, accessed April 2014)

Reference	Reference (source) for Dermal Cancer Slope Factor
[1]	EPA. 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), Final, EPA/540/R/99/005, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/oswer/riskassessment/ragse/pdf/2004_1101_part_e.pdf)

Table 5-5 provides the Inhalation Slope Factor (CSF_i) and Oral Slope Factor (CSF_o) for assessment of the potential increase in the probability of a cancer response due to the inhalation or ingestion (via food consumption) of radioisotopes, respectively. Blank entries in the table indicate where data are not available.

Table 5-5 Inhalation and Oral (Food Ingestion) Cancer Slope Factors for ROPCs

CAS Registry Number	Constituent Name	Inhalation Slope Factor (CSF_i)	Units for Inhalation Slope Factor	Reference	Ingestion of Food Slope Factor (CSF_o)	Units for Ingestion of Food Slope Factor	Reference
10028-17-8	Tritium	5.62E-14	risk/pCi	[1]	1.44E-13	risk/pCi	[1]
10045-97-3	Cesium-137	1.19E-11	risk/pCi	[1]	3.74E-11	risk/pCi	[1]
10098-97-2	Strontium-90	1.05E-10	risk/pCi	[1]	6.88E-11	risk/pCi	[1]
10198-40-0	Cobalt-60	3.58E-11	risk/pCi	[1]	2.23E-11	risk/pCi	[1]
13966-29-5	Uranium-234	1.14E-08	risk/pCi	[1]	9.55E-11	risk/pCi	[1]
13967-48-1	Ruthenium-106						
13967-70-9	Cesium-134	1.65E-11	risk/pCi	[1]	5.14E-11	risk/pCi	[1]
13968-55-3	Uranium-233	1.16E-08	risk/pCi	[1]	9.69E-11	risk/pCi	[1]
13981-15-2	Curium-244	2.53E-08	risk/pCi	[1]	1.08E-10	risk/pCi	[1]
13981-16-3	Plutonium-238	3.36E-08	risk/pCi	[1]	1.69E-10	risk/pCi	[1]
13981-37-8	Nickel-63	1.64E-12	risk/pCi	[1]	9.51E-13	risk/pCi	[1]
13982-10-0	Plutonium-242	3.13E-08	risk/pCi	[1]	1.65E-10	risk/pCi	[1]
13982-63-3	Radium-226	1.15E-08	risk/pCi	[1]	5.14E-10	risk/pCi	[1]
13982-70-2	Uranium-236	1.05E-08	risk/pCi	[1]	9.03E-11	risk/pCi	[1]
13994-20-2	Neptunium-237	1.77E-08	risk/pCi	[1]	8.29E-11	risk/pCi	[1]
14119-32-5	Plutonium-241	3.34E-10	risk/pCi	[1]	2.28E-12	risk/pCi	[1]
14119-33-6	Plutonium-240	3.33E-08	risk/pCi	[1]	1.74E-10	risk/pCi	[1]
14133-76-7	Technetium-99	1.41E-11	risk/pCi	[1]	4.00E-12	risk/pCi	[1]
14158-29-3	Uranium-232	1.95E-08	risk/pCi	[1]	3.85E-10	risk/pCi	[1]
14234-35-6	Antimony-125	1.66E-11	risk/pCi	[1]	6.14E-12	risk/pCi	[1]
14331-85-2	Protactinium-231	4.55E-08	risk/pCi	[1]	2.26E-10	risk/pCi	[1]
14336-70-0	Nickel-59	4.66E-13	risk/pCi	[1]	3.89E-13	risk/pCi	[1]
14391-16-3	Europium-155	1.48E-11	risk/pCi	[1]	2.77E-12	risk/pCi	[1]
14596-10-2	Americium-241	2.81E-08	risk/pCi	[1]	1.34E-10	risk/pCi	[1]
14683-23-9	Europium-152	9.10E-11	risk/pCi	[1]	8.70E-12	risk/pCi	[1]
14762-75-5	Carbon-14	1.99E-14	risk/pCi	[1]	2.00E-12	risk/pCi	[1]
14952-40-0	Actinium-227	1.49E-07	risk/pCi	[1]	2.45E-10	risk/pCi	[1]
14993-75-0	Americium-243	2.70E-08	risk/pCi	[1]	1.34E-10	risk/pCi	[1]

Table 5-5 Inhalation and Oral (Food Ingestion) Cancer Slope Factors for ROPCs

CAS Registry Number	Constituent Name	Inhalation Slope Factor (CSF_i)	Units for Inhalation Slope Factor	Reference	Ingestion of Food Slope Factor (CSF_o)	Units for Ingestion of Food Slope Factor	Reference
15046-84-1	Iodine-129	1.60E-10	risk/pCi	[1]	3.22E-10	risk/pCi	[1]
15117-48-3	Plutonium-239	3.33E-08	risk/pCi	[1]	1.74E-10	risk/pCi	[1]
15117-96-1	Uranium-235	1.01E-08	risk/pCi	[1]	9.44E-11	risk/pCi	[1]
15262-20-1	Radium-228	5.18E-09	risk/pCi	[1]	1.43E-09	risk/pCi	[1]
15510-73-3	Curium-242	1.51E-08	risk/pCi	[1]	5.48E-11	risk/pCi	[1]
15585-10-1	Europium-154	1.15E-10	risk/pCi	[1]	1.49E-11	risk/pCi	[1]
15594-54-4	Thorium-229	1.75E-07	risk/pCi	[1]	2.90E-10	risk/pCi	[1]
15715-94-3	Samarium-151	4.88E-12	risk/pCi	[1]	8.07E-13	risk/pCi	[1]
15751-77-6	Zirconium-93	7.29E-12	risk/pCi	[1]	1.44E-12	risk/pCi	[1]
15757-87-6	Curium-243	2.69E-08	risk/pCi	[1]	1.23E-10	risk/pCi	[1]
15758-45-9	Selenium-79	3.33E-12	risk/pCi	[1]	9.69E-12	risk/pCi	[1]
15832-50-5	Tin-126	9.95E-11	risk/pCi	[1]	3.69E-11	risk/pCi	[1]
378253-44-2	Cadmium-113m	1.30E-10	risk/pCi	[1]	3.64E-11	risk/pCi	[1]
378782-82-2	Niobium-93m	1.90E-12	risk/pCi	[1]	1.17E-12	risk/pCi	[1]
7440-29-1	Thorium-232	4.33E-08	risk/pCi	[1]	1.33E-10	risk/pCi	[1]
7440-61-1R	Uranium-238	9.32E-09	risk/pCi	[1]	8.66E-11	risk/pCi	[1]

Reference **Reference (source) for Radionuclide Inhalation Cancer Slope Factors**

[1] EPA. 2001. *Health Effects Assessment Summary Tables (HEAST) - Radionuclides Table (formerly Table 4)*, Office of Radiation and Indoor Air, Radiation Protection Division, Washington, D.C. (http://www.epa.gov/radiation/heast/index.html, accessed online May 2014)

Reference **Reference (source) for Radionuclide Oral (food) Cancer Slope Factors**

[1] EPA. 2001. *Health Effects Assessment Summary Tables (HEAST) - Radionuclides Table (formerly Table 4)*, Office of Radiation and Indoor Air, Radiation Protection Division, Washington, D.C. (http://www.epa.gov/radiation/heast/index.html, accessed online May 2014)

Table 5-6 provides the Oral Slope Factor (CSF_o) for assessment of the potential increase in the probability of a cancer response due to the ingestion of radioisotopes in water or via incidental soil consumption, respectively. Blank entries in the table indicate where data are not available.

Table 5-6 Oral (Water and Soil Ingestion) Cancer Slope Factors for ROPCs

CAS Registry Number	Constituent Name	Ingestion of Water Slope Factor (CSF_o)	Units for Ingestion of Water Slope Factor	Reference	Ingestion of Soil Slope Factor (CSF_o)	Units for Ingestion of Soil Slope Factor	Reference
10028-17-8	Tritium	1.12E-13	risk/pCi	[1]	2.20E-13	risk/pCi	[1]
10045-97-3	Cesium-137	3.04E-11	risk/pCi	[1]	4.33E-11	risk/pCi	[1]
10098-97-2	Strontium-90	5.59E-11	risk/pCi	[1]	9.18E-11	risk/pCi	[1]
10198-40-0	Cobalt-60	1.57E-11	risk/pCi	[1]	4.03E-11	risk/pCi	[1]
13966-29-5	Uranium-234	7.07E-11	risk/pCi	[1]	1.58E-10	risk/pCi	[1]
13967-48-1	Ruthenium-106						
13967-70-9	Cesium-134	4.22E-11	risk/pCi	[1]	5.81E-11	risk/pCi	[1]
13968-55-3	Uranium-233	7.18E-11	risk/pCi	[1]	1.60E-10	risk/pCi	[1]
13981-15-2	Curium-244	8.36E-11	risk/pCi	[1]	1.81E-10	risk/pCi	[1]
13981-16-3	Plutonium-238	1.31E-10	risk/pCi	[1]	2.72E-10	risk/pCi	[1]
13981-37-8	Nickel-63	6.70E-13	risk/pCi	[1]	1.79E-12	risk/pCi	[1]
13982-10-0	Plutonium-242	1.28E-10	risk/pCi	[1]	2.63E-10	risk/pCi	[1]
13982-63-3	Radium-226	3.85E-10	risk/pCi	[1]	7.29E-10	risk/pCi	[1]
13982-70-2	Uranium-236	6.70E-11	risk/pCi	[1]	1.49E-10	risk/pCi	[1]
13994-20-2	Neptunium-237	6.18E-11	risk/pCi	[1]	1.46E-10	risk/pCi	[1]
14119-32-5	Plutonium-241	1.76E-12	risk/pCi	[1]	3.29E-12	risk/pCi	[1]
14119-33-6	Plutonium-240	1.35E-10	risk/pCi	[1]	2.77E-10	risk/pCi	[1]
14133-76-7	Technetium-99	2.75E-12	risk/pCi	[1]	7.66E-12	risk/pCi	[1]
14158-29-3	Uranium-232	2.92E-10	risk/pCi	[1]	5.74E-10	risk/pCi	[1]
14234-35-6	Antimony-125	4.37E-12	risk/pCi	[1]	1.12E-11	risk/pCi	[1]
14331-85-2	Protactinium-231	1.73E-10	risk/pCi	[1]	3.74E-10	risk/pCi	[1]
14336-70-0	Nickel-59	2.74E-13	risk/pCi	[1]	7.33E-13	risk/pCi	[1]
14391-16-3	Europium-155	1.90E-12	risk/pCi	[1]	5.40E-12	risk/pCi	[1]
14596-10-2	Americium-241	1.04E-10	risk/pCi	[1]	2.17E-10	risk/pCi	[1]
14683-23-9	Europium-152	6.07E-12	risk/pCi	[1]	1.62E-11	risk/pCi	[1]
14762-75-5	Carbon-14	1.55E-12	risk/pCi	[1]	2.79E-12	risk/pCi	[1]
14952-40-0	Actinium-227	2.01E-10	risk/pCi	[1]	3.81E-10	risk/pCi	[1]
14993-75-0	Americium-243	1.03E-10	risk/pCi	[1]	2.17E-10	risk/pCi	[1]
15046-84-1	Iodine-129	1.48E-10	risk/pCi	[1]	2.71E-10	risk/pCi	[1]

Table 5-6 Oral (Water and Soil Ingestion) Cancer Slope Factors for ROPCs

CAS Registry Number	Constituent Name	Ingestion of Water Slope Factor (CSF_o)	Units for Ingestion of Water Slope Factor	Reference	Ingestion of Soil Slope Factor (CSF_o)	Units for Ingestion of Soil Slope Factor	Reference
15117-48-3	Plutonium-239	1.35E-10	risk/pCi	[1]	2.76E-10	risk/pCi	[1]
15117-96-1	Uranium-235	6.96E-11	risk/pCi	[1]	1.57E-10	risk/pCi	[1]
15262-20-1	Radium-228	1.04E-09	risk/pCi	[1]	2.28E-09	risk/pCi	[1]
15510-73-3	Curium-242	3.85E-11	risk/pCi	[1]	1.05E-10	risk/pCi	[1]
15585-10-1	Europium-154	1.03E-11	risk/pCi	[1]	2.85E-11	risk/pCi	[1]
15594-54-4	Thorium-229	2.24E-10	risk/pCi	[1]	4.96E-10	risk/pCi	[1]
15715-94-3	Samarium-151	5.55E-13	risk/pCi	[1]	1.59E-12	risk/pCi	[1]
15751-77-6	Zirconium-93	1.11E-12	risk/pCi	[1]	2.12E-12	risk/pCi	[1]
15757-87-6	Curium-243	9.47E-11	risk/pCi	[1]	2.05E-10	risk/pCi	[1]
15758-45-9	Selenium-79	7.29E-12	risk/pCi	[1]	1.60E-11	risk/pCi	[1]
15832-50-5	Tin-126	2.56E-11	risk/pCi	[1]	7.07E-11	risk/pCi	[1]
378253-44-2	Cadmium-113m	2.87E-11	risk/pCi	[1]	5.11E-11	risk/pCi	[1]
378782-82-2	Niobium-93m	8.03E-13	risk/pCi	[1]	2.31E-12	risk/pCi	[1]
7440-29-1	Thorium-232	1.01E-10	risk/pCi	[1]	2.31E-10	risk/pCi	[1]
7440-61-1R	Uranium-238	6.40E-11	risk/pCi	[1]	1.43E-10	risk/pCi	[1]

Reference **Reference (source) for Radionuclide Water Ingestion Cancer Slope Factors**

[1] EPA. 2001. *Health Effects Assessment Summary Tables (HEAST) - Radionuclides Table (formerly Table 4)*, Office of Radiation and Indoor Air, Radiation Protection Division, Washington, D.C. (http://www.epa.gov/radiation/heast/index.html, accessed online May 2014)

Reference **Reference (source) for Radionuclide Soil Ingestion Cancer Slope Factors**

[1] EPA. 2001. *Health Effects Assessment Summary Tables (HEAST) - Radionuclides Table (formerly Table 4)*, Office of Radiation and Indoor Air, Radiation Protection Division, Washington, D.C. (http://www.epa.gov/radiation/heast/index.html, accessed online May 2014)

Table 5-7 provides the Oral Slope Factor (CSF_{dermal}) for assessment of the potential increase in the probability of a cancer response due to external exposure to radioisotopes in air and soil, respectively. Blank entries in the table indicate where data are not available.

Table 5-7 External Exposure Cancer Slope Factors for ROPCs

CAS Registry Number	Constituent Name	External Exposure to Air Slope Factor (CSF_x)	Units for External Exposure to Air Slope Factor	Reference	External Exposure to Soil Slope Factor (CSF_x)	Units for External Exposure to Soil Slope Factor	Reference
10028-17-8	Tritium	0.00E+00	m3/Bq-sec	[1]	0.00E+00	risk/year per pCi/g soil	[1]
10045-97-3	Cesium-137	2.04E-15	m3/Bq-sec	[1]	5.32E-10	risk/year per pCi/g soil	[1]
10098-97-2	Strontium-90	2.10E-17	m3/Bq-sec	[1]	4.82E-10	risk/year per pCi/g soil	[1]
10198-40-0	Cobalt-60	9.63E-15	m3/Bq-sec	[1]	1.24E-05	risk/year per pCi/g soil	[1]
13966-29-5	Uranium-234	4.37E-19	m3/Bq-sec	[1]	2.52E-10	risk/year per pCi/g soil	[1]
13967-48-1	Ruthenium-106	7.85E-16	m3/Bq-sec	[1]	9.66E-07	risk/year per pCi/g soil	[1]
13967-70-9	Cesium-134	5.68E-15	m3/Bq-sec	[1]	7.10E-06	risk/year per pCi/g soil	[1]
13968-55-3	Uranium-233	1.09E-18	m3/Bq-sec	[1]	9.82E-10	risk/year per pCi/g soil	[1]
13981-15-2	Curium-244	2.15E-19	m3/Bq-sec	[1]	4.85E-11	risk/year per pCi/g soil	[1]
13981-16-3	Plutonium-238	2.28E-19	m3/Bq-sec	[1]	7.22E-11	risk/year per pCi/g soil	[1]
13981-37-8	Nickel-63	0.00E+00	m3/Bq-sec	[1]	0.00E+00	risk/year per pCi/g soil	[1]
13982-10-0	Plutonium-242	1.91E-19	m3/Bq-sec	[1]	6.25E-11	risk/year per pCi/g soil	[1]
13982-63-3	Radium-226	6.74E-15	m3/Bq-sec	[1]	2.29E-08	risk/year per pCi/g soil	[1]
13982-70-2	Uranium-236	2.67E-19	m3/Bq-sec	[1]	1.25E-10	risk/year per pCi/g soil	[1]
13994-20-2	Neptunium-237	7.43E-16	m3/Bq-sec	[1]	5.36E-08	risk/year per pCi/g soil	[1]
14119-32-5	Plutonium-241	4.89E-21	m3/Bq-sec	[1]	4.11E-12	risk/year per pCi/g soil	[1]
14119-33-6	Plutonium-240	2.24E-19	m3/Bq-sec	[1]	6.98E-11	risk/year per pCi/g soil	[1]
14133-76-7	Technetium-99	3.72E-19	m3/Bq-sec	[1]	8.14E-11	risk/year per pCi/g soil	[1]
14158-29-3	Uranium-232	8.67E-19	m3/Bq-sec	[1]	5.98E-10	risk/year per pCi/g soil	[1]
14234-35-6	Antimony-125	1.50E-15	m3/Bq-sec	[1]	1.81E-06	risk/year per pCi/g soil	[1]
14331-85-2	Protactinium-231	1.24E-16	m3/Bq-sec	[1]	1.39E-07	risk/year per pCi/g soil	[1]
14336-70-0	Nickel-59	0.00E+00	m3/Bq-sec	[1]	0.00E+00	risk/year per pCi/g soil	[1]
14391-16-3	Europium-155	1.64E-16	m3/Bq-sec	[1]	1.24E-07	risk/year per pCi/g soil	[1]
14596-10-2	Americium-241	5.00E-17	m3/Bq-sec	[1]	2.76E-08	risk/year per pCi/g soil	[1]
14683-23-9	Europium-152	4.25E-15	m3/Bq-sec	[1]	5.30E-06	risk/year per pCi/g soil	[1]
14762-75-5	Carbon-14	3.66E-20	m3/Bq-sec	[1]	7.83E-12	risk/year per pCi/g soil	[1]
14952-40-0	Actinium-227	1.34E-15	m3/Bq-sec	[1]	3.48E-10	risk/year per pCi/g soil	[1]
14993-75-0	Americium-243	6.83E-16	m3/Bq-sec	[1]	9.47E-08	risk/year per pCi/g soil	[1]
15046-84-1	Iodine-129	1.85E-17	m3/Bq-sec	[1]	6.10E-09	risk/year per pCi/g soil	[1]

Table 5-7 External Exposure Cancer Slope Factors for ROPCs

CAS Registry Number	Constituent Name	External Exposure to Air Slope Factor (CSF_x)	Units for External Exposure to Air Slope Factor	Reference	External Exposure to Soil Slope Factor (CSF_x)	Units for External Exposure to Soil Slope Factor	Reference
15117-48-3	Plutonium-239	2.56E-19	m3/Bq-sec	[1]	2.00E-10	risk/year per pCi/g soil	[1]
15117-96-1	Uranium-235	5.43E-16	m3/Bq-sec	[1]	5.18E-07	risk/year per pCi/g soil	[1]
15262-20-1	Radium-228	3.61E-15	m3/Bq-sec	[1]	0.00E+00	risk/year per pCi/g soil	[1]
15510-73-3	Curium-242	2.59E-19	m3/Bq-sec	[1]	7.73E-11	risk/year per pCi/g soil	[1]
15585-10-1	Europium-154	4.63E-15	m3/Bq-sec	[1]	5.83E-06	risk/year per pCi/g soil	[1]
15594-54-4	Thorium-229	1.08E-15	m3/Bq-sec	[1]	2.25E-07	risk/year per pCi/g soil	[1]
15715-94-3	Samarium-151	1.52E-21	m3/Bq-sec	[1]	3.60E-13	risk/year per pCi/g soil	[1]
15751-77-6	Zirconium-93	0.00E+00	m3/Bq-sec	[1]	0.00E+00	risk/year per pCi/g soil	[1]
15757-87-6	Curium-243	4.16E-16	m3/Bq-sec	[1]	4.19E-07	risk/year per pCi/g soil	[1]
15758-45-9	Selenium-79	5.39E-20	m3/Bq-sec	[1]	1.10E-11	risk/year per pCi/g soil	[1]
15832-50-5	Tin-126	7.19E-15	m3/Bq-sec	[1]	9.96E-08	risk/year per pCi/g soil	[1]
378253-44-2	Cadmium-113m	1.29E-18	m3/Bq-sec	[1]	4.45E-10	risk/year per pCi/g soil	[1]
378782-82-2	Niobium-93m	1.92E-19	m3/Bq-sec	[1]	3.83E-11	risk/year per pCi/g soil	[1]
7440-29-1	Thorium-232	5.35E-19	m3/Bq-sec	[1]	3.42E-10	risk/year per pCi/g soil	[1]
7440-61-1R	Uranium-238	9.03E-17	m3/Bq-sec	[1]	4.99E-11	risk/year per pCi/g soil	[1]

Reference **Reference (source) for Radionuclide External Air Cancer Slope Factor**

[1] EPA. 1999. *Cancer Risk Coefficients for Environmental Exposure to Radionuclides*, Federal Guidance Report No. 13, EPA 402-R-99-001 (Table 2.3), Air and Radiation, September 1999. US Environmental Protection Agency, Washington, DC, USA

Reference **Reference (source) for Radionuclide External Soil Contact Cancer Slope Factor**

[1] EPA. 2001. *Health Effects Assessment Summary Tables (HEAST) - Radionuclides Table (formerly Table 4)*, Office of Radiation and Indoor Air, Radiation Protection Division, Washington, D.C. (http://www.epa.gov/radiation/heast/index.html, accessed online May 2014)

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6 Bioconcentration Factors for Ecological Receptors

Table 6-1 provides the soil/sediment-to-plant and water-to-plant bioconcentration factors used to estimate the tissue concentration of plants exposed to contaminants in soil/sediment or water, respectively. These bioconcentration factors represent the ratio of the contaminant concentration in the plant tissue to that in exposure media (soil, sediment, or water). Blank entries in the table indicate where data are not available.

Table 6-1 Media-to-Plant Bioconcentration Factors

CAS Registry Number	Constituent	Soil/ Sediment-to-Plant Bioconcentration Factor ($BCF_{s\text{-}p}$)	Units for Soil/ Sediment-to-Plant Bioconcentration Factor	Reference	Water-to-Plant Bioconcentration Factor ($BCF_{w\text{-}p}$)	Units for Water-to-Plant Bioconcentration Factor	Reference
100-02-7	p-Nitrophenol						
100-21-0	Phthalic acid						
100-25-4	1,4-Dinitrobenzene						
100-40-3	4-Ethenylcyclohexene						
100-41-4	Ethyl benzene						
100-42-5	Styrene						
100-44-7	Benzyl chloride						
100-47-0	Benzonitrile						
100-51-6	Benzyl alcohol						
100-52-7	Benzaldehyde						
10028-15-6	Ozone						
10028-17-8	Tritium						
10045-97-3	Cesium-137	8.00E-02	kg dry soil / kg dry tissue	[1]			
10061-01-5	cis-1,3-Dichloropropene						
10061-02-6	trans-1,3-Dichloropropene						
10098-91-6	Yttrium-90	1.50E-02	kg dry soil / kg dry tissue	[1]			
10098-97-2	Strontium-90	2.50E+00	kg dry soil / kg dry tissue	[1]			
101-55-3	4-Bromophenylphenyl ether						
101-77-9	4,4-Methylenedianiline						
10102-44-0	Nitrogen dioxide						
10198-40-0	Cobalt-60	2.00E-02	kg dry soil / kg dry tissue	[1]			
103-33-3	Azobenzene						

Table 6-1 Media-to-Plant Bioconcentration Factors

CAS Registry Number	Constituent	Soil/ Sediment-to-Plant Bioconcentration Factor (BCF_{s-p})	Units for Soil/ Sediment-to-Plant Bioconcentration Factor	Reference	Water-to-Plant Bioconcentration Factor (BCF_{w-p})	Units for Water-to-Plant Bioconcentration Factor	Reference
103-65-1	n-Propyl benzene (isocumene)						
104-51-8	n-Butylbenzene						
104-76-7	2-Ethyl-1-hexanol						
105-67-9	2,4-Dimethylphenol						
10595-95-6	n-Nitrosomethylethylamine						
106-43-4	4-Chlorotoluene (p-tolyl chloride)						
106-44-5	p-Cresol (4-methyl phenol)						
106-46-7	1,4-Dichlorobenzene						
106-47-8	p-Chloroaniline						
106-49-0	p-Toluidine						
106-51-4	Quinone						
106-88-7	1,2-Epoxybutane						
106-89-8	Epichlorohydrin (1-chloro-2,3-epoxypropane)						
106-93-4	Ethylene dibromide						
106-99-0	1,3-Butadiene						
107-02-8	Acrolein						
107-05-1	3-Chloropropene						
107-06-2	1,2-Dichloroethane						
107-12-0	Propionitrile						
107-13-1	Acrylonitrile	2.78E+01	kg dry soil / kg dry tissue	[2]	1.10E-01	L/kg tissue	[1]
107-19-7	Propargyl alcohol						
107-21-1	Ethylene glycol (1,2-ethanediol)						
107-98-2	Propylene glycol monomethyl ether						
108-05-4	Acetic acid vinyl ester						
108-10-1	4-Methyl-2-pentanone						
108-39-4	m-Cresol						
108-60-1	bis(2-Chloroisopropyl) ether						
108-67-8	1,3,5-Trimethylbenzene						
108-86-1	Bromobenzene (phenyl bromide)						
108-87-2	Methylcyclohexane						

Table 6-1 Media-to-Plant Bioconcentration Factors

CAS Registry Number	Constituent	Soil/ Sediment-to-Plant Bioconcentration Factor (BCF_{s-p})	Units for Soil/ Sediment-to-Plant Bioconcentration Factor	Reference	Water-to-Plant Bioconcentration Factor (BCF_{w-p})	Units for Water-to-Plant Bioconcentration Factor	Reference
108-88-3	Toluene						
108-90-7	Chlorobenzene						
108-94-1	Cyclohexanone						
108-95-2	Phenol						
109-74-0	n-Butanenitrile						
109-75-1	3-Butenenitrile						
109-77-3	Malononitrile						
109-86-4	2-Methoxyethanol						
109-99-9	Tetrahydrofuran						
110-00-9	Furan						
110-54-3	n-Hexane						
110-59-8	Pentanenitrile						
110-80-5	2-Ethoxyethanol						
110-82-7	Cyclohexane						
110-83-8	Cyclohexene						
110-86-1	Pyridine						
111-15-9	Ethylene glycol monoethyl ether acetate						
111-44-4	bis(2-Chloroethyl)ether						
111-65-9	n-Octane						
111-76-2	2-Butoxyethanol						
111-84-2	n-Nonane						
111-91-1	bis(2-Chloroethoxy)methane						
112-30-1	1-Decanol						
112-31-2	Decanal						
112-40-3	Dodecane						
1120-21-4	Undecane						
1120-71-4	1,3-Propane sultone						
117-81-7	bis(2-Ethylhexyl)phthalate	3.80E-02	kg dry soil / kg dry tissue	[2]	9.93E+03	L/kg tissue	[1]
117-84-0	Di-n-octylphthalate	1.57E-04	kg dry soil / kg dry tissue	[2]	2.85E+04	L/kg tissue	[1]

Table 6-1 Media-to-Plant Bioconcentration Factors

CAS Registry Number	Constituent	Soil/ Sediment-to-Plant Bioconcentration Factor (BCF_{s-p})	Units for Soil/ Sediment-to-Plant Bioconcentration Factor	Reference	Water-to-Plant Bioconcentration Factor (BCF_{w-p})	Units for Water-to-Plant Bioconcentration Factor	Reference
118-74-1	Hexachlorobenzene	2.55E-02	kg dry soil / kg dry tissue	[2]	1.11E+04	L/kg tissue	[1]
119-90-4	3,3'-Dimethoxybenzidine						
120-12-7	Anthracene						
120-82-1	1,2,4-Trichlorobenzene						
120-83-2	2,4-Dichlorophenol						
121-14-2	2,4-Dinitrotoluene	2.72E+00	kg dry soil / kg dry tissue	[2]	2.51E+03	L/kg tissue	[1]
122-39-4	N,N-Diphenylamine						
122-66-7	1,2-Diphenylhydrazine						
123-33-1	Maleic hydrazide						
123-38-6	Propionaldehyde						
123-72-8	Butanal						
123-91-1	1,4-Dioxan	5.53E+01	kg dry soil / kg dry tissue	[2]	4.00E-02	L/kg tissue	[1]
124-18-5	Decane						
124-38-9	Carbon dioxide						
124-48-1	Chlorodibromomethane						
126-73-8	Tributyl phosphate						
126-98-7	2-Methyl-2-propenenitrile						
127-18-4	1,1,2,2-Tetrachloroethene						
128-37-0	2,6-bis(tert-butyl)-4-Methylphenol						
129-00-0	Pyrene						
131-11-3	Dimethyl Phthalate						
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol						
132-64-9	Dibenzofuran						
133-06-2	Captan						
1330-20-7	Xylenes (mixed isomers)						
1336-36-3	Polychlorinated biphenyls				4.77E+05	L/kg tissue	[1]
134-32-7	alpha-Naphthylamine						
135-98-8	sec-Butylbenzene						

Table 6-1 Media-to-Plant Bioconcentration Factors

CAS Registry Number	Constituent	Soil/ Sediment-to-Plant Bioconcentration Factor (BCF_{s-p})	Units for Soil/ Sediment-to-Plant Bioconcentration Factor	Reference	Water-to-Plant Bioconcentration Factor (BCF_{w-p})	Units for Water-to-Plant Bioconcentration Factor	Reference
13966-29-5	Uranium-234	8.50E-03	kg dry soil / kg dry tissue	[1]			
13967-48-1	Ruthenium-106	7.50E-02	kg dry soil / kg dry tissue	[1]			
13967-70-9	Cesium-134	8.00E-02	kg dry soil / kg dry tissue	[1]			
13968-55-3	Uranium-233	8.50E-03	kg dry soil / kg dry tissue	[1]			
13981-15-2	Curium-244	8.50E-04	kg dry soil / kg dry tissue	[1]			
13981-16-3	Plutonium-238	4.50E-04	kg dry soil / kg dry tissue	[1]			
13981-37-8	Nickel-63	3.20E-02	kg dry soil / kg dry tissue	[2]	6.10E+01	L/kg tissue	[1]
13982-10-0	Plutonium-242	4.50E-04	kg dry soil / kg dry tissue	[1]			
13982-63-3	Radium-226	1.50E-02	kg dry soil / kg dry tissue	[1]			
13982-70-2	Uranium-236	8.50E-03	kg dry soil / kg dry tissue	[1]			
13994-20-2	Neptunium-237	1.00E-01	kg dry soil / kg dry tissue	[1]			
141-78-6	Acetic acid ethyl ester						
14119-32-5	Plutonium-241	4.50E-04	kg dry soil / kg dry tissue	[1]			
14119-33-6	Plutonium-240	4.50E-04	kg dry soil / kg dry tissue	[1]			
14133-76-7	Technetium-99	9.50E+00	kg dry soil / kg dry tissue	[1]			
14158-29-3	Uranium-232	8.50E-03	kg dry soil / kg dry tissue	[1]			
14234-35-6	Antimony-125	2.00E-01	kg dry soil / kg dry tissue	[2]			
14265-44-2	Phosphate	3.50E+00	kg dry soil / kg dry tissue	[1]			
14331-85-2	Protactinium-231	2.50E-03	kg dry soil / kg dry tissue	[1]			

Table 6-1 Media-to-Plant Bioconcentration Factors

CAS Registry Number	Constituent	Soil/ Sediment-to-Plant Bioconcentration Factor (BCF_{s-p})	Units for Soil/ Sediment-to-Plant Bioconcentration Factor	Reference	Water-to-Plant Bioconcentration Factor (BCF_{w-p})	Units for Water-to-Plant Bioconcentration Factor	Reference
14336-70-0	Nickel-59	3.20E-02	kg dry soil / kg dry tissue	[2]	6.10E+01	L/kg tissue	[1]
14391-16-3	Europium-155	1.00E-02	kg dry soil / kg dry tissue	[1]			
145-73-3	Endothall						
14596-10-2	Americium-241	5.50E-03	kg dry soil / kg dry tissue	[1]			
14683-23-9	Europium-152	1.00E-02	kg dry soil / kg dry tissue	[1]			
14762-75-5	Carbon-14						
14797-55-8	Nitrate						
14797-65-0	Nitrite						
14808-79-8	Sulfate	1.50E+00	kg dry soil / kg dry tissue	[1]			
14952-40-0	Actinium-227	3.50E-03	kg dry soil / kg dry tissue	[1]			
14993-75-0	Americium-243	5.50E-03	kg dry soil / kg dry tissue	[1]			
15046-84-1	Iodine-129	1.50E-01	kg dry soil / kg dry tissue	[1]			
15117-48-3	Plutonium-239	4.50E-04	kg dry soil / kg dry tissue	[1]			
15117-96-1	Uranium-235	8.50E-03	kg dry soil / kg dry tissue	[1]			
15262-20-1	Radium-228	1.50E-02	kg dry soil / kg dry tissue	[1]			
15510-73-3	Curium-242	8.50E-04	kg dry soil / kg dry tissue	[1]			
15585-10-1	Europium-154	1.00E-02	kg dry soil / kg dry tissue	[1]			
15594-54-4	Thorium-229	8.50E-04	kg dry soil / kg dry tissue	[1]			
156-59-2	cis-1,2-Dichloroethene						
156-60-5	1,2-trans-Dichloroethene						
15715-94-3	Samarium-151	1.00E-02	kg dry soil / kg dry tissue	[1]			

Table 6-1 Media-to-Plant Bioconcentration Factors

CAS Registry Number	Constituent	Soil/ Sediment-to-Plant Bioconcentration Factor (BCF_{s-p})	Units for Soil/ Sediment-to-Plant Bioconcentration Factor	Reference	Water-to-Plant Bioconcentration Factor (BCF_{w-p})	Units for Water-to-Plant Bioconcentration Factor	Reference
15751-77-6	Zirconium-93	2.00E-03	kg dry soil / kg dry tissue	[1]			
15757-87-6	Curium-243	8.50E-04	kg dry soil / kg dry tissue	[1]			
15758-45-9	Selenium-79	2.50E-02	kg dry soil / kg dry tissue	[2]			
15832-50-5	Tin-126	3.00E-02	kg dry soil / kg dry tissue	[1]			
1634-04-4	Methyl tert-butyl ether						
16887-00-6	Chloride	7.00E+01	kg dry soil / kg dry tissue	[1]			
16984-48-8	Fluoride	6.00E-02	kg dry soil / kg dry tissue	[1]			
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p) dioxin (TCDD)	5.60E-03	kg dry soil / kg dry tissue	[2]	3.30E+03	L/kg tissue	[1]
18540-29-9	Chromium(VI)	7.50E-03	kg dry soil / kg dry tissue	[2]	4.41E+03	L/kg tissue	[1]
189-55-9	Dibenzo[a,i]pyrene						
189-64-0	Dibenzo[a,h]pyrene						
191-24-2	Benzo[g,h,i]perylene						
191-30-0	Dibenzo[a,l]pyrene						
192-65-4	Dibenzo[a,e]pyrene						
192-97-2	Benzo[e]pyrene						
193-39-5	Indeno[1,2,3-cd]pyrene	3.90E-03	kg dry soil / kg dry tissue	[2]	5.26E+03	L/kg tissue	[1]
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	7.80E-04	kg dry soil / kg dry tissue	[2]	4.62E+02	L/kg tissue	[1]
205-82-3	Benzo[j]fluoranthene						
205-99-2	Benzo[b]fluoranthene	1.01E-02	kg dry soil / kg dry tissue	[2]	5.26E+03	L/kg tissue	[1]
206-44-0	Fluoranthene						
207-08-9	Benzo[k]fluoranthene	1.01E-02	kg dry soil / kg dry tissue	[2]	5.26E+03	L/kg tissue	[1]
208-96-8	Acenaphthylene						

Table 6-1 Media-to-Plant Bioconcentration Factors

CAS Registry Number	Constituent	Soil/ Sediment-to-Plant Bioconcentration Factor (BCF_{s-p})	Units for Soil/ Sediment-to-Plant Bioconcentration Factor	Reference	Water-to-Plant Bioconcentration Factor (BCF_{w-p})	Units for Water-to-Plant Bioconcentration Factor	Reference
218-01-9	Chrysene	1.87E-02	kg dry soil / kg dry tissue	[2]	5.26E+03	L/kg tissue	[1]
224-42-0	Dibenz[a,j]acridine						
2245-38-7	2,3,5-Trimethylnaphthalene						
226-36-8	Dibenz[a,h]acridine						
22967-92-6	Methyl mercury	1.37E-01	kg dry soil / kg dry tissue	[2]	8.00E+04	L/kg tissue	[1]
23950-58-5	Pronamide						
24959-67-9	Bromide	1.50E+00	kg dry soil / kg dry tissue	[1]			
27154-33-2	Trichlorofluoroethane						
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)						
319-84-6	alpha-BHC						
319-85-7	beta-BHC						
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)						
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)						
3268-87-9	Octachlorodibenzo(p)dioxin	6.70E-05	kg dry soil / kg dry tissue	[2]	3.96E+01	L/kg tissue	[1]
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)						
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	2.90E-04	kg dry soil / kg dry tissue	[2]	1.68E+02	L/kg tissue	[1]
3697-24-3	5-Methylchrysene						
378253-40-8	Barium-137m	1.50E-01	kg dry soil / kg dry tissue	[2]			
378253-44-2	Cadmium-113m						
378782-82-2	Niobium-93m	2.00E-02	kg dry soil / kg dry tissue	[1]			
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)						
39001-02-0	Octachlorodibenzofuran	9.00E-05	kg dry soil / kg dry tissue	[2]	5.28E+01	L/kg tissue	[1]

Table 6-1 Media-to-Plant Bioconcentration Factors

CAS Registry Number	Constituent	Soil/ Sediment-to-Plant Bioconcentration Factor (BCF_{s-p})	Units for Soil/ Sediment-to-Plant Bioconcentration Factor	Reference	Water-to-Plant Bioconcentration Factor (BCF_{w-p})	Units for Water-to-Plant Bioconcentration Factor	Reference
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo (p)dioxin	1.70E-03	kg dry soil / kg dry tissue	[2]	1.02E+03	L/kg tissue	[1]
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)						
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	5.20E-03	kg dry soil / kg dry tissue	[2]	3.04E+03	L/kg tissue	[1]
4170-30-3	Crotonaldehyde (propylene aldehyde)	1.86E+01	kg dry soil / kg dry tissue	[2]	2.00E-01	L/kg tissue	[1]
41851-50-7	Chlorocyclopentadiene						
460-19-5	Cyanogen (oxalonitrile)						
4786-20-3	2-Butenenitrile						
50-00-0	Formaldehyde	2.46E+01	kg dry soil / kg dry tissue	[2]	1.40E-01	L/kg tissue	[1]
50-32-8	Benzo[a]pyrene	0.00E+00	kg dry soil / kg dry tissue	[2]	5.26E+03	L/kg tissue	[1]
506-68-3	Cyanogen bromide (bromocyanide)						
506-77-4	Cyanogen chloride						
51-28-5	2,4-Dinitrophenol						
51-79-6	Ethyl carbamate (urethane)						
510-15-6	Chlorobenzilate						
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	4.50E-03	kg dry soil / kg dry tissue	[2]	2.64E+03	L/kg tissue	[1]
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)						
528-29-0	1,2-Dinitrobenzene (o-dinitrobenzene)						
53-70-3	Dibenz[a,h]anthracene	6.40E-03	kg dry soil / kg dry tissue	[2]	5.26E+03	L/kg tissue	[1]
532-27-4	2-Chloroacetophenone						
534-52-1	4,6-Dinitro-o-cresol						
5385-75-1	Dibenzo[a,e]fluoranthene						
540-59-0	1,2-Dichloroethene (total)						
540-73-8	1,2-Dimethylhydrazine						
540-84-1	2,2,4-Trimethylpentane						
541-73-1	1,3-Dichlorobenzene						

Table 6-1 Media-to-Plant Bioconcentration Factors

CAS Registry Number	Constituent	Soil/ Sediment-to-Plant Bioconcentration Factor (BCF_{s-p})	Units for Soil/ Sediment-to-Plant Bioconcentration Factor	Reference	Water-to-Plant Bioconcentration Factor (BCF_{w-p})	Units for Water-to-Plant Bioconcentration Factor	Reference
542-75-6	1,3-Dichloropropene						
542-88-1	bis(Chloromethyl)ether						
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	2.20E-03	kg dry soil / kg dry tissue	[2]	1.29E+03	L/kg tissue	[1]
56-23-5	Carbon tetrachloride	1.04E+00	kg dry soil / kg dry tissue	[2]	3.00E+02	L/kg tissue	[1]
56-49-5	3-Methylcholanthrene						
56-55-3	Benzo[a]anthracene	2.02E-02	kg dry soil / kg dry tissue	[2]	5.26E+03	L/kg tissue	[1]
57-12-5	Cyanide				2.20E+01	L/kg tissue	[1]
57-24-9	Strychnine						
57-74-9	Chlordane						
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	9.00E-03	kg dry soil / kg dry tissue	[2]	5.28E+03	L/kg tissue	[1]
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	1.10E-03	kg dry soil / kg dry tissue	[2]	7.26E+02	L/kg tissue	[1]
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	1.10E-03	kg dry soil / kg dry tissue	[2]	6.27E+02	L/kg tissue	[1]
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)						
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	6.70E-04	kg dry soil / kg dry tissue	[2]	3.96E+02	L/kg tissue	[1]
58-89-9	gamma-BHC (Lindane)						
58-90-2	2,3,4,6-Tetrachlorophenol						
581-42-0	2,6-Dimethylnaphthalene						
584-84-9	2,4-Toluene diisocyanate						
589-38-8	3-Hexanone						
59-50-7	4-Chloro-3-methylphenol						
59-89-2	N-Nitrosomorpholine						
591-50-4	Benzene, iodo-						
591-78-6	2-Hexanone						
593-60-2	Bromoethene (vinyl bromide)						
593-74-8	Dimethyl mercury						

Table 6-1 Media-to-Plant Bioconcentration Factors

CAS Registry Number	Constituent	Soil/ Sediment-to-Plant Bioconcentration Factor (BCF_{s-p})	Units for Soil/ Sediment-to-Plant Bioconcentration Factor	Reference	Water-to-Plant Bioconcentration Factor (BCF_{w-p})	Units for Water-to-Plant Bioconcentration Factor	Reference
60-11-7	Dimethyl aminoazobenzene						
60-29-7	Ethyl ether						
60-35-5	Acetamide						
602-87-9	5-Nitroacenaphthene						
606-20-2	2,6-Dinitrotoluene	3.15E+00	kg dry soil / kg dry tissue	[2]	2.51E+03	L/kg tissue	[1]
608-93-5	Pentachlorobenzene	4.40E-02	kg dry soil / kg dry tissue	[2]	4.00E+03	L/kg tissue	[1]
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	3.80E-03	kg dry soil / kg dry tissue	[2]	2.21E+03	L/kg tissue	[1]
61626-71-9	Dichloropentadiene						
62-50-0	Ethyl methanesulfonate						
62-53-3	Aniline						
62-75-9	N-Nitroso-N,N-dimethylamine						
621-64-7	N-Nitroso-di-n-propylamine						
624-83-9	Methyl isocyanate						
628-73-9	Hexanenitrile						
630-08-0	Carbon monoxide						
630-20-6	1,1,1,2-Tetrachloroethane						
64-18-6	Formic acid (methanoic acid)						
65-85-0	Benzoic acid						
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)						
67-56-1	Methyl alcohol						
67-63-0	2-Propyl alcohol						
67-64-1	2-Propanone (acetone)	5.20E+01	kg dry soil / kg dry tissue	[2]	5.00E-02	L/kg tissue	[1]
67-66-3	Chloroform	2.90E+00	kg dry soil / kg dry tissue	[2]	2.82E+00	L/kg tissue	[1]
67-72-1	Hexachloroethane						
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	6.20E-05	kg dry soil / kg dry tissue	[2]	3.63E+01	L/kg tissue	[1]
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)						

Table 6-1 Media-to-Plant Bioconcentration Factors

CAS Registry Number	Constituent	Soil/ Sediment-to-Plant Bioconcentration Factor (BCF_{s-p})	Units for Soil/ Sediment-to-Plant Bioconcentration Factor	Reference	Water-to-Plant Bioconcentration Factor (BCF_{w-p})	Units for Water-to-Plant Bioconcentration Factor	Reference
70-30-4	Hexachlorophene	1.70E-03	kg dry soil / kg dry tissue	[2]	1.50E+03	L/kg tissue	[1]
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)						
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	4.30E-04	kg dry soil / kg dry tissue	[2]	2.51E+02	L/kg tissue	[1]
71-36-3	n-Butyl alcohol						
71-43-2	Benzene						
71-55-6	1,1,1-Trichloroethane						
72-43-5	Methoxychlor						
72-55-9	4,4-DDE	9.37E-03	kg dry soil / kg dry tissue	[2]	1.13E+04	L/kg tissue	[1]
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	3.50E-03	kg dry soil / kg dry tissue	[2]	2.08E+03	L/kg tissue	[1]
74-83-9	Bromomethane						
74-87-3	Chloromethane						
74-88-4	Iodomethane						
74-95-3	Methylene bromide						
74-97-5	Bromochloromethane						
7429-90-5	Aluminum	4.00E-03	kg dry soil / kg dry tissue	[2]	8.33E+02	L/kg tissue	[1]
7439-89-6	Iron	4.00E-03	kg dry soil / kg dry tissue	[1]			
7439-92-1	Lead	4.50E-02	kg dry soil / kg dry tissue	[2]	1.71E+03	L/kg tissue	[1]
7439-93-2	Lithium	2.50E-02	kg dry soil / kg dry tissue	[1]			
7439-95-4	Magnesium	1.00E+00	kg dry soil / kg dry tissue	[1]			
7439-96-5	Manganese	2.50E-01	kg dry soil / kg dry tissue	[1]			
7439-97-6	Mercury						
7439-98-7	Molybdenum	2.50E-01	kg dry soil / kg dry tissue	[1]			

Table 6-1 Media-to-Plant Bioconcentration Factors

CAS Registry Number	Constituent	Soil/ Sediment-to-Plant Bioconcentration Factor (BCF_{s-p})	Units for Soil/ Sediment-to-Plant Bioconcentration Factor	Reference	Water-to-Plant Bioconcentration Factor (BCF_{w-p})	Units for Water-to-Plant Bioconcentration Factor	Reference
7440-02-0	Nickel	3.20E-02	kg dry soil / kg dry tissue	[2]	6.10E+01	L/kg tissue	[1]
7440-16-6	Rhodium	1.50E-01	kg dry soil / kg dry tissue	[1]			
7440-22-4	Silver	4.00E-01	kg dry soil / kg dry tissue	[2]	1.07E+04	L/kg tissue	[1]
7440-23-5	Sodium	7.50E-02	kg dry soil / kg dry tissue	[1]			
7440-24-6	Strontium (total)	2.50E+00	kg dry soil / kg dry tissue	[1]			
7440-25-7	Tantalum	1.00E-02	kg dry soil / kg dry tissue	[1]			
7440-28-0	Thallium	4.00E-03	kg dry soil / kg dry tissue	[2]	1.50E+04	L/kg tissue	[1]
7440-29-1	Thorium-232	8.50E-04	kg dry soil / kg dry tissue	[1]			
7440-31-5	Tin	3.00E-02	kg dry soil / kg dry tissue	[1]			
7440-33-7	Tungsten	4.50E-02	kg dry soil / kg dry tissue	[1]			
7440-36-0	Antimony	2.00E-01	kg dry soil / kg dry tissue	[2]	1.48E+03	L/kg tissue	[1]
7440-38-2	Arsenic	3.60E-02	kg dry soil / kg dry tissue	[2]	2.93E+02	L/kg tissue	[1]
7440-39-3	Barium	1.50E-01	kg dry soil / kg dry tissue	[2]	2.60E+02	L/kg tissue	[1]
7440-41-7	Beryllium	1.00E-02	kg dry soil / kg dry tissue	[2]	1.41E+02	L/kg tissue	[1]
7440-43-9	Cadmium	3.64E-01	kg dry soil / kg dry tissue	[2]	7.82E+02	L/kg tissue	[1]
7440-47-3	Chromium	7.50E-03	kg dry soil / kg dry tissue	[2]	4.41E+03	L/kg tissue	[1]
7440-48-4	Cobalt	2.00E-02	kg dry soil / kg dry tissue	[1]			
7440-50-8	Copper	4.00E-01	kg dry soil / kg dry tissue	[2]	5.41E+02	L/kg tissue	[1]

Table 6-1 Media-to-Plant Bioconcentration Factors

CAS Registry Number	Constituent	Soil/ Sediment-to-Plant Bioconcentration Factor (BCF_{s-p})	Units for Soil/ Sediment-to-Plant Bioconcentration Factor	Reference	Water-to-Plant Bioconcentration Factor (BCF_{w-p})	Units for Water-to-Plant Bioconcentration Factor	Reference
7440-61-1	Uranium	8.50E-03	kg dry soil / kg dry tissue	[1]			
7440-61-1R	Uranium-238	8.50E-03	kg dry soil / kg dry tissue	[1]			
7440-62-2	Vanadium	5.50E-03	kg dry soil / kg dry tissue	[1]			
7440-65-5	Yttrium	1.50E-02	kg dry soil / kg dry tissue	[1]			
7440-66-6	Zinc	1.20E-12	kg dry soil / kg dry tissue	[2]	2.18E+03	L/kg tissue	[1]
7440-67-7	Zirconium	2.00E-03	kg dry soil / kg dry tissue	[1]			
7446-09-5	Sulfur dioxide						
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)						
7487-94-7	Mercuric chloride ($HgCl_2$)	3.75E-02	kg dry soil / kg dry tissue	[2]	2.48E+04	L/kg tissue	[1]
75-00-3	Chloroethane						
75-01-4	1-Chloroethene	8.43E+00	kg dry soil / kg dry tissue	[2]	6.20E-01	L/kg tissue	[1]
75-02-5	Fluoroethene (vinyl fluoride)						
75-05-8	Acetonitrile						
75-07-0	Acetaldehyde						
75-09-2	Dichloromethane (methylene chloride)						
75-15-0	Carbon disulfide						
75-21-8	Ethylene oxide (Oxirane)						
75-25-2	Bromoform						
75-27-4	Bromodichloromethane						
75-29-6	2-Chloropropane						
75-34-3	1,1-Dichloroethane						
75-35-4	1,1-Dichloroethene						
75-44-5	Phosgene (hydrogen phosphide)						
75-45-6	Chlorodifluoromethane						
75-50-3	Trimethylamine						

Table 6-1 Media-to-Plant Bioconcentration Factors

CAS Registry Number	Constituent	Soil/ Sediment-to-Plant Bioconcentration Factor (BCF_{s-p})	Units for Soil/ Sediment-to-Plant Bioconcentration Factor	Reference	Water-to-Plant Bioconcentration Factor (BCF_{w-p})	Units for Water-to-Plant Bioconcentration Factor	Reference
75-69-4	Trichlorofluoromethane						
75-71-8	Dichlorodifluoromethane						
76-01-7	Pentachloroethane						
76-13-1	1,2,2-Trichlorotrifluoroethane						
76-44-8	Heptachlor	4.89E-02	kg dry soil / kg dry tissue	[2]	2.10E+04	L/kg tissue	[1]
764-41-0	1,4-Dichloro-2-butene						
7647-01-0	Hydrogen chloride	7.00E+01	kg dry soil / kg dry tissue	[1]			
765-34-4	Glycidylaldehyde						
7664-39-3	Hydrogen fluoride	6.00E-02	kg dry soil / kg dry tissue	[1]			
7664-41-7	Ammonia/Ammonium						
77-47-4	Hexachlorocyclopentadiene	5.65E-02	kg dry soil / kg dry tissue	[2]	6.10E+02	L/kg tissue	[1]
77-78-1	Dimethyl sulfate						
7704-34-9	Total Sulfur (thermodynamically stable)						
7723-14-0	Phosphorus	3.50E+00	kg dry soil / kg dry tissue	[1]			
7782-41-4	Fluorine gas (F_2)						
7782-49-2	Selenium	1.60E-02	kg dry soil / kg dry tissue	[2]	1.85E+03	L/kg tissue	[1]
7782-50-5	Chlorine	7.00E+01	kg dry soil / kg dry tissue	[1]			
78-83-1	2-Methylpropyl alcohol						
78-87-5	1,2-Dichloropropane						
78-93-3	2-Butanone						
79-00-5	1,1,2-Trichloroethane						
79-01-6	1,1,2-Trichloroethylene						
79-10-7	2-Propenoic acid						
79-34-5	1,1,2,2-Tetrachloroethane						
79-46-9	2-Nitropropane						
80-62-6	Methyl methacrylate						

Table 6-1 Media-to-Plant Bioconcentration Factors

CAS Registry Number	Constituent	Soil/ Sediment-to-Plant Bioconcentration Factor (BCF_{s-p})	Units for Soil/ Sediment-to-Plant Bioconcentration Factor	Reference	Water-to-Plant Bioconcentration Factor (BCF_{w-p})	Units for Water-to-Plant Bioconcentration Factor	Reference
82-68-8	Pentachloronitrobenzene (PCNB)	8.00E-02	kg dry soil / kg dry tissue	[2]	4.74E+03	L/kg tissue	[1]
822-06-0	Hexamethylene-1,5-diisocyanate						
823-40-5	Toluene-2,6-diamine						
83-32-9	Acenaphthene						
832-69-9	1-Methylphenanthrene						
84-66-2	Diethyl phthalate						
84-74-2	Di-n-butylphthalate						
85-01-8	Phenanthrene						
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)						
85-68-7	Butylbenzylphthalate						
86-73-7	Fluorene						
87-61-6	1,2,3-Trichlorobenzene						
87-68-3	Hexachlorobutadiene	7.14E-02	kg dry soil / kg dry tissue	[2]	1.60E+02	L/kg tissue	[1]
87-86-5	Pentachlorophenol	4.49E-02	kg dry soil / kg dry tissue	[2]	1.71E+03	L/kg tissue	[1]
88-06-2	2,4,6-Trichlorophenol						
88-74-4	o-Nitroaniline (2-nitroaniline)						
88-75-5	2-Nitrophenol						
90-04-0	o-Anisidine						
90-12-0	1-Methylnaphthalene						
91-20-3	Naphthalene						
91-22-5	Quinoline						
91-57-6	2-Methylnaphthalene						
91-58-7	2-Chloronaphthalene						
91-94-1	3,3'-Dichlorobenzidine						
92-52-4	1,1`-Biphenyl						
924-16-3	N-Nitroso-di-n-Buetylamine						
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)						
94-75-7	2,4-D						

Table 6-1 Media-to-Plant Bioconcentration Factors

CAS Registry Number	Constituent	Soil/ Sediment-to-Plant Bioconcentration Factor ($BCF_{s\text{-}p}$)	Units for Soil/ Sediment-to-Plant Bioconcentration Factor	Reference	Water-to-Plant Bioconcentration Factor ($BCF_{w\text{-}p}$)	Units for Water-to-Plant Bioconcentration Factor	Reference
95-48-7	o-Cresol						
95-49-8	o-Chlorotoluene						
95-50-1	1,2-Dichlorobenzene						
95-53-4	o-Toluidine						
95-57-8	2-Chlorophenol						
95-63-6	1,2,4-Trimethyl benzene						
95-94-3	1,2,4,5-Tetrachlorobenzene						
95-95-4	2,4,5-Trichlorophenol						
96-12-8	1,2-Dibromo-3-chloropropane						
96-18-4	1,2,3-Trichloropropane						
96-45-7	Ethylene thiourea						
97-63-2	Ethyl methacrylate						
98-01-1	Furfural						
98-06-6	tert-Butyl benzene						
98-07-7	Benzotrichloride						
98-82-8	Cumene						
98-83-9	Methyl styrene (mixed isomers)						
98-86-2	Acetophenone						
98-95-3	Nitrobenzene	3.38E+00	kg dry soil / kg dry tissue	[2]	2.40E+01	L/kg tissue	[1]
99-35-4	1,3,5-Trinitrobenzene						
99-65-0	1,3-Dinitrobenzene	5.32E+00	kg dry soil / kg dry tissue	[2]	2.51E+03	L/kg tissue	[1]
99-87-6	p-Cymene						

Reference	Reference (source) for Soil/Sediment-to-Plant Bioconcentration Factor
[1]	Baes CF, III, Sharp RD, Sjoreen AL, and Shor RW. 1984. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides Through Agriculture*, ORNL-5786. Oak Ridge National Laboratory, Oak Ridge, Tennessee.
[2]	Table C-2 of EPA. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Peer Review Draft*, EPA 530-D-99-001. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/ecorisk.htm)

Reference	Reference (source) for Water-to-Plant Bioconcentration Factor
[1]	Calculated value per Eq. 2-6 (BCF_TCDD × BEF) from EPA. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, Peer Review Draft, EPA 530-D-99-001. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/ecorisk.htm)
[2]	Table C-3 of EPA. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Peer Review Draft*, EPA 530-D-99-001. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/ecorisk.htm)

Table 6-2 provides the soil-to-invertebrate, sediment-to-benthic invertebrate, and water-to-invertebrate bioconcentration factors used to estimate the tissue concentration of invertebrate exposed to contaminants in soil, sediment, or water, respectively. These bioconcentration factors represent the ratio of the contaminant concentration in the invertebrate tissue to that in exposure media (soil, sediment, or water). Blank entries in the table indicate where data are not available.

Table 6-2 Media-to-Terrestrial and Aquatic Invertebrate Bioconcentration Factors

CAS Registry Number	Constituent	Soil-to-Invertebrate Bioconcentration Factor ($BCF_{s\text{-}inv}$)	Units for Soil-to-Invertebrate Bioconcentration Factor	Reference	Sediment-to-Benthic Invertebrate Transfer Factor ($BCF_{s\text{-}binv}$)	Units for Sediment-to-Benthic Invertebrate Transfer Factor	Reference	Water-to-Invertebrate Transfer Factor ($BCF_{w\text{-}inv}$)	Units for Water-to-Invertebrate Transfer Factor	Reference
100-02-7	p-Nitrophenol									
100-21-0	Phthalic acid									
100-25-4	1,4-Dinitrobenzene									
100-40-3	4-Ethenylcyclohexene									
100-41-4	Ethyl benzene									
100-42-5	Styrene									
100-44-7	Benzyl chloride									
100-47-0	Benzonitrile									
100-51-6	Benzyl alcohol									
100-52-7	Benzaldehyde									
10028-15-6	Ozone									
10028-17-8	Tritium									
10045-97-3	Cesium-137									
10061-01-5	cis-1,3-Dichloropropene									
10061-02-6	trans-1,3-Dichloropropene									
10098-91-6	Yttrium-90									
10098-97-2	Strontium-90									
101-55-3	4-Bromophenylphenyl ether									
101-77-9	4,4-Methylenedianiline									
10102-44-0	Nitrogen dioxide									
10198-40-0	Cobalt-60									
103-33-3	Azobenzene									
103-65-1	n-Propyl benzene (isocumene)									

Table 6-2 Media-to-Terrestrial and Aquatic Invertebrate Bioconcentration Factors

CAS Registry Number	Constituent	Soil-to-Invertebrate Bioconcentration Factor ($BCF_{s\text{-}inv}$)	Units for Soil-to-Invertebrate Bioconcentration Factor	Reference	Sediment-to-Benthic Invertebrate Transfer Factor ($BCF_{s\text{-}binv}$)	Units for Sediment-to-Benthic Invertebrate Transfer Factor	Reference	Water-to-Invertebrate Transfer Factor ($BCF_{w\text{-}inv}$)	Units for Water-to-Invertebrate Transfer Factor	Reference
104-51-8	n-Butylbenzene									
104-76-7	2-Ethyl-1-hexanol									
105-67-9	2,4-Dimethylphenol									
10595-95-6	n-Nitrosomethylethylamine									
106-43-4	4-Chlorotoluene (p-tolyl chloride)									
106-44-5	p-Cresol (4-methyl phenol)									
106-46-7	1,4-Dichlorobenzene									
106-47-8	p-Chloroaniline									
106-49-0	p-Toluidine									
106-51-4	Quinone									
106-88-7	1,2-Epoxybutane									
106-89-8	Epichlorohydrin (1-chloro-2,3-epoxypropane)									
106-93-4	Ethylene dibromide									
106-99-0	1,3-Butadiene									
107-02-8	Acrolein									
107-05-1	3-Chloropropene									
107-06-2	1,2-Dichloroethane									
107-12-0	Propionitrile									
107-13-1	Acrylonitrile	1.10E-01	kg dry soil / kg tissue	[1]	1.10E-01	kg dry sediment / kg tissue	[1]	1.10E-01	L/kg tissue	[2]
107-19-7	Propargyl alcohol									
107-21-1	Ethylene glycol (1,2-ethanediol)									
107-98-2	Propylene glycol monomethyl ether									
108-05-4	Acetic acid vinyl ester									
108-10-1	4-Methyl-2-pentanone									

Table 6-2 Media-to-Terrestrial and Aquatic Invertebrate Bioconcentration Factors

CAS Registry Number	Constituent	Soil-to-Invertebrate Bioconcentration Factor ($BCF_{s\text{-}inv}$)	Units for Soil-to-Invertebrate Bioconcentration Factor	Reference	Sediment-to-Benthic Invertebrate Transfer Factor ($BCF_{s\text{-}binv}$)	Units for Sediment-to-Benthic Invertebrate Transfer Factor	Reference	Water-to-Invertebrate Transfer Factor ($BCF_{w\text{-}inv}$)	Units for Water-to-Invertebrate Transfer Factor	Reference
108-39-4	m-Cresol									
108-60-1	bis(2-Chloroisopropyl)ether									
108-67-8	1,3,5-Trimethylbenzene									
108-86-1	Bromobenzene (phenyl bromide)									
108-87-2	Methylcyclohexane									
108-88-3	Toluene									
108-90-7	Chlorobenzene									
108-94-1	Cyclohexanone									
108-95-2	Phenol									
109-74-0	n-Butanenitrile									
109-75-1	3-Butenenitrile									
109-77-3	Malononitrile									
109-86-4	2-Methoxyethanol									
109-99-9	Tetrahydrofuran									
110-00-9	Furan									
110-54-3	n-Hexane									
110-59-8	Pentanenitrile									
110-80-5	2-Ethoxyethanol									
110-82-7	Cyclohexane									
110-83-8	Cyclohexene									
110-86-1	Pyridine									
111-15-9	Ethylene glycol monoethyl ether acetate									
111-44-4	bis(2-Chloroethyl)ether									
111-65-9	n-Octane									
111-76-2	2-Butoxyethanol									
111-84-2	n-Nonane									

Table 6-2 Media-to-Terrestrial and Aquatic Invertebrate Bioconcentration Factors

CAS Registry Number	Constituent	Soil-to-Invertebrate Bioconcentration Factor ($BCF_{s\text{-}inv}$)	Units for Soil-to-Invertebrate Bioconcentration Factor	Reference	Sediment-to-Benthic Invertebrate Transfer Factor ($BCF_{s\text{-}binv}$)	Units for Sediment-to-Benthic Invertebrate Transfer Factor	Reference	Water-to-Invertebrate Transfer Factor ($BCF_{w\text{-}inv}$)	Units for Water-to-Invertebrate Transfer Factor	Reference
111-91-1	bis(2-Chloroethoxy) methane									
112-30-1	1-Decanol									
112-31-2	Decanal									
112-40-3	Dodecane									
1120-21-4	Undecane									
1120-71-4	1,3-Propane sultone									
117-81-7	bis(2-Ethylhexyl)phthalate	1.31E+03	kg dry soil / kg tissue	[1]	1.31E+03	kg dry sediment / kg tissue	[1]	3.18E+02	L/kg tissue	[2]
117-84-0	Di-n-octylphthalate	3.13E+06	kg dry soil / kg tissue	[1]	3.13E+06	kg dry sediment / kg tissue	[1]	5.95E+03	L/kg tissue	[2]
118-74-1	Hexachlorobenzene	2.30E+03	kg dry soil / kg tissue	[1]	2.30E+03	kg dry sediment / kg tissue	[1]	2.60E+03	L/kg tissue	[2]
119-90-4	3,3'-Dimethoxybenzidine									
120-12-7	Anthracene				3.27E+00	kg dry sediment / kg tissue	[4]			
120-82-1	1,2,4-Trichlorobenzene									
120-83-2	2,4-Dichlorophenol									
121-14-2	2,4-Dinitrotoluene	3.08E+00	kg dry soil / kg tissue	[1]	5.80E+01	kg dry sediment / kg tissue	[1]	1.30E+01	L/kg tissue	[2]
122-39-4	N,N-Diphenylamine									
122-66-7	1,2-Diphenylhydrazine									
123-33-1	Maleic hydrazide									
123-38-6	Propionaldehyde									
123-72-8	Butanal									
123-91-1	1,4-Dioxan	4.00E-02	kg dry soil / kg tissue	[1]	4.00E-02	kg dry sediment / kg tissue	[1]	4.30E-02	L/kg tissue	[2]

Table 6-2 Media-to-Terrestrial and Aquatic Invertebrate Bioconcentration Factors

CAS Registry Number	Constituent	Soil-to-Invertebrate Bioconcentration Factor ($BCF_{s\text{-}inv}$)	Units for Soil-to-Invertebrate Bioconcentration Factor	Reference	Sediment-to-Benthic Invertebrate Transfer Factor ($BCF_{s\text{-}binv}$)	Units for Sediment-to-Benthic Invertebrate Transfer Factor	Reference	Water-to-Invertebrate Transfer Factor ($BCF_{w\text{-}inv}$)	Units for Water-to-Invertebrate Transfer Factor	Reference
124-18-5	Decane									
124-38-9	Carbon dioxide									
124-48-1	Chlorodibromomethane									
126-73-8	Tributyl phosphate									
126-98-7	2-Methyl-2-propenenitrile									
127-18-4	1,1,2,2-Tetrachloroethene									
128-37-0	2,6-bis(tert-butyl)-4-Methylphenol									
129-00-0	Pyrene				3.73E+00	kg dry sediment / kg tissue	[4]			
131-11-3	Dimethyl Phthalate									
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol									
132-64-9	Dibenzofuran				1.00E+02	kg dry sediment / kg tissue	[4]			
133-06-2	Captan									
1330-20-7	Xylenes (mixed isomers)									
1336-36-3	Polychlorinated biphenyls	1.13E+00	kg dry soil / kg tissue	[1]	5.30E-01	kg dry sediment / kg tissue	[1]	5.54E+03	L/kg tissue	[2]
134-32-7	alpha-Naphthylamine									
135-98-8	sec-Butylbenzene									
13966-29-5	Uranium-234									
13967-48-1	Ruthenium-106									
13967-70-9	Cesium-134									
13968-55-3	Uranium-233									
13981-15-2	Curium-244									
13981-16-3	Plutonium-238									

Table 6-2 Media-to-Terrestrial and Aquatic Invertebrate Bioconcentration Factors

CAS Registry Number	Constituent	Soil-to-Invertebrate Bioconcentration Factor ($BCF_{s\text{-}inv}$)	Units for Soil-to-Invertebrate Bioconcentration Factor	Reference	Sediment-to-Benthic Invertebrate Transfer Factor ($BCF_{s\text{-}binv}$)	Units for Sediment-to-Benthic Invertebrate Transfer Factor	Reference	Water-to-Invertebrate Transfer Factor ($BCF_{w\text{-}inv}$)	Units for Water-to-Invertebrate Transfer Factor	Reference
13981-37-8	Nickel-63	2.00E-02	kg dry soil / kg tissue	[1]	9.00E-01	kg dry sediment / kg tissue	[1]	2.80E+01	L/kg tissue	[2]
13982-10-0	Plutonium-242									
13982-63-3	Radium-226									
13982-70-2	Uranium-236									
13994-20-2	Neptunium-237									
141-78-6	Acetic acid ethyl ester									
14119-32-5	Plutonium-241									
14119-33-6	Plutonium-240									
14133-76-7	Technetium-99									
14158-29-3	Uranium-232									
14234-35-6	Antimony-125									
14265-44-2	Phosphate									
14331-85-2	Protactinium-231									
14336-70-0	Nickel-59	2.00E-02	kg dry soil / kg tissue	[1]	9.00E-01	kg dry sediment / kg tissue	[1]	2.80E+01	L/kg tissue	[2]
14391-16-3	Europium-155									
145-73-3	Endothall									
14596-10-2	Americium-241									
14683-23-9	Europium-152									
14762-75-5	Carbon-14									
14797-55-8	Nitrate									
14797-65-0	Nitrite									
14808-79-8	Sulfate									
14952-40-0	Actinium-227									
14993-75-0	Americium-243									
15046-84-1	Iodine-129									
15117-48-3	Plutonium-239									

Table 6-2 Media-to-Terrestrial and Aquatic Invertebrate Bioconcentration Factors

CAS Registry Number	Constituent	Soil-to-Invertebrate Bioconcentration Factor ($BCF_{s\text{-}inv}$)	Units for Soil-to-Invertebrate Bioconcentration Factor	Reference	Sediment-to-Benthic Invertebrate Transfer Factor ($BCF_{s\text{-}binv}$)	Units for Sediment-to-Benthic Invertebrate Transfer Factor	Reference	Water-to-Invertebrate Transfer Factor ($BCF_{w\text{-}inv}$)	Units for Water-to-Invertebrate Transfer Factor	Reference
15117-96-1	Uranium-235									
15262-20-1	Radium-228									
15510-73-3	Curium-242									
15585-10-1	Europium-154									
15594-54-4	Thorium-229									
156-59-2	cis-1,2-Dichloroethene									
156-60-5	1,2-trans-Dichloroethene									
15715-94-3	Samarium-151									
15751-77-6	Zirconium-93									
15757-87-6	Curium-243									
15758-45-9	Selenium-79									
15832-50-5	Tin-126									
1634-04-4	Methyl tert-butyl ether									
16887-00-6	Chloride									
16984-48-8	Fluoride									
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1.59E+00	kg dry soil / kg tissue	[1]	1.96E+04	kg dry sediment / kg tissue	[1]	1.56E+03	L/kg tissue	[2]
18540-29-9	Chromium(VI)	1.00E-02	kg dry soil / kg tissue	[1]	3.90E-01	kg dry sediment / kg tissue	[1]	3.00E+03	L/kg tissue	[2]
189-55-9	Dibenzo[a,i]pyrene									
189-64-0	Dibenzo[a,h]pyrene									
191-24-2	Benzo[g,h,i]perylene				2.15E-01	kg dry sediment / kg tissue	[4]			
191-30-0	Dibenzo[a,l]pyrene									
192-65-4	Dibenzo[a,e]pyrene									
192-97-2	Benzo[e]pyrene				4.55E-01	kg dry sediment / kg tissue	[4]			

Table 6-2 Media-to-Terrestrial and Aquatic Invertebrate Bioconcentration Factors

CAS Registry Number	Constituent	Soil-to-Invertebrate Bioconcentration Factor ($BCF_{s\text{-}inv}$)	Units for Soil-to-Invertebrate Bioconcentration Factor	Reference	Sediment-to-Benthic Invertebrate Transfer Factor ($BCF_{s\text{-}binv}$)	Units for Sediment-to-Benthic Invertebrate Transfer Factor	Reference	Water-to-Invertebrate Transfer Factor ($BCF_{w\text{-}inv}$)	Units for Water-to-Invertebrate Transfer Factor	Reference
193-39-5	Indeno[1,2,3-cd]pyrene	8.00E-02	kg dry soil / kg tissue	[1]	1.61E+00	kg dry sediment / kg tissue	[1]	4.70E+03	L/kg tissue	[2]
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	2.20E-01	kg dry soil / kg tissue	[1]	2.74E+03	kg dry sediment / kg tissue	[1]	2.18E+02	L/kg tissue	[2]
205-82-3	Benzo[j]fluoranthene									
205-99-2	Benzo[b]fluoranthene	7.00E-02	kg dry soil / kg tissue	[1]	1.61E+00	kg dry sediment / kg tissue	[1]	4.70E+03	L/kg tissue	[2]
206-44-0	Fluoranthene				1.33E+01	kg dry sediment / kg tissue	[4]			
207-08-9	Benzo[k]fluoranthene	8.00E-02	kg dry soil / kg tissue	[1]	1.61E+00	kg dry sediment / kg tissue	[1]	1.32E+04	L/kg tissue	[2]
208-96-8	Acenaphthylene				2.85E+00	kg dry sediment / kg tissue	[4]			
218-01-9	Chrysene	4.00E-02	kg dry soil / kg tissue	[1]	1.38E+00	kg dry sediment / kg tissue	[1]	9.80E+02	L/kg tissue	[2]
224-42-0	Dibenz[a,j]acridine									
2245-38-7	2,3,5-Trimethylnaphthalene									
226-36-8	Dibenz[a,h]acridine									
22967-92-6	Methyl mercury	8.50E+00	kg dry soil / kg tissue	[1]	4.80E-01	kg dry sediment / kg tissue	[1]	5.50E+04	L/kg tissue	[2]
23950-58-5	Pronamide									
24959-67-9	Bromide									
27154-33-2	Trichlorofluoroethane									
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)				4.74E+00	kg dry sediment / kg tissue	[4]			

Table 6-2 Media-to-Terrestrial and Aquatic Invertebrate Bioconcentration Factors

CAS Registry Number	Constituent	Soil-to-Invertebrate Bioconcentration Factor ($BCF_{s\text{-}inv}$)	Units for Soil-to-Invertebrate Bioconcentration Factor	Reference	Sediment-to-Benthic Invertebrate Transfer Factor ($BCF_{s\text{-}binv}$)	Units for Sediment-to-Benthic Invertebrate Transfer Factor	Reference	Water-to-Invertebrate Transfer Factor ($BCF_{w\text{-}inv}$)	Units for Water-to-Invertebrate Transfer Factor	Reference
319-84-6	alpha-BHC				1.00E+00	kg dry sediment / kg tissue	[4]			
319-85-7	beta-BHC									
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)									
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)				3.85E+00	kg dry sediment / kg tissue	[4]			
3268-87-9	Octachlorodibenzo(p)dioxin	1.90E-02	kg dry soil / kg tissue	[1]	2.35E+01	kg dry sediment / kg tissue	[1]	1.87E+01	L/kg tissue	[1]
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)				1.00E+02	kg dry sediment / kg tissue	[4]			
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	8.10E-02	kg dry soil / kg tissue	[1]	9.94E+01	kg dry sediment / kg tissue	[1]	7.96E+01	L/kg tissue	[2]
3697-24-3	5-Methylchrysene									
378253-40-8	Barium-137m	2.20E-01	kg dry soil / kg tissue	[1]						
378253-44-2	Cadmium-113m									
378782-82-2	Niobium-93m									
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)				6.70E-01	kg dry sediment / kg tissue	[4]			
39001-02-0	Octachlorodibenzofuran	2.50E-02	kg dry soil / kg tissue	[1]	3.14E+02	kg dry sediment / kg tissue	[1]	2.50E+01	L/kg tissue	[2]
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo (p)dioxin	4.90E-01	kg dry soil / kg tissue	[1]	6.08E+03	kg dry sediment / kg tissue	[1]	4.84E+02	L/kg tissue	[2]

Table 6-2 Media-to-Terrestrial and Aquatic Invertebrate Bioconcentration Factors

CAS Registry Number	Constituent	Soil-to-Invertebrate Bioconcentration Factor ($BCF_{s\text{-}inv}$)	Units for Soil-to-Invertebrate Bioconcentration Factor	Reference	Sediment-to-Benthic Invertebrate Transfer Factor ($BCF_{s\text{-}binv}$)	Units for Sediment-to-Benthic Invertebrate Transfer Factor	Reference	Water-to-Invertebrate Transfer Factor ($BCF_{w\text{-}inv}$)	Units for Water-to-Invertebrate Transfer Factor	Reference
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)									
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	1.46E+00	kg dry soil / kg tissue	[1]	1.80E+04	kg dry sediment / kg tissue	[1]	1.44E+03	L/kg tissue	[2]
4170-30-3	Crotonaldehyde (propylene aldehyde)	2.00E-01	kg dry soil / kg tissue	[1]	2.00E-01	kg dry sediment / kg tissue	[1]	2.00E-01	L/kg tissue	[2]
41851-50-7	Chlorocyclopentadiene									
460-19-5	Cyanogen (oxalonitrile)									
4786-20-3	2-Butenenitrile									
50-00-0	Formaldehyde	1.40E-01	kg dry soil / kg tissue	[1]	1.40E-01	kg dry sediment / kg tissue	[1]	1.40E-01	L/kg tissue	[2]
50-32-8	Benzo[a]pyrene	7.00E-02	kg dry soil / kg tissue	[1]	1.59E+00	kg dry sediment / kg tissue	[1]	4.70E+03	L/kg tissue	[2]
506-68-3	Cyanogen bromide (bromocyanide)									
506-77-4	Cyanogen chloride									
51-28-5	2,4-Dinitrophenol									
51-79-6	Ethyl carbamate (urethane)									
510-15-6	Chlorobenzilate									
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	1.27E+00	kg dry soil / kg tissue	[1]	2.64E+03	kg dry sediment / kg tissue	[1]	1.25E+03	L/kg tissue	[1]
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)				1.00E+02	kg dry sediment / kg tissue	[2]			
528-29-0	1,2-Dinitrobenzene (o-dinitrobenzene)									

Table 6-2 Media-to-Terrestrial and Aquatic Invertebrate Bioconcentration Factors

CAS Registry Number	Constituent	Soil-to-Invertebrate Bioconcentration Factor ($BCF_{s\text{-}inv}$)	Units for Soil-to-Invertebrate Bioconcentration Factor	Reference	Sediment-to-Benthic Invertebrate Transfer Factor ($BCF_{s\text{-}binv}$)	Units for Sediment-to-Benthic Invertebrate Transfer Factor	Reference	Water-to-Invertebrate Transfer Factor ($BCF_{w\text{-}inv}$)	Units for Water-to-Invertebrate Transfer Factor	Reference
53-70-3	Dibenz[a,h]anthracene	7.00E-02	kg dry soil / kg tissue	[1]	1.61E+00	kg dry sediment / kg tissue	[1]	7.10E+02	L/kg tissue	[2]
532-27-4	2-Chloroacetophenone									
534-52-1	4,6-Dinitro-o-cresol									
5385-75-1	Dibenzo[a,e]fluoranthene									
540-59-0	1,2-Dichloroethene (total)									
540-73-8	1,2-Dimethylhydrazine									
540-84-1	2,2,4-Trimethylpentane									
541-73-1	1,3-Dichlorobenzene									
542-75-6	1,3-Dichloropropene									
542-88-1	bis(Chloromethyl)ether									
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	6.20E-01	kg dry soil / kg tissue	[1]	7.64E+03	kg dry sediment / kg tissue	[1]	6.08E+02	L/kg tissue	[2]
56-23-5	Carbon tetrachloride	1.20E+01	kg dry soil / kg tissue	[1]	1.20E+01	kg dry sediment / kg tissue	[1]	1.20E+01	L/kg tissue	[2]
56-49-5	3-Methylcholanthrene									
56-55-3	Benzo[a]anthracene	3.00E-02	kg dry soil / kg tissue	[1]	1.45E+00	kg dry sediment / kg tissue	[1]	1.23E+04	L/kg tissue	[2]
57-12-5	Cyanide	1.12E+00	kg dry soil / kg tissue	[1]	9.00E-01	kg dry sediment / kg tissue	[1]	4.07E+03	L/kg tissue	[2]
57-24-9	Strychnine									
57-74-9	Chlordane				2.32E+01	kg dry sediment / kg tissue	[4]			
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	2.54E+00	kg dry soil / kg tissue	[1]	3.14E+04	kg dry sediment / kg tissue	[1]	2.50E+03	L/kg tissue	[2]

Table 6-2 Media-to-Terrestrial and Aquatic Invertebrate Bioconcentration Factors

CAS Registry Number	Constituent	Soil-to-Invertebrate Bioconcentration Factor ($BCF_{s\text{-}inv}$)	Units for Soil-to-Invertebrate Bioconcentration Factor	Reference	Sediment-to-Benthic Invertebrate Transfer Factor ($BCF_{s\text{-}binv}$)	Units for Sediment-to-Benthic Invertebrate Transfer Factor	Reference	Water-to-Invertebrate Transfer Factor ($BCF_{w\text{-}inv}$)	Units for Water-to-Invertebrate Transfer Factor	Reference
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	3.20E-01	kg dry soil / kg tissue	[1]	4.31E+03	kg dry sediment / kg tissue	[1]	3.43E+02	L/kg tissue	[2]
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	3.00E-01	kg dry soil / kg tissue	[1]	3.72E+03	kg dry sediment / kg tissue	[1]	2.96E+02	L/kg tissue	[2]
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)									
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	1.90E-01	kg dry soil / kg tissue	[1]	2.35E+03	kg dry sediment / kg tissue	[1]	1.87E+02	L/kg tissue	[2]
58-89-9	gamma-BHC (Lindane)									
58-90-2	2,3,4,6-Tetrachlorophenol									
581-42-0	2,6-Dimethylnaphthalene									
584-84-9	2,4-Toluene diisocyanate									
589-38-8	3-Hexanone									
59-50-7	4-Chloro-3-methylphenol									
59-89-2	N-Nitrosomorpholine									
591-50-4	Benzene, iodo-									
591-78-6	2-Hexanone									
593-60-2	Bromoethene (vinyl bromide)									
593-74-8	Dimethyl mercury									
60-11-7	Dimethyl aminoazobenzene									
60-29-7	Ethyl ether									
60-35-5	Acetamide									
602-87-9	5-Nitroacenaphthene									
606-20-2	2,6-Dinitrotoluene	2.50E+00	kg dry soil / kg tissue	[1]	2.50E+00	kg dry sediment / kg tissue	[1]	1.30E+01	L/kg tissue	[2]

Table 6-2 Media-to-Terrestrial and Aquatic Invertebrate Bioconcentration Factors

CAS Registry Number	Constituent	Soil-to-Invertebrate Bioconcentration Factor ($BCF_{s\text{-}inv}$)	Units for Soil-to-Invertebrate Bioconcentration Factor	Reference	Sediment-to-Benthic Invertebrate Transfer Factor ($BCF_{s\text{-}binv}$)	Units for Sediment-to-Benthic Invertebrate Transfer Factor	Reference	Water-to-Invertebrate Transfer Factor ($BCF_{w\text{-}inv}$)	Units for Water-to-Invertebrate Transfer Factor	Reference
608-93-5	Pentachlorobenzene	1.05E+03	kg dry soil / kg tissue	[1]	3.20E-01	kg dry sediment / kg tissue	[1]	2.60E+03	L/kg tissue	[2]
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	1.07E+00	kg dry soil / kg tissue	[1]	1.31E+04	kg dry sediment / kg tissue	[1]	1.05E+03	L/kg tissue	[2]
61626-71-9	Dichloropentadiene									
62-50-0	Ethyl methanesulfonate									
62-53-3	Aniline									
62-75-9	N-Nitroso-N,N-dimethylamine									
621-64-7	N-Nitroso-di-n-propylamine									
624-83-9	Methyl isocyanate									
628-73-9	Hexanenitrile									
630-08-0	Carbon monoxide									
630-20-6	1,1,1,2-Tetrachloroethane									
64-18-6	Formic acid (methanoic acid)									
65-85-0	Benzoic acid									
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)									
67-56-1	Methyl alcohol									
67-63-0	2-Propyl alcohol									
67-64-1	2-Propanone (acetone)	5.00E-02	kg dry soil / kg tissue	[1]	5.00E-02	kg dry sediment / kg tissue	[1]	5.00E-02	L/kg tissue	[2]
67-66-3	Chloroform	2.82E+00	kg dry soil / kg tissue	[1]	2.82E+00	kg dry sediment / kg tissue	[1]	2.82E+00	L/kg tissue	[2]
67-72-1	Hexachloroethane									
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	1.70E-02	kg dry soil / kg tissue	[1]	2.16E+02	kg dry sediment / kg tissue	[1]	1.72E+01	L/kg tissue	[2]

Table 6-2 Media-to-Terrestrial and Aquatic Invertebrate Bioconcentration Factors

CAS Registry Number	Constituent	Soil-to-Invertebrate Bioconcentration Factor ($BCF_{s\text{-}inv}$)	Units for Soil-to-Invertebrate Bioconcentration Factor	Reference	Sediment-to-Benthic Invertebrate Transfer Factor ($BCF_{s\text{-}binv}$)	Units for Sediment-to-Benthic Invertebrate Transfer Factor	Reference	Water-to-Invertebrate Transfer Factor ($BCF_{w\text{-}inv}$)	Units for Water-to-Invertebrate Transfer Factor	Reference
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)				1.00E+02	kg dry sediment / kg tissue	[3]			
70-30-4	Hexachlorophene	1.07E+05	kg dry soil / kg tissue	[1]	1.07E+05	kg dry sediment / kg tissue	[1]	9.70E+02	L/kg tissue	[2]
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)									
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	1.21E-01	kg dry soil / kg tissue	[1]	1.49E+03	kg dry sediment / kg tissue	[1]	1.19E+02	L/kg tissue	[2]
71-36-3	n-Butyl alcohol									
71-43-2	Benzene									
71-55-6	1,1,1-Trichloroethane									
72-43-5	Methoxychlor				2.00E+00	kg dry sediment / kg tissue	[4]			
72-55-9	4,4-DDE	1.26E+00	kg dry soil / kg tissue	[1]	9.50E-01	kg dry sediment / kg tissue	[1]	1.19E+04	L/kg tissue	[2]
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	1.00E+00	kg dry soil / kg tissue	[1]	1.23E+04	kg dry sediment / kg tissue	[1]	9.83E+02	L/kg tissue	[2]
74-83-9	Bromomethane									
74-87-3	Chloromethane									
74-88-4	Iodomethane									
74-95-3	Methylene bromide									
74-97-5	Bromochloromethane									
7429-90-5	Aluminum	2.20E-01	kg dry soil / kg tissue	[1]	9.00E-01	kg dry sediment / kg tissue	[1]	4.07E+03	L/kg tissue	[2]
7439-89-6	Iron									

Table 6-2 Media-to-Terrestrial and Aquatic Invertebrate Bioconcentration Factors

CAS Registry Number	Constituent	Soil-to-Invertebrate Bioconcentration Factor ($BCF_{s\text{-}inv}$)	Units for Soil-to-Invertebrate Bioconcentration Factor	Reference	Sediment-to-Benthic Invertebrate Transfer Factor ($BCF_{s\text{-}binv}$)	Units for Sediment-to-Benthic Invertebrate Transfer Factor	Reference	Water-to-Invertebrate Transfer Factor ($BCF_{w\text{-}inv}$)	Units for Water-to-Invertebrate Transfer Factor	Reference
7439-92-1	Lead	3.00E-02	kg dry soil / kg tissue	[1]	6.30E-01	kg dry sediment / kg tissue	[1]	5.06E+03	L/kg tissue	[2]
7439-93-2	Lithium									
7439-95-4	Magnesium									
7439-96-5	Manganese									
7439-97-6	Mercury									
7439-98-7	Molybdenum									
7440-02-0	Nickel	2.00E-02	kg dry soil / kg tissue	[1]	9.00E-01	kg dry sediment / kg tissue	[1]	2.80E+01	L/kg tissue	[2]
7440-16-6	Rhodium									
7440-22-4	Silver	2.20E-01	kg dry soil / kg tissue	[1]	9.00E-01	kg dry sediment / kg tissue	[1]	2.98E+02	L/kg tissue	[2]
7440-23-5	Sodium									
7440-24-6	Strontium (total)									
7440-25-7	Tantalum									
7440-28-0	Thallium	2.20E-01	kg dry soil / kg tissue	[1]	9.00E-01	kg dry sediment / kg tissue	[1]	1.50E+04	L/kg tissue	[2]
7440-29-1	Thorium-232									
7440-31-5	Tin									
7440-33-7	Tungsten									
7440-36-0	Antimony	2.20E-01	kg dry soil / kg tissue	[1]	9.00E-01	kg dry sediment / kg tissue	[1]	7.00E+00	L/kg tissue	[2]
7440-38-2	Arsenic	1.10E-01	kg dry soil / kg tissue	[1]	9.00E-01	kg dry sediment / kg tissue	[1]	7.30E+01	L/kg tissue	[2]
7440-39-3	Barium	2.20E-01	kg dry soil / kg tissue	[1]	9.00E-01	kg dry sediment / kg tissue	[1]	2.00E+02	L/kg tissue	[2]

Table 6-2 Media-to-Terrestrial and Aquatic Invertebrate Bioconcentration Factors

CAS Registry Number	Constituent	Soil-to-Invertebrate Bioconcentration Factor ($BCF_{s\text{-}inv}$)	Units for Soil-to-Invertebrate Bioconcentration Factor	Reference	Sediment-to-Benthic Invertebrate Transfer Factor ($BCF_{s\text{-}binv}$)	Units for Sediment-to-Benthic Invertebrate Transfer Factor	Reference	Water-to-Invertebrate Transfer Factor ($BCF_{w\text{-}inv}$)	Units for Water-to-Invertebrate Transfer Factor	Reference
7440-41-7	Beryllium	2.20E-01	kg dry soil / kg tissue	[1]	9.00E-01	kg dry sediment / kg tissue	[1]	4.50E+01	L/kg tissue	[2]
7440-43-9	Cadmium	9.60E-01	kg dry soil / kg tissue	[1]	3.40E+00	kg dry sediment / kg tissue	[1]	3.46E+03	L/kg tissue	[2]
7440-47-3	Chromium	1.00E-02	kg dry soil / kg tissue	[1]	3.90E-01	kg dry sediment / kg tissue	[1]	3.00E+03	L/kg tissue	[2]
7440-48-4	Cobalt									
7440-50-8	Copper	4.00E-02	kg dry soil / kg tissue	[1]	3.00E-01	kg dry sediment / kg tissue	[1]	3.72E+03	L/kg tissue	[2]
7440-61-1	Uranium									
7440-61-1R	Uranium-238									
7440-62-2	Vanadium									
7440-65-5	Yttrium									
7440-66-6	Zinc	5.60E-01	kg dry soil / kg tissue	[1]	5.70E-01	kg dry sediment / kg tissue	[1]	4.58E+03	L/kg tissue	[2]
7440-67-7	Zirconium									
7446-09-5	Sulfur dioxide									
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)									
7487-94-7	Mercuric chloride ($HgCl_2$)	4.00E-02	kg dry soil / kg tissue	[1]	6.80E-02	kg dry sediment / kg tissue	[1]	2.02E+04	L/kg tissue	[2]
75-00-3	Chloroethane									
75-01-4	1-Chloroethene	6.20E-01	kg dry soil / kg tissue	[1]	6.20E-01	kg dry sediment / kg tissue	[1]	6.20E-01	L/kg tissue	[2]
75-02-5	Fluoroethene (vinyl fluoride)									
75-05-8	Acetonitrile									

Table 6-2 Media-to-Terrestrial and Aquatic Invertebrate Bioconcentration Factors

CAS Registry Number	Constituent	Soil-to-Invertebrate Bioconcentration Factor ($BCF_{s\text{-}inv}$)	Units for Soil-to-Invertebrate Bioconcentration Factor	Reference	Sediment-to-Benthic Invertebrate Transfer Factor ($BCF_{s\text{-}binv}$)	Units for Sediment-to-Benthic Invertebrate Transfer Factor	Reference	Water-to-Invertebrate Transfer Factor ($BCF_{w\text{-}inv}$)	Units for Water-to-Invertebrate Transfer Factor	Reference
75-07-0	Acetaldehyde									
75-09-2	Dichloromethane (methylene chloride)									
75-15-0	Carbon disulfide									
75-21-8	Ethylene oxide (Oxirane)									
75-25-2	Bromoform									
75-27-4	Bromodichloromethane									
75-29-6	2-Chloropropane									
75-34-3	1,1-Dichloroethane									
75-35-4	1,1-Dichloroethene									
75-44-5	Phosgene (hydrogen phosphide)									
75-45-6	Chlorodifluoromethane									
75-50-3	Trimethylamine									
75-69-4	Trichlorofluoromethane									
75-71-8	Dichlorodifluoromethane									
76-01-7	Pentachloroethane									
76-13-1	1,2,2-Trichlorotrifluoroethane									
76-44-8	Heptachlor	1.40E+00	kg dry soil / kg tissue	[1]	1.67E+00	kg dry sediment / kg tissue	[1]	3.81E+03	L/kg tissue	[2]
764-41-0	1,4-Dichloro-2-butene									
7647-01-0	Hydrogen chloride									
765-34-4	Glycidylaldehyde									
7664-39-3	Hydrogen fluoride									
7664-41-7	Ammonia/Ammonium									
77-47-4	Hexachlorocyclopentadiene	7.45E+02	kg dry soil / kg tissue	[1]	7.46E+02	kg dry sediment / kg tissue	[1]	1.23E+03	L/kg tissue	[2]
77-78-1	Dimethyl sulfate									

Table 6-2 Media-to-Terrestrial and Aquatic Invertebrate Bioconcentration Factors

CAS Registry Number	Constituent	Soil-to-Invertebrate Bioconcentration Factor ($BCF_{s\text{-}inv}$)	Units for Soil-to-Invertebrate Bioconcentration Factor	Reference	Sediment-to-Benthic Invertebrate Transfer Factor ($BCF_{s\text{-}binv}$)	Units for Sediment-to-Benthic Invertebrate Transfer Factor	Reference	Water-to-Invertebrate Transfer Factor ($BCF_{w\text{-}inv}$)	Units for Water-to-Invertebrate Transfer Factor	Reference
7704-34-9	Total Sulfur (thermodynamically stable)									
7723-14-0	Phosphorus									
7782-41-4	Fluorine gas (F_2)									
7782-49-2	Selenium	2.20E-01	kg dry soil / kg tissue	[1]	9.00E-01	kg dry sediment / kg tissue	[1]	1.26E+03	L/kg tissue	[2]
7782-50-5	Chlorine									
78-83-1	2-Methylpropyl alcohol									
78-87-5	1,2-Dichloropropane									
78-93-3	2-Butanone									
79-00-5	1,1,2-Trichloroethane									
79-01-6	1,1,2-Trichloroethylene									
79-10-7	2-Propenoic acid									
79-34-5	1,1,2,2-Tetrachloroethane									
79-46-9	2-Nitropropane									
80-62-6	Methyl methacrylate									
82-68-8	Pentachloronitrobenzene (PCNB)	4.51E+02	kg dry soil / kg tissue	[1]	4.51E+02	kg dry sediment / kg tissue	[1]	1.30E+01	L/kg tissue	[2]
822-06-0	Hexamethylene-1,5-diisocyanate									
823-40-5	Toluene-2,6-diamine									
83-32-9	Acenaphthene				2.04E+00	kg dry sediment / kg tissue	[4]			
832-69-9	1-Methylphenanthrene									
84-66-2	Diethyl phthalate									
84-74-2	Di-n-butylphthalate									
85-01-8	Phenanthrene				2.92E+00	kg dry sediment / kg tissue	[4]			

Table 6-2 Media-to-Terrestrial and Aquatic Invertebrate Bioconcentration Factors

CAS Registry Number	Constituent	Soil-to-Invertebrate Bioconcentration Factor ($BCF_{s\text{-}inv}$)	Units for Soil-to-Invertebrate Bioconcentration Factor	Reference	Sediment-to-Benthic Invertebrate Transfer Factor ($BCF_{s\text{-}binv}$)	Units for Sediment-to-Benthic Invertebrate Transfer Factor	Reference	Water-to-Invertebrate Transfer Factor ($BCF_{w\text{-}inv}$)	Units for Water-to-Invertebrate Transfer Factor	Reference
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)									
85-68-7	Butylbenzylphthalate									
86-73-7	Fluorene				1.36E+00	kg dry sediment / kg tissue	[4]			
87-61-6	1,2,3-Trichlorobenzene									
87-68-3	Hexachlorobutadiene	5.35E+02	kg dry soil / kg tissue	[1]	4.40E-01	kg dry sediment / kg tissue	[1]	1.05E+01	L/kg tissue	[2]
87-86-5	Pentachlorophenol	1.03E+03	kg dry soil / kg tissue	[1]	1.03E+03	kg dry sediment / kg tissue	[1]	5.20E+01	L/kg tissue	[2]
88-06-2	2,4,6-Trichlorophenol									
88-74-4	o-Nitroaniline (2-nitroaniline)									
88-75-5	2-Nitrophenol									
90-04-0	o-Anisidine									
90-12-0	1-Methylnaphthalene									
91-20-3	Naphthalene				8.80E+00	kg dry sediment / kg tissue	[4]			
91-22-5	Quinoline									
91-57-6	2-Methylnaphthalene				6.70E+00	kg dry sediment / kg tissue	[4]			
91-58-7	2-Chloronaphthalene									
91-94-1	3,3'-Dichlorobenzidine									
92-52-4	1,1`-Biphenyl									
924-16-3	N-Nitroso-di-n-Buetylamine									
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)									
94-75-7	2,4-D									

Table 6-2 Media-to-Terrestrial and Aquatic Invertebrate Bioconcentration Factors

CAS Registry Number	Constituent	Soil-to-Invertebrate Bioconcentration Factor ($BCF_{s\text{-}inv}$)	Units for Soil-to-Invertebrate Bioconcentration Factor	Reference	Sediment-to-Benthic Invertebrate Transfer Factor ($BCF_{s\text{-}binv}$)	Units for Sediment-to-Benthic Invertebrate Transfer Factor	Reference	Water-to-Invertebrate Transfer Factor ($BCF_{w\text{-}inv}$)	Units for Water-to-Invertebrate Transfer Factor	Reference
95-48-7	o-Cresol									
95-49-8	o-Chlorotoluene									
95-50-1	1,2-Dichlorobenzene									
95-53-4	o-Toluidine									
95-57-8	2-Chlorophenol									
95-63-6	1,2,4-Trimethyl benzene									
95-94-3	1,2,4,5-Tetrachlorobenzene									
95-95-4	2,4,5-Trichlorophenol									
96-12-8	1,2-Dibromo-3-chloropropane									
96-18-4	1,2,3-Trichloropropane									
96-45-7	Ethylene thiourea									
97-63-2	Ethyl methacrylate									
98-01-1	Furfural									
98-06-6	tert-Butyl benzene									
98-07-7	Benzotrichloride									
98-82-8	Cumene									
98-83-9	Methyl styrene (mixed isomers)									
98-86-2	Acetophenone									
98-95-3	Nitrobenzene	2.26E+00	kg dry soil / kg tissue	[1]	2.27E+00	kg dry sediment / kg tissue	[1]	1.30E+01	L/kg tissue	[2]
99-35-4	1,3,5-Trinitrobenzene									
99-65-0	1,3-Dinitrobenzene	1.19E+00	kg dry soil / kg tissue	[1]	1.19E+00	kg dry sediment / kg tissue	[1]	1.30E+01	L/kg tissue	[2]
99-87-6	p-Cymene									

Reference	Reference (source) for Soil-to-Invertebrate Bioconcentration Factor
[1]	Calculated value per Eq. 2-6 (BCF_TCDD × BEF) from EPA. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Peer Review Draft*, EPA 530-D-99-001. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/ecorisk.htm)

Reference	Reference (source) for Sediment-to-Benthic Invertebrate Transfer Factor
[1]	Table C-6 of EPA. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Peer Review Draft*, EPA 530-D-99-001. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/ecorisk.htm)
[2]	USACE. 2004. *BSAF Database*, U.S. Army Corps of Engineers, Engineer Research and Development Center (http://el.erdc.usace.army.mil/bsaf/bsaf.html) (log Kow of 3,3',4,4',5,5'-hexachloro-biphenyl used as surrogate)
[3]	USACE. 2004. *BSAF Database*, U.S. Army Corps of Engineers, Engineer Research and Development Center (http://el.erdc.usace.army.mil/bsaf/bsaf.html) (log Kow of 3,3',4,4',5,5'-hexachloro-biphenyl used as surrogate, maximum reported BSAF)
[4]	USACE. 2004. *BSAF Database*, U.S. Army Corps of Engineers, Engineer Research and Development Center (http://el.erdc.usace.army.mil/bsaf/bsaf.html) (maximum reported BSAF)

Reference	Reference (source) for Water-to-Aquatic Invertebrate Transfer Factor
[1]	Calculated value per Eq. 2-6 (BCF_TCDD × BEF) from EPA. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Peer Review Draft*, EPA 530-D-99-001. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/ecorisk.htm)
[2]	Table C-3 of EPA. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Peer Review Draft*, EPA 530-D-99-001. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/ecorisk.htm)

Table 6-3 provides the water-to-fish bioconcentration factors used to estimate the tissue concentration of fish exposed to contaminants in water. It is the ratio of the contaminant concentration in the fish tissue to that in the water (units have been simplified by dropping terms for mass). The table also provides the mammal ingestion-to-tissue transfer factor, the ratio of the concentration of a contaminant in mammal tissue to the daily mass of contaminated food consumed. This factor is used to compute the food-to-animal bioconcentration factor as described in Section 8.2.3.1 of the RAWP. Blank entries in the table indicate where data are not available.

Table 6-3 Water-to-Fish Bioconcentration Factors and Mammal Ingestion-to-Tissue Transfer Factors

CAS Registry Number	Constituent	Water-to-Fish Bioconcentration Factor ($BCF_{w\text{-}fish}$)	Units for Water-to-Fish Bioconcentration Factor	Reference	Mammal Ingestion-to-Tissue Transfer Factor (*Ba*)	Units for Ingestion-to-Tissue Transfer Factor	Reference
100-02-7	p-Nitrophenol						
100-21-0	Phthalic acid						
100-25-4	1,4-Dinitrobenzene						
100-40-3	4-Ethenylcyclohexene						
100-41-4	Ethyl benzene						
100-42-5	Styrene						
100-44-7	Benzyl chloride						
100-47-0	Benzonitrile						
100-51-6	Benzyl alcohol						
100-52-7	Benzaldehyde						
10028-15-6	Ozone						
10028-17-8	Tritium						
10045-97-3	Cesium-137	2.00E+03	L/kg tissue	[9]	2.00E-02	[mg/kg tissue] / [mg ingested/day]	[1]
10061-01-5	cis-1,3-Dichloropropene						
10061-02-6	trans-1,3-Dichloropropene						
10098-91-6	Yttrium-90	2.50E+01	L/kg tissue	[9]	3.00E-04	[mg/kg tissue] / [mg ingested/day]	[1]
10098-97-2	Strontium-90	5.00E+01	L/kg tissue	[9]	3.00E-04	[mg/kg tissue] / [mg ingested/day]	[1]
101-55-3	4-Bromophenylphenyl ether						
101-77-9	4,4-Methylenedianiline						
10102-44-0	Nitrogen dioxide	1.50E+05	L/kg tissue	[4]			
10198-40-0	Cobalt-60	3.30E+02	L/kg tissue	[9]	2.00E-02	[mg/kg tissue] / [mg ingested/day]	[1]
103-33-3	Azobenzene						
103-65-1	n-Propyl benzene (isocumene)						

Table 6-3 Water-to-Fish Bioconcentration Factors and Mammal Ingestion-to-Tissue Transfer Factors

CAS Registry Number	Constituent	Water-to-Fish Bioconcentration Factor ($BCF_{w\text{-}fish}$)	Units for Water-to-Fish Bioconcentration Factor	Reference	Mammal Ingestion-to-Tissue Transfer Factor (*Ba*)	Units for Ingestion-to-Tissue Transfer Factor	Reference
104-51-8	n-Butylbenzene						
104-76-7	2-Ethyl-1-hexanol						
105-67-9	2,4-Dimethylphenol						
10595-95-6	n-Nitrosomethylethylamine						
106-43-4	4-Chlorotoluene (p-tolyl chloride)						
106-44-5	p-Cresol (4-methyl phenol)						
106-46-7	1,4-Dichlorobenzene						
106-47-8	p-Chloroaniline						
106-49-0	p-Toluidine						
106-51-4	Quinone	5.00E+01	L/kg tissue	[11]			
106-88-7	1,2-Epoxybutane						
106-89-8	Epichlorohydrin (1-chloro-2,3-epoxypropane)						
106-93-4	Ethylene dibromide						
106-99-0	1,3-Butadiene						
107-02-8	Acrolein						
107-05-1	3-Chloropropene						
107-06-2	1,2-Dichloroethane						
107-12-0	Propionitrile						
107-13-1	Acrylonitrile	4.80E+01	L/kg tissue	[12]			
107-19-7	Propargyl alcohol						
107-21-1	Ethylene glycol (1,2-ethanediol)						
107-98-2	Propylene glycol monomethyl ether						
108-05-4	Acetic acid vinyl ester						
108-10-1	4-Methyl-2-pentanone						
108-39-4	m-Cresol						
108-60-1	bis(2-Chloroisopropyl) ether						
108-67-8	1,3,5-Trimethylbenzene						
108-86-1	Bromobenzene (phenyl bromide)						
108-87-2	Methylcyclohexane						
108-88-3	Toluene						

Table 6-3 Water-to-Fish Bioconcentration Factors and Mammal Ingestion-to-Tissue Transfer Factors

CAS Registry Number	Constituent	Water-to-Fish Bioconcentration Factor ($BCF_{w\text{-}fish}$)	Units for Water-to-Fish Bioconcentration Factor	Reference	Mammal Ingestion-to-Tissue Transfer Factor (*Ba*)	Units for Ingestion-to-Tissue Transfer Factor	Reference
108-90-7	Chlorobenzene						
108-94-1	Cyclohexanone						
108-95-2	Phenol						
109-74-0	n-Butanenitrile						
109-75-1	3-Butenenitrile						
109-77-3	Malononitrile						
109-86-4	2-Methoxyethanol						
109-99-9	Tetrahydrofuran						
110-00-9	Furan						
110-54-3	n-Hexane						
110-59-8	Pentanenitrile						
110-80-5	2-Ethoxyethanol						
110-82-7	Cyclohexane						
110-83-8	Cyclohexene						
110-86-1	Pyridine						
111-15-9	Ethylene glycol monoethyl ether acetate						
111-44-4	bis(2-Chloroethyl)ether						
111-65-9	n-Octane						
111-76-2	2-Butoxyethanol						
111-84-2	n-Nonane						
111-91-1	bis(2-Chloroethoxy) methane						
112-30-1	1-Decanol						
112-31-2	Decanal						
112-40-3	Dodecane						
1120-21-4	Undecane						
1120-71-4	1,3-Propane sultone						
117-81-7	bis(2-Ethylhexyl)phthalate	7.00E+01	L/kg tissue	[12]			
117-84-0	Di-n-octylphthalate	9.40E+03	L/kg tissue	[12]			
118-74-1	Hexachlorobenzene	2.53E+02	L/kg tissue	[12]			
119-90-4	3,3'-Dimethoxybenzidine						

Table 6-3 Water-to-Fish Bioconcentration Factors and Mammal Ingestion-to-Tissue Transfer Factors

CAS Registry Number	Constituent	Water-to-Fish Bioconcentration Factor ($BCF_{w\text{-}fish}$)	Units for Water-to-Fish Bioconcentration Factor	Reference	Mammal Ingestion-to-Tissue Transfer Factor (*Ba*)	Units for Ingestion-to-Tissue Transfer Factor	Reference
120-12-7	Anthracene						
120-82-1	1,2,4-Trichlorobenzene						
120-83-2	2,4-Dichlorophenol						
121-14-2	2,4-Dinitrotoluene	2.10E+01	L/kg tissue	[12]			
122-39-4	N,N-Diphenylamine						
122-66-7	1,2-Diphenylhydrazine						
123-33-1	Maleic hydrazide						
123-38-6	Propionaldehyde						
123-72-8	Butanal						
123-91-1	1,4-Dioxan						
124-18-5	Decane						
124-38-9	Carbon dioxide						
124-48-1	Chlorodibromomethane						
126-73-8	Tributyl phosphate						
126-98-7	2-Methyl-2-propenenitrile						
127-18-4	1,1,2,2-Tetrachloroethene						
128-37-0	2,6-bis(tert-butyl)-4-Methylphenol						
129-00-0	Pyrene						
131-11-3	Dimethyl Phthalate						
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol						
132-64-9	Dibenzofuran						
133-06-2	Captan						
1330-20-7	Xylenes (mixed isomers)						
1336-36-3	Polychlorinated biphenyls						
134-32-7	alpha-Naphthylamine						
135-98-8	sec-Butylbenzene						
13966-29-5	Uranium-234	5.00E+01	L/kg tissue	[9]	2.00E-04	[mg/kg tissue] / [mg ingested/day]	[1]
13967-48-1	Ruthenium-106	1.00E+02	L/kg tissue	[9]	2.00E-03	[mg/kg tissue] / [mg ingested/day]	[1]
13967-70-9	Cesium-134	2.00E+03	L/kg tissue	[9]	2.00E-02	[mg/kg tissue] / [mg ingested/day]	[1]

Table 6-3 Water-to-Fish Bioconcentration Factors and Mammal Ingestion-to-Tissue Transfer Factors

CAS Registry Number	Constituent	Water-to-Fish Bioconcentration Factor ($BCF_{w\text{-}fish}$)	Units for Water-to-Fish Bioconcentration Factor	Reference	Mammal Ingestion-to-Tissue Transfer Factor (Ba)	Units for Ingestion-to-Tissue Transfer Factor	Reference
13968-55-3	Uranium-233	5.00E+01	L/kg tissue	[9]	2.00E-04	[mg/kg tissue] / [mg ingested/day]	[1]
13981-15-2	Curium-244	2.50E+02	L/kg tissue	[9]	3.50E-06	[mg/kg tissue] / [mg ingested/day]	[1]
13981-16-3	Plutonium-238	2.50E+02	L/kg tissue	[9]	5.00E-07	[mg/kg tissue] / [mg ingested/day]	[1]
13981-37-8	Nickel-63	7.80E+01	L/kg tissue	[12]	6.00E-03	[mg/kg tissue] / [mg ingested/day]	[1]
13982-10-0	Plutonium-242	2.50E+02	L/kg tissue	[9]	5.00E-07	[mg/kg tissue] / [mg ingested/day]	[1]
13982-63-3	Radium-226	7.00E+01	L/kg tissue	[9]	2.50E-04	[mg/kg tissue] / [mg ingested/day]	[1]
13982-70-2	Uranium-236	5.00E+01	L/kg tissue	[9]	2.00E-04	[mg/kg tissue] / [mg ingested/day]	[1]
13994-20-2	Neptunium-237	2.50E+02	L/kg tissue	[9]	5.50E-05	[mg/kg tissue] / [mg ingested/day]	[1]
141-78-6	Acetic acid ethyl ester						
14119-32-5	Plutonium-241	2.50E+02	L/kg tissue	[9]	5.00E-07	[mg/kg tissue] / [mg ingested/day]	[1]
14119-33-6	Plutonium-240	2.50E+02	L/kg tissue	[9]	5.00E-07	[mg/kg tissue] / [mg ingested/day]	[1]
14133-76-7	Technetium-99	1.50E+01	L/kg tissue	[9]	8.50E-03	[mg/kg tissue] / [mg ingested/day]	[1]
14158-29-3	Uranium-232	5.00E+01	L/kg tissue	[9]	2.00E-04	[mg/kg tissue] / [mg ingested/day]	[1]
14234-35-6	Antimony-125	4.00E+01	L/kg tissue	[12]	1.00E-03	[mg/kg tissue] / [mg ingested/day]	[1]
14265-44-2	Phosphate				5.50E-02	[mg/kg tissue] / [mg ingested/day]	[1]
14331-85-2	Protactinium-231	1.10E+01	L/kg tissue	[9]	1.00E-05	[mg/kg tissue] / [mg ingested/day]	[1]
14336-70-0	Nickel-59	7.80E+01	L/kg tissue	[12]	6.00E-03	[mg/kg tissue] / [mg ingested/day]	[1]
14391-16-3	Europium-155	2.50E+01	L/kg tissue	[9]	5.00E-03	[mg/kg tissue] / [mg ingested/day]	[1]
145-73-3	Endothall						

Table 6-3 Water-to-Fish Bioconcentration Factors and Mammal Ingestion-to-Tissue Transfer Factors

CAS Registry Number	Constituent	Water-to-Fish Bioconcentration Factor ($BCF_{w\text{-}fish}$)	Units for Water-to-Fish Bioconcentration Factor	Reference	Mammal Ingestion-to-Tissue Transfer Factor (*Ba*)	Units for Ingestion-to-Tissue Transfer Factor	Reference
14596-10-2	Americium-241	2.50E+02	L/kg tissue	[9]	3.50E-06	[mg/kg tissue] / [mg ingested/day]	[1]
14683-23-9	Europium-152	2.50E+01	L/kg tissue	[9]	5.00E-03	[mg/kg tissue] / [mg ingested/day]	[1]
14762-75-5	Carbon-14						
14797-55-8	Nitrate	1.50E+05	L/kg tissue	[2]	7.50E-02	[mg/kg tissue] / [mg ingested/day]	[1]
14797-65-0	Nitrite	1.50E+05	L/kg tissue	[2]	7.50E-02	[mg/kg tissue] / [mg ingested/day]	[1]
14808-79-8	Sulfate	1.00E+03	L/kg tissue	[3]	1.00E-01	[mg/kg tissue] / [mg ingested/day]	[1]
14952-40-0	Actinium-227	2.50E+01	L/kg tissue	[9]	2.50E-03	[mg/kg tissue] / [mg ingested/day]	[1]
14993-75-0	Americium-243	2.50E+02	L/kg tissue	[9]	3.50E-06	[mg/kg tissue] / [mg ingested/day]	[1]
15046-84-1	Iodine-129	5.00E+02	L/kg tissue	[9]	7.00E-03	[mg/kg tissue] / [mg ingested/day]	[1]
15117-48-3	Plutonium-239	2.50E+02	L/kg tissue	[9]	5.00E-07	[mg/kg tissue] / [mg ingested/day]	[1]
15117-96-1	Uranium-235	5.00E+01	L/kg tissue	[9]	2.00E-04	[mg/kg tissue] / [mg ingested/day]	[1]
15262-20-1	Radium-228	7.00E+01	L/kg tissue	[9]	2.50E-04	[mg/kg tissue] / [mg ingested/day]	[1]
15510-73-3	Curium-242	2.50E+02	L/kg tissue	[9]	3.50E-06	[mg/kg tissue] / [mg ingested/day]	[1]
15585-10-1	Europium-154	2.50E+01	L/kg tissue	[9]	5.00E-03	[mg/kg tissue] / [mg ingested/day]	[1]
15594-54-4	Thorium-229	1.00E+02	L/kg tissue	[9]	6.00E-06	[mg/kg tissue] / [mg ingested/day]	[1]
156-59-2	cis-1,2-Dichloroethene						
156-60-5	1,2-trans-Dichloroethene						
15715-94-3	Samarium-151	2.50E+01	L/kg tissue	[9]	5.00E-03	[mg/kg tissue] / [mg ingested/day]	[1]
15751-77-6	Zirconium-93	2.00E+02	L/kg tissue	[9]	5.50E-03	[mg/kg tissue] / [mg ingested/day]	[1]

Table 6-3 Water-to-Fish Bioconcentration Factors and Mammal Ingestion-to-Tissue Transfer Factors

CAS Registry Number	Constituent	Water-to-Fish Bioconcentration Factor ($BCF_{w\text{-}fish}$)	Units for Water-to-Fish Bioconcentration Factor	Reference	Mammal Ingestion-to-Tissue Transfer Factor (*Ba*)	Units for Ingestion-to-Tissue Transfer Factor	Reference
15757-87-6	Curium-243	2.50E+02	L/kg tissue	[9]	3.50E-06	[mg/kg tissue] / [mg ingested/day]	[1]
15758-45-9	Selenium-79	1.29E+02	L/kg tissue	[12]	1.50E-02	[mg/kg tissue] / [mg ingested/day]	[1]
15832-50-5	Tin-126	3.00E+03	L/kg tissue	[9]	8.00E-02	[mg/kg tissue] / [mg ingested/day]	[1]
1634-04-4	Methyl tert-butyl ether						
16887-00-6	Chloride	5.00E+01	L/kg tissue	[10]	8.00E-02	[mg/kg tissue] / [mg ingested/day]	[1]
16984-48-8	Fluoride	1.00E+01	L/kg tissue	[10]	1.50E-01	[mg/kg tissue] / [mg ingested/day]	[1]
1746-01-6	2,3,7,8-Tetrachlorodibenzo (p)dioxin (TCDD)	4.24E+03	L/kg tissue	[12]			
18540-29-9	Chromium(VI)	1.90E+01	L/kg tissue	[12]	5.51E-03	[mg/kg tissue] / [mg ingested/day]	[4]
189-55-9	Dibenzo[a,i]pyrene						
189-64-0	Dibenzo[a,h]pyrene						
191-24-2	Benzo[g,h,i]perylene						
191-30-0	Dibenzo[a,l]pyrene						
192-65-4	Dibenzo[a,e]pyrene						
192-97-2	Benzo[e]pyrene						
193-39-5	Indeno[1,2,3-cd]pyrene	5.00E+02	L/kg tissue	[12]			
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	5.93E+02	L/kg tissue	[12]	7.61E-03	[mg/kg tissue] / [mg ingested/day]	[2]
205-82-3	Benzo[j]fluoranthene						
205-99-2	Benzo[b]fluoranthene	5.00E+02	L/kg tissue	[12]			
206-44-0	Fluoranthene						
207-08-9	Benzo[k]fluoranthene	5.00E+02	L/kg tissue	[12]			
208-96-8	Acenaphthylene						
218-01-9	Chrysene	5.00E+02	L/kg tissue	[12]			
224-42-0	Dibenz[a,j]acridine						
2245-38-7	2,3,5-Trimethylnaphthalene						
226-36-8	Dibenz[a,h]acridine	3.50E+03	L/kg tissue	[1]			

Table 6-3 Water-to-Fish Bioconcentration Factors and Mammal Ingestion-to-Tissue Transfer Factors

CAS Registry Number	Constituent	Water-to-Fish Bioconcentration Factor ($BCF_{w\text{-}fish}$)	Units for Water-to-Fish Bioconcentration Factor	Reference	Mammal Ingestion-to-Tissue Transfer Factor (*Ba*)	Units for Ingestion-to-Tissue Transfer Factor	Reference
22967-92-6	Methyl mercury	1.12E+04	L/kg tissue	[12]	7.80E-04	[mg/kg tissue] / [mg ingested/day]	[3]
23950-58-5	Pronamide						
24959-67-9	Bromide	4.20E+02	L/kg tissue	[10]	2.50E-02	[mg/kg tissue] / [mg ingested/day]	[1]
27154-33-2	Trichlorofluoroethane						
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)						
319-84-6	alpha-BHC						
319-85-7	beta-BHC						
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)						
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)						
3268-87-9	Octachlorodibenzo(p)dioxin	5.08E+01	L/kg tissue	[12]	6.52E-04	[mg/kg tissue] / [mg ingested/day]	[2]
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)						
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	2.16E+02	L/kg tissue	[12]	2.77E-03	[mg/kg tissue] / [mg ingested/day]	[2]
3697-24-3	5-Methylchrysene						
378253-40-8	Barium-137m	2.00E+02	L/kg tissue	[9]	1.50E-04	[mg/kg tissue] / [mg ingested/day]	[1]
378253-44-2	Cadmium-113m						
378782-82-2	Niobium-93m	2.00E+02	L/kg tissue	[9]	2.50E-01	[mg/kg tissue] / [mg ingested/day]	[1]
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)						
39001-02-0	Octachlorodibenzofuran	6.78E+01	L/kg tissue	[12]	8.70E-04	[mg/kg tissue] / [mg ingested/day]	[2]
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo (p)dioxin	1.31E+03	L/kg tissue	[12]	1.68E-02	[mg/kg tissue] / [mg ingested/day]	[2]
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)						
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	3.90E+03	L/kg tissue	[12]	5.00E-02	[mg/kg tissue] / [mg ingested/day]	[2]

Table 6-3 Water-to-Fish Bioconcentration Factors and Mammal Ingestion-to-Tissue Transfer Factors

CAS Registry Number	Constituent	Water-to-Fish Bioconcentration Factor ($BCF_{w\text{-}fish}$)	Units for Water-to-Fish Bioconcentration Factor	Reference	Mammal Ingestion-to-Tissue Transfer Factor (*Ba*)	Units for Ingestion-to-Tissue Transfer Factor	Reference
4170-30-3	Crotonaldehyde (propylene aldehyde)	5.20E-01	L/kg tissue	[12]			
41851-50-7	Chlorocyclopentadiene						
460-19-5	Cyanogen (oxalonitrile)						
4786-20-3	2-Butenenitrile						
50-00-0	Formaldehyde	3.40E-01	L/kg tissue	[12]			
50-32-8	Benzo[a]pyrene	5.00E+02	L/kg tissue	[12]			
506-68-3	Cyanogen bromide (bromocyanide)						
506-77-4	Cyanogen chloride						
51-28-5	2,4-Dinitrophenol						
51-79-6	Ethyl carbamate (urethane)						
510-15-6	Chlorobenzilate						
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	3.39E+03	L/kg tissue	[12]	4.34E-02	[mg/kg tissue] / [mg ingested/day]	[2]
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)						
528-29-0	1,2-Dinitrobenzene (o-dinitrobenzene)						
53-70-3	Dibenz[a,h]anthracene	5.00E+02	L/kg tissue	[12]			
532-27-4	2-Chloroacetophenone						
534-52-1	4,6-Dinitro-o-cresol						
5385-75-1	Dibenzo[a,e]fluoranthene						
540-59-0	1,2-Dichloroethene (total)						
540-73-8	1,2-Dimethylhydrazine						
540-84-1	2,2,4-Trimethylpentane						
541-73-1	1,3-Dichlorobenzene						
542-75-6	1,3-Dichloropropene						
542-88-1	bis(Chloromethyl)ether						
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	1.65E+03	L/kg tissue	[12]	2.12E-02	[mg/kg tissue] / [mg ingested/day]	[2]
56-23-5	Carbon tetrachloride	3.00E+01	L/kg tissue	[12]			
56-49-5	3-Methylcholanthrene						
56-55-3	Benzo[a]anthracene	5.00E+02	L/kg tissue	[12]			

Table 6-3 Water-to-Fish Bioconcentration Factors and Mammal Ingestion-to-Tissue Transfer Factors

CAS Registry Number	Constituent	Water-to-Fish Bioconcentration Factor ($BCF_{w\text{-}fish}$)	Units for Water-to-Fish Bioconcentration Factor	Reference	Mammal Ingestion-to-Tissue Transfer Factor (*Ba*)	Units for Ingestion-to-Tissue Transfer Factor	Reference
57-12-5	Cyanide	6.33E+02	L/kg tissue	[12]			
57-24-9	Strychnine						
57-74-9	Chlordane						
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	6.78E+03	L/kg tissue	[12]	8.70E-02	[mg/kg tissue] / [mg ingested/day]	[2]
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	9.32E+02	L/kg tissue	[12]	1.20E-02	[mg/kg tissue] / [mg ingested/day]	[2]
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	8.05E+02	L/kg tissue	[12]	1.03E-02	[mg/kg tissue] / [mg ingested/day]	[2]
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)						
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	5.08E+02	L/kg tissue	[12]	6.52E-03	[mg/kg tissue] / [mg ingested/day]	[2]
58-89-9	gamma-BHC (Lindane)						
58-90-2	2,3,4,6-Tetrachlorophenol						
581-42-0	2,6-Dimethylnaphthalene						
584-84-9	2,4-Toluene diisocyanate						
589-38-8	3-Hexanone						
59-50-7	4-Chloro-3-methylphenol						
59-89-2	N-Nitrosomorpholine						
591-50-4	Benzene, iodo-						
591-78-6	2-Hexanone						
593-60-2	Bromoethene (vinyl bromide)						
593-74-8	Dimethyl mercury						
60-11-7	Dimethyl aminoazobenzene						
60-29-7	Ethyl ether						
60-35-5	Acetamide						
602-87-9	5-Nitroacenaphthene						
606-20-2	2,6-Dinitrotoluene	2.10E+01	L/kg tissue	[12]			
608-93-5	Pentachlorobenzene	1.27E+04	L/kg tissue	[12]			
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	2.84E+03	L/kg tissue	[12]	3.64E-02	[mg/kg tissue] / [mg ingested/day]	[2]
61626-71-9	Dichloropentadiene						

Table 6-3 Water-to-Fish Bioconcentration Factors and Mammal Ingestion-to-Tissue Transfer Factors

CAS Registry Number	Constituent	Water-to-Fish Bioconcentration Factor ($BCF_{w\text{-}fish}$)	Units for Water-to-Fish Bioconcentration Factor	Reference	Mammal Ingestion-to-Tissue Transfer Factor (*Ba*)	Units for Ingestion-to-Tissue Transfer Factor	Reference
62-50-0	Ethyl methanesulfonate						
62-53-3	Aniline						
62-75-9	N-Nitroso-N,N-dimethylamine	2.60E-02	L/kg tissue	[8]			
621-64-7	N-Nitroso-di-n-propylamine						
624-83-9	Methyl isocyanate						
628-73-9	Hexanenitrile						
630-08-0	Carbon monoxide	2.12E+03	L/kg tissue	[6]			
630-20-6	1,1,1,2-Tetrachloroethane						
64-18-6	Formic acid (methanoic acid)						
65-85-0	Benzoic acid						
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)						
67-56-1	Methyl alcohol						
67-63-0	2-Propyl alcohol						
67-64-1	2-Propanone (acetone)	1.00E-01	L/kg tissue	[12]			
67-66-3	Chloroform	3.59E+00	L/kg tissue	[12]			
67-72-1	Hexachloroethane						
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	4.66E+01	L/kg tissue	[12]	5.98E-04	[mg/kg tissue] / [mg ingested/day]	[2]
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	3.76E+04	L/kg tissue	[1]			
70-30-4	Hexachlorophene	2.78E+02	L/kg tissue	[12]			
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)						
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	3.22E+02	L/kg tissue	[12]	4.13E-03	[mg/kg tissue] / [mg ingested/day]	[2]
71-36-3	n-Butyl alcohol						
71-43-2	Benzene						
71-55-6	1,1,1-Trichloroethane						
72-43-5	Methoxychlor						
72-55-9	4,4-DDE	2.55E+04	L/kg tissue	[12]			
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	2.67E+03	L/kg tissue	[12]	3.42E-02	[mg/kg tissue] / [mg ingested/day]	[2]

Table 6-3 Water-to-Fish Bioconcentration Factors and Mammal Ingestion-to-Tissue Transfer Factors

CAS Registry Number	Constituent	Water-to-Fish Bioconcentration Factor ($BCF_{w\text{-}fish}$)	Units for Water-to-Fish Bioconcentration Factor	Reference	Mammal Ingestion-to-Tissue Transfer Factor (*Ba*)	Units for Ingestion-to-Tissue Transfer Factor	Reference
74-83-9	Bromomethane						
74-87-3	Chloromethane						
74-88-4	Iodomethane						
74-95-3	Methylene bromide						
74-97-5	Bromochloromethane						
7429-90-5	Aluminum	2.70E+00	L/kg tissue	[12]	1.50E-03	[mg/kg tissue] / [mg ingested/day]	[1]
7439-89-6	Iron	2.00E+03	L/kg tissue	[9]	2.00E-02	[mg/kg tissue] / [mg ingested/day]	[1]
7439-92-1	Lead	9.00E-02	L/kg tissue	[12]	3.00E-04	[mg/kg tissue] / [mg ingested/day]	[1]
7439-93-2	Lithium				1.00E-02	[mg/kg tissue] / [mg ingested/day]	[1]
7439-95-4	Magnesium	2.12E+03	L/kg tissue	[6]	5.00E-03	[mg/kg tissue] / [mg ingested/day]	[1]
7439-96-5	Manganese	4.00E+02	L/kg tissue	[9]	4.00E-04	[mg/kg tissue] / [mg ingested/day]	[1]
7439-97-6	Mercury						
7439-98-7	Molybdenum	1.27E+03	L/kg tissue	[9]	6.00E-03	[mg/kg tissue] / [mg ingested/day]	[1]
7440-02-0	Nickel	7.80E+01	L/kg tissue	[12]	6.00E-03	[mg/kg tissue] / [mg ingested/day]	[1]
7440-16-6	Rhodium	1.00E+01	L/kg tissue	[9]	2.00E-03	[mg/kg tissue] / [mg ingested/day]	[1]
7440-22-4	Silver	8.77E+01	L/kg tissue	[12]	3.00E-03	[mg/kg tissue] / [mg ingested/day]	[5]
7440-23-5	Sodium	1.00E+02	L/kg tissue	[9]	5.50E-02	[mg/kg tissue] / [mg ingested/day]	[1]
7440-24-6	Strontium (total)	5.00E+01	L/kg tissue	[9]	3.00E-04	[mg/kg tissue] / [mg ingested/day]	[1]
7440-25-7	Tantalum	2.12E+03	L/kg tissue	[6]	6.00E-04	[mg/kg tissue] / [mg ingested/day]	[1]
7440-28-0	Thallium	1.00E+04	L/kg tissue	[12]	4.00E-02	[mg/kg tissue] / [mg ingested/day]	[5]
7440-29-1	Thorium-232	1.00E+02	L/kg tissue	[9]	6.00E-06	[mg/kg tissue] / [mg ingested/day]	[1]

Table 6-3 Water-to-Fish Bioconcentration Factors and Mammal Ingestion-to-Tissue Transfer Factors

CAS Registry Number	Constituent	Water-to-Fish Bioconcentration Factor ($BCF_{w\text{-}fish}$)	Units for Water-to-Fish Bioconcentration Factor	Reference	Mammal Ingestion-to-Tissue Transfer Factor (*Ba*)	Units for Ingestion-to-Tissue Transfer Factor	Reference
7440-31-5	Tin	3.00E+03	L/kg tissue	[9]	8.00E-02	[mg/kg tissue] / [mg ingested/day]	[1]
7440-33-7	Tungsten	1.20E+03	L/kg tissue	[9]	4.50E-02	[mg/kg tissue] / [mg ingested/day]	[1]
7440-36-0	Antimony	4.00E+01	L/kg tissue	[12]	1.00E-03	[mg/kg tissue] / [mg ingested/day]	[1]
7440-38-2	Arsenic	1.14E+02	L/kg tissue	[12]	2.00E-03	[mg/kg tissue] / [mg ingested/day]	[1]
7440-39-3	Barium	6.33E+02	L/kg tissue	[12]	1.50E-04	[mg/kg tissue] / [mg ingested/day]	[1]
7440-41-7	Beryllium	6.20E+01	L/kg tissue	[12]	1.00E-03	[mg/kg tissue] / [mg ingested/day]	[1]
7440-43-9	Cadmium	9.07E+02	L/kg tissue	[12]	1.20E-04	[mg/kg tissue] / [mg ingested/day]	[4]
7440-47-3	Chromium	1.90E+01	L/kg tissue	[12]			
7440-48-4	Cobalt	3.30E+02	L/kg tissue	[9]	2.00E-02	[mg/kg tissue] / [mg ingested/day]	[1]
7440-50-8	Copper	7.10E+02	L/kg tissue	[12]	1.00E-02	[mg/kg tissue] / [mg ingested/day]	[1]
7440-61-1	Uranium	5.00E+01	L/kg tissue	[9]	2.00E-04	[mg/kg tissue] / [mg ingested/day]	[1]
7440-61-1R	Uranium-238	5.00E+01	L/kg tissue	[9]	2.00E-04	[mg/kg tissue] / [mg ingested/day]	[1]
7440-62-2	Vanadium	2.12E+03	L/kg tissue	[6]	2.50E-03	[mg/kg tissue] / [mg ingested/day]	[1]
7440-65-5	Yttrium	2.50E+01	L/kg tissue	[9]	3.00E-04	[mg/kg tissue] / [mg ingested/day]	[1]
7440-66-6	Zinc	2.06E+03	L/kg tissue	[12]	1.00E-01	[mg/kg tissue] / [mg ingested/day]	[5]
7440-67-7	Zirconium	2.00E+02	L/kg tissue	[9]	5.50E-03	[mg/kg tissue] / [mg ingested/day]	[1]
7446-09-5	Sulfur dioxide						
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)						
7487-94-7	Mercuric chloride ($HgCl_2$)	3.53E+03	L/kg tissue	[12]	5.22E-03	[mg/kg tissue] / [mg ingested/day]	[3]

Table 6-3 Water-to-Fish Bioconcentration Factors and Mammal Ingestion-to-Tissue Transfer Factors

CAS Registry Number	Constituent	Water-to-Fish Bioconcentration Factor ($BCF_{w\text{-}fish}$)	Units for Water-to-Fish Bioconcentration Factor	Reference	Mammal Ingestion-to-Tissue Transfer Factor (*Ba*)	Units for Ingestion-to-Tissue Transfer Factor	Reference
75-00-3	Chloroethane						
75-01-4	1-Chloroethene	1.81E+00	L/kg tissue	[12]			
75-02-5	Fluoroethene (vinyl fluoride)						
75-05-8	Acetonitrile						
75-07-0	Acetaldehyde						
75-09-2	Dichloromethane (methylene chloride)						
75-15-0	Carbon disulfide						
75-21-8	Ethylene oxide (Oxirane)						
75-25-2	Bromoform						
75-27-4	Bromodichloromethane						
75-29-6	2-Chloropropane						
75-34-3	1,1-Dichloroethane						
75-35-4	1,1-Dichloroethene						
75-44-5	Phosgene (hydrogen phosphide)						
75-45-6	Chlorodifluoromethane						
75-50-3	Trimethylamine						
75-69-4	Trichlorofluoromethane						
75-71-8	Dichlorodifluoromethane						
76-01-7	Pentachloroethane						
76-13-1	1,2,2-Trichlorotrifluoroethane						
76-44-8	Heptachlor	5.52E+03	L/kg tissue	[12]			
764-41-0	1,4-Dichloro-2-butene						
7647-01-0	Hydrogen chloride	3.16E+00	L/kg tissue	[7]	8.00E-02	[mg/kg tissue] / [mg ingested/day]	[1]
765-34-4	Glycidylaldehyde						
7664-39-3	Hydrogen fluoride				1.50E-01	[mg/kg tissue] / [mg ingested/day]	[1]
7664-41-7	Ammonia/Ammonium						
77-47-4	Hexachlorocyclopentadiene	1.65E+02	L/kg tissue	[12]			
77-78-1	Dimethyl sulfate						
7704-34-9	Total Sulfur (thermodynamically stable)	1.00E+03	L/kg tissue	[5]			

Table 6-3 Water-to-Fish Bioconcentration Factors and Mammal Ingestion-to-Tissue Transfer Factors

CAS Registry Number	Constituent	Water-to-Fish Bioconcentration Factor ($BCF_{w\text{-}fish}$)	Units for Water-to-Fish Bioconcentration Factor	Reference	Mammal Ingestion-to-Tissue Transfer Factor (*Ba*)	Units for Ingestion-to-Tissue Transfer Factor	Reference
7723-14-0	Phosphorus	7.00E+04	L/kg tissue	[9]	5.50E-02	[mg/kg tissue] / [mg ingested/day]	[1]
7782-41-4	Fluorine gas (F_2)	1.00E+01	L/kg tissue	[5]			
7782-49-2	Selenium	1.29E+02	L/kg tissue	[12]	2.26E-03	[mg/kg tissue] / [mg ingested/day]	[5]
7782-50-5	Chlorine	5.00E+01	L/kg tissue	[9]	8.00E-02	[mg/kg tissue] / [mg ingested/day]	[1]
78-83-1	2-Methylpropyl alcohol						
78-87-5	1,2-Dichloropropane						
78-93-3	2-Butanone						
79-00-5	1,1,2-Trichloroethane						
79-01-6	1,1,2-Trichloroethylene						
79-10-7	2-Propenoic acid						
79-34-5	1,1,2,2-Tetrachloroethane						
79-46-9	2-Nitropropane						
80-62-6	Methyl methacrylate						
82-68-8	Pentachloronitrobenzene (PCNB)	2.14E+02	L/kg tissue	[12]			
822-06-0	Hexamethylene-1,5-diisocyanate						
823-40-5	Toluene-2,6-diamine						
83-32-9	Acenaphthene						
832-69-9	1-Methylphenanthrene						
84-66-2	Diethyl phthalate						
84-74-2	Di-n-butylphthalate						
85-01-8	Phenanthrene						
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)						
85-68-7	Butylbenzylphthalate						
86-73-7	Fluorene						
87-61-6	1,2,3-Trichlorobenzene						
87-68-3	Hexachlorobutadiene	7.83E+02	L/kg tissue	[12]			
87-86-5	Pentachlorophenol	1.09E+02	L/kg tissue	[12]			
88-06-2	2,4,6-Trichlorophenol						

Table 6-3 Water-to-Fish Bioconcentration Factors and Mammal Ingestion-to-Tissue Transfer Factors

CAS Registry Number	Constituent	Water-to-Fish Bioconcentration Factor ($BCF_{w\text{-}fish}$)	Units for Water-to-Fish Bioconcentration Factor	Reference	Mammal Ingestion-to-Tissue Transfer Factor (*Ba*)	Units for Ingestion-to-Tissue Transfer Factor	Reference
88-74-4	o-Nitroaniline (2-nitroaniline)						
88-75-5	2-Nitrophenol						
90-04-0	o-Anisidine						
90-12-0	1-Methylnaphthalene						
91-20-3	Naphthalene						
91-22-5	Quinoline						
91-57-6	2-Methylnaphthalene						
91-58-7	2-Chloronaphthalene						
91-94-1	3,3'-Dichlorobenzidine						
92-52-4	1,1`-Biphenyl						
924-16-3	N-Nitroso-di-n-Buetylamine						
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)						
94-75-7	2,4-D						
95-48-7	o-Cresol						
95-49-8	o-Chlorotoluene						
95-50-1	1,2-Dichlorobenzene						
95-53-4	o-Toluidine						
95-57-8	2-Chlorophenol						
95-63-6	1,2,4-Trimethyl benzene						
95-94-3	1,2,4,5-Tetrachlorobenzene						
95-95-4	2,4,5-Trichlorophenol						
96-12-8	1,2-Dibromo-3-chloropropane						
96-18-4	1,2,3-Trichloropropane						
96-45-7	Ethylene thiourea						
97-63-2	Ethyl methacrylate						
98-01-1	Furfural						
98-06-6	tert-Butyl benzene						
98-07-7	Benzotrichloride						
98-82-8	Cumene						
98-83-9	Methyl styrene (mixed isomers)						
98-86-2	Acetophenone						

Table 6-3 Water-to-Fish Bioconcentration Factors and Mammal Ingestion-to-Tissue Transfer Factors

CAS Registry Number	Constituent	Water-to-Fish Bioconcentration Factor ($BCF_{w\text{-}fish}$)	Units for Water-to-Fish Bioconcentration Factor	Reference	Mammal Ingestion-to-Tissue Transfer Factor (*Ba*)	Units for Ingestion-to-Tissue Transfer Factor	Reference
98-95-3	Nitrobenzene	2.10E+01	L/kg tissue	[12]			
99-35-4	1,3,5-Trinitrobenzene						
99-65-0	1,3-Dinitrobenzene	7.40E+01	L/kg tissue	[12]			
99-87-6	p-Cymene						

Reference	Reference (source) for Water-to-Fish Bioconcentration Factor
[1]	64 FR 688. 1999. "40 CFR Part 372: Persistent Bioaccumulative Toxic (PBT) Chemicals; Proposed Rule," Federal Register, Vol 64, No. 2, January 5, 1999.
[2]	ANL. 2001. *User's Manual for RESRAD Version 6*, ANL/EAD-4, Environmental Assessment Division, Argonne National Laboratory, Argonne, IL (elemental nitrogen).
[3]	ANL. 2001. *User's Manual for RESRAD Version 6*, ANL/EAD-4, Environmental Assessment Division, Argonne National Laboratory, Argonne, IL (elemental sulfur).
[4]	ANL. 2001. *User's Manual for RESRAD Version 6*, ANL/EAD-4, Environmental Assessment Division, Argonne National Laboratory, Argonne, IL (nitrogen only).
[5]	ANL. 2001. *User's Manual for RESRAD Version 6*, ANL/EAD-4, Environmental Assessment Division, Argonne National Laboratory, Argonne, IL.
[6]	Arithmetic average of the available BCF values for other inorganics (actinium, aluminum, antimony, arsenic, barium, beryllium, bismuth, bromine, cadmium, calcium, chlorine, chromium, cobalt, copper, curium, europium, fluorine, iodine, iron, lead, manganese, mercury (Hg^{+2}), molybdenum, neptunium, nickel, niobium, phosphorus, plutonium, potassium, protactinium, radium, rhodium, ruthenium, samarium, selenium, silver, sodium, strontium, sulfur, technetium, thallium, thorium, tin, tungsten, yttrium, zinc, and zirconium.)
[7]	EPA. 2005. *The Hazardous Waste Companion Database*. US Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, DC. (http://www.epa.gov/wastes/hazard/tsd/td/combust/risk.htm, accessed January 2013).
[8]	Ecology. *Cleanup Levels and Risk Calculations (CLARC) database* (https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx, accessed May 2014).
[9]	NRC. 1992. *Residual Radioactive Contamination from Decomissioning - Technical Basis for Translating Contamination Levels to Annual Total Effective Dose Equivalant: Final Report*, NUREG/CR-5512V1, PNL 7994, Pacific Northwest Laboratory, Richland, Washington.
[10]	NRC. 1992. *Residual Radioactive Contamination from Decomissioning - Technical Basis for Translating Contamination Levels to Annual Total Effective Dose Equivalant: Final Report*, NUREG/CR-5512V1, PNL 7994, Pacific Northwest Laboratory, Richland, Washington.
[11]	Staven LH, Rhoads K, Napier BA, Strenge DL. 2003. *A Compendium of Transfer Factors for Agricultural and Animal Products*, PNNL-13421, Pacific Northwest National Laboratory, Richland, WA.
[12]	Table C-5 of EPA. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Peer Review Draft*, EPA 530-D-99-001. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/epaoswer/hazwaste/combust/ecorisk.htm)

Reference	Reference (source) for Mammal Ingestion-to-Tissue Transfer Factor
[1]	Baes CF, III, Sharp RD, Sjoreen AL, and Shor RW. 1984. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides Through Agriculture*, ORNL-5786. Oak Ridge National Laboratory, Oak Ridge, Tennessee.
[2]	Calculated value per Eq. 2-6 (BCF_TCDD × BEF) from EPA. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Peer Review Draft*, EPA 530-D-99-001A. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC.
[3]	EPA. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Peer Review Draft*, EPA 530-D-99-001A. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC (Sect. D-1.1).
[4]	EPA. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Peer Review Draft*, EPA 530-D-99-001A. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC (Table 5-1 and D-2, deer mouse BCF divided by IR, see Sect. D-1.1).
[5]	EPA. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, Peer Review Draft, EPA 530-D-99-001A. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC. (http://www.epa.gov/region6/6pd/rcra_c/protocol/slerap.htm)

Table 6-4 provide the bioaccumulation equivalance factors (BEF), and toxicity equivalence factors (TEF) for birds, fish, and mammals. The BEF is the ratio of bioaccumulation of a dioxin, furan, or PCB to the bioaccumulation of 2,3,7,8-TCDD (refer to Section 8.2.5.3 of the RAWP). TEFs are used to evaluate the cumulative toxicity of dioxins, furans, and PCBs (refer to the RAWP Section 8.3.3).

References are indicated by bracketed numbers in the column headers. Blank entries in the table indicate where data are not available.

Table 6-4 Bio-Equivalence Factors, and Bird, Fish, and Mammal Toxicity Equivalence Factors

CAS Registry Number	Constituent	Bioaccum-ulation Equivalence Factor [1]	Bird Toxicity Equivalence Factor [2]	Fish Toxicity Equivalence Factor [2]	Mammal Toxicity Equivalence Factor [3]
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin	1.00E+00	1.00E+00	1.00E+00	1.00E+00
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	1.40E-01	1.00E-01	1.00E-02	1.00E-01
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)		1.00E-05	5.00E-06	3.00E-05
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)		5.00E-02	1.00E-04	1.00E-04
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)		1.00E-04	5.00E-06	3.00E-05
3268-87-9	Octachlorodibenzo(p)dioxin	1.20E-02			3.00E-04
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)		1.00E-03	5.00E-05	3.00E-02
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	5.10E-02	1.00E-03	1.00E-03	1.00E-02
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)		1.00E-04	5.00E-06	3.00E-05
39001-02-0	Octachlorodibenzofuran	1.60E-02	1.00E-04	1.00E-04	3.00E-04
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	3.10E-01	5.00E-02	5.00E-01	1.00E-01
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)		1.00E-05	5.00E-06	3.00E-05
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	9.20E-01	1.00E+00	1.00E+00	1.00E+00
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	8.00E-01	1.00E+00	5.00E-02	1.00E-01
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)		1.00E-05	5.00E-06	3.00E-05
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	3.90E-01	1.00E-02	1.00E-02	1.00E-02
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	1.60E+00	1.00E+00	5.00E-01	3.00E-01
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	2.20E-01	1.00E-01	5.00E-02	3.00E-02
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	1.90E-01	1.00E-01	1.00E-01	1.00E-01
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)		1.00E-01	5.00E-03	1.00E-01
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo(p)dioxin	1.20E-01	1.00E-02	1.00E-02	1.00E-01
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	6.70E-01	1.00E-01	1.00E-01	1.00E-01
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)		1.00E-05	5.00E-06	3.00E-05
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	1.10E-02	1.00E-02	1.00E-02	1.00E-02
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)		1.00E-04	5.00E-06	3.00E-05
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)		1.00E-01	5.00E-04	3.00E-04
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	7.60E-02	1.00E-01	1.00E-01	1.00E-01

Table 6-4 Bio-Equivalence Factors, and Bird, Fish, and Mammal Toxicity Equivalence Factors

CAS Registry Number	Constituent	Bioaccum-ulation Equivalence Factor [1]	Bird Toxicity Equivalence Factor [2]	Fish Toxicity Equivalence Factor [2]	Mammal Toxicity Equivalence Factor [3]
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	6.30E-01	1.00E-01	1.00E-01	1.00E-01
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)		1.00E-04	5.00E-06	3.00E-05

Reference **References (source) for Bio-Equivalence Factors and Toxicity Equivalence Factors**

[1] EPA. 2003. *Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds*, NAS Review Draft, EPA/600/P-00/001 Cb (Part 1, Vol. 2, Table 2-10), Exposure Assessment and Risk Characterization Group National Center for Environmental Assessment - Washington Office of Research and Development, Washington, DC. (www.epa.gov/ncea/dioxin)

[2] EPA. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, Peer Review Draft, EPA 530-D-99-001. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC, USA. (http://www.epa.gov/epaoswer/hazwaste/combust/ecorisk.htm)

[3] WAC 173-340-900. Tables, Washington Administrative Code, effective 12 November 2007.

Table 6-5 provides the food chain multipliers used in the estimate the propagation of contaminates up the food chain from the transfer of constituents from prey to predators by ingestion of prey tissue. Use of the FCM is described in Section 8.2.5.3 of the RAWP. The reference is indicated by the bracketed number in the column header.

Table 6-5 Food Chain Multipliers

CAS Registry Number	Constituent	Food Chain Multipliers [1]		
		FCM_2	FCM_3	FCM_4
100-02-7	4-Nitrophenol	1.0	1.0	1.0
100-21-0	p-Phthalic acid	1.0	1.0	1.0
100-25-4	1,4-Dinitrobenzene	1.0	1.0	1.0
100-40-3	4-Ethenylcyclohexene	1.0	1.3	1.1
100-41-4	Ethyl benzene	1.0	1.0	1.0
100-42-5	Styrene	1.0	1.0	1.0
100-44-7	Benzyl chloride	1.0	1.0	1.0
100-47-0	Benzonitrile	1.0	1.0	1.0
100-51-6	Benzyl alcohol	1.0	1.0	1.0
100-52-7	Benzaldehyde	1.0	1.0	1.0
10028-15-6	Ozone	1.0	1.0	1.0
10061-01-5	cis-1,3-Dichloropropene	1.0	1.0	1.0
10061-02-6	trans-1,3-Dichloropropene	1.0	1.0	1.0
101-55-3	4-Bromophenylphenyl ether	1.0	4.8	4.7
101-77-9	4,4'-Methylenedianiline	1.0	1.0	1.0
10102-44-0	Nitrogen dioxide	1.0	1.0	1.0
103-33-3	Azobenzene	1.0	1.2	1.1
103-65-1	n-Propyl benzene	1.0	1.1	1.0
104-51-8	n-Butyl benzene	1.0	1.6	1.2
104-76-7	2-Ethyl-1-hexanol	1.0	1.0	1.0
105-67-9	2,4-Dimethylphenol	1.0	1.0	1.0
10595-95-6	n-Nitrosomethylethylamine	1.0	1.0	1.0
106-43-4	4-Chlorotoluene	1.0	1.1	1.0
106-44-5	p-Cresol	1.0	1.0	1.0
106-46-7	1,4-Dichlorobenzene	1.0	1.1	1.0
106-47-8	p-Chloroaniline	1.0	1.0	1.0
106-49-0	p-Toluidine	1.0	1.0	1.0
106-51-4	Quinone	1.0	1.0	1.0
106-88-7	1,2-Epoxybutane	1.0	1.0	1.0
106-89-8	Epichlorohydrin	1.0	1.0	1.0
106-93-4	Ethylene dibromide	1.0	1.0	1.0

Table 6-5 Food Chain Multipliers

CAS Registry Number	Constituent	Food Chain Multipliers [1]		
		FCM_2	FCM_3	FCM_4
106-99-0	1,3-Butadiene	1.0	1.0	1.0
107-02-8	Acrolein	1.0	1.0	1.0
107-05-1	3-Chloropropene (allyl chloride)	1.0	1.0	1.0
107-06-2	1,2-Dichloroethane	1.0	1.0	1.0
107-12-0	Propionitrile	1.0	1.0	1.0
107-13-1	Acrylonitrile	1.0	1.0	1.0
107-19-7	Propargyl alcohol	1.0	1.0	1.0
107-21-1	Ethylene glycol	1.0	1.0	1.0
107-98-2	Propylene glycol monomethyl ether	1.0	1.0	1.0
108-05-4	Vinyl acetate	1.0	1.0	1.0
108-10-1	4-Methyl-2-pentanone	1.0	1.0	1.0
108-39-4	m-Cresol	1.0	1.0	1.0
108-60-1	Dichloroisopropyl ether	1.0	1.0	1.0
108-67-8	1,3,5-Trimethyl benzene	1.0	1.1	1.0
108-86-1	Bromobenzene	1.0	1.0	1.0
108-87-2	Methylcyclohexane	1.0	1.1	1.0
108-88-3	Toluene	1.0	1.0	1.0
108-90-7	Chlorobenzene	1.0	1.0	1.0
108-94-1	Cyclohexanone	1.0	1.0	1.0
108-95-2	Phenol	1.0	1.0	1.0
109-74-0	n-Butanenitrile	1.0	1.0	1.0
109-75-1	3-Butenenitrile	1.0	1.0	1.0
109-77-3	Malononitrile	1.0	1.0	1.0
109-86-4	2-Methoxyethanol	1.0	1.0	1.0
109-99-9	Tetrahydrofuran	1.0	1.0	1.0
110-00-9	Furan	1.0	1.0	1.0
110-54-3	n-Hexane	1.0	1.2	1.1
110-59-8	Pentanenitrile	1.0	1.0	1.0
110-80-5	2-Ethoxyethanol	1.0	1.0	1.0
110-82-7	Cyclohexane	1.0	1.1	1.0
110-83-8	Cyclohexene	1.0	1.0	1.0
110-86-1	Pyridine	1.0	1.0	1.0
111-15-9	Ethylene glycol monoethyl ether acetate	1.0	1.0	1.0
111-44-4	bis(2-Chloroethyl)ether	1.0	1.0	1.0
111-65-9	n-Octane	1.0	4.2	3.9

Table 6-5 Food Chain Multipliers

CAS Registry Number	Constituent	Food Chain Multipliers [1]		
		FCM_2	FCM_3	FCM_4
111-76-2	Ethylene glycol monobutyl ether	1.0	1.0	1.0
111-84-2	n-Nonane	1.0	8.0	10
111-91-1	Bis(2-Chloroethoxy)methane	1.0	1.0	1.0
112-30-1	1-Decanol	1.0	2.0	1.5
112-31-2	Decanal	1.0	1.0	1.0
112-40-3	Dodecane	1.0	11	18
1120-21-4	Undecane	1.0	1.0	1.0
1120-71-4	1,3-Propane sultone	1.0	1.0	1.0
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	1.0	4.2	3.9
117-84-0	n-Dioctyl phthalate	1.0	7.3	6.0
118-74-1	Hexachlorobenzene	1.0	4.8	4.7
119-90-4	3,3'-Dimethoxybenzidine	1.0	1.0	1.0
120-12-7	Anthracene	1.0	1.8	1.3
120-82-1	1,2,4-Trichlorobenzene	1.0	1.3	1.1
120-83-2	2,4-Dichlorophenol	1.0	1.0	1.0
121-14-2	2,4-Dinitrotoluene	1.0	1.0	1.0
122-39-4	N,N-Diphenylamine	1.0	1.1	1.0
122-66-7	1,2-Diphenylhydrazine	1.0	1.0	1.0
123-33-1	Maleic hydrazide	1.0	1.0	1.0
123-38-6	n-Propionaldehyde	1.0	1.0	1.0
123-72-8	Butanal	1.0	1.0	1.0
123-91-1	1,4-Dioxane	1.0	1.0	1.0
124-18-5	Decane	1.0	3.6	3.2
124-38-9	Carbon dioxide	1.0	1.0	1.0
124-48-1	Chlorodibromomethane	1.0	1.0	1.0
126-73-8	Tributyl phosphate	1.0	1.3	1.1
126-98-7	2-Methyl-2-propenenitrile	1.0	1.0	1.0
127-18-4	1,1,2,2-Tetrachloroethene	1.0	1.1	1.0
128-37-0	2,6-bis(tert-butyl)-4-Methylphenol	1.0	4.2	3.9
129-00-0	Pyrene	1.0	2.8	2.2
131-11-3	Dimethyl phthalate	1.0	1.0	1.0
131-89-5	2-Cyclohexyl-4,6-dinitrophenol	1.0	1.4	1.1
132-64-9	Dibenzofuran	1.0	1.4	1.1
133-06-2	Captan	1.0	1.0	1.0
1330-20-7	Xylenes (total)	1.0	1.0	1.0

Table 6-5 Food Chain Multipliers

CAS Registry Number	Constituent	Food Chain Multipliers [1]		
		FCM_2	FCM_3	FCM_4
1336-36-3	Polychlorinated biphenyls (PCBs)	1.0	13	22
134-32-7	alpha-Naphthylamine	1.0	1.0	1.0
135-98-8	sec-Butyl benzene	1.0	2.0	1.5
141-78-6	Acetic acid ethyl ester	1.0	1.0	1.0
14265-44-2	Phosphate	1.0	1.0	1.0
145-73-3	Endothall	1.0	1.0	1.0
14797-55-8	Nitrate	1.0	1.0	1.0
14797-65-0	Nitrite	1.0	1.0	1.0
14808-79-8	Sulfate	1.0	1.0	1.0
156-59-2	cis-1,2-Dichloroethene	1.0	1.0	1.0
156-60-5	trans-1,2-Dichloroethylene	1.0	1.0	1.0
1634-04-4	Methyl tert-butyl ether	1.0	1.0	1.0
16887-00-6	Chloride	1.0	1.0	1.0
16984-48-8	Fluoride	1.0	1.0	1.0
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin	1.0	14	27
18540-29-9	Chromium	1.0	1.0	1.0
189-55-9	Dibenzo[a,i]pyrene	1.0	13	23
189-64-0	Dibenzo[a,h]pyrene	1.0	13	23
191-24-2	Benzo[g,h,i]perylene	1.0	14	26
191-30-0	Benzo[a,i]pyrene	1.0	10	12
192-65-4	Dibenzo[a,e]pyrene	1.0	13	23
192-97-2	Benzo[e]pyrene	1.0	14	25
193-39-5	Indeno [1,2,3-cd]pyrene	1.0	14	26
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	1.0	13	23
205-82-3	Benzo[j]fluoranthene	1.0	12	20
205-99-2	Benzo[b]fluoranthene	1.0	12	20
206-44-0	Fluoranthene	1.0	3.2	2.6
207-08-9	Benzo[k]fluoranthene	1.0	12	20
208-96-8	Acenaphthylene	1.0	1.3	1.1
218-01-9	Chrysene	1.0	8.0	10
224-42-0	Dibenz[a,j]acridine	1.0	8.0	10
2245-38-7	2,3,5-Trimethylnaphthalene	1.0	1.0	1.0
226-36-8	Dibenz[a,h]acridine	1.0	8.8	12
22967-92-6	Methylmercury	1.0	1.0	1.0
23950-58-5	Pronamide	1.0	1.1	1.0

Table 6-5 Food Chain Multipliers

CAS Registry Number	Constituent	Food Chain Multipliers [1]		
		FCM_2	FCM_3	FCM_4
24959-67-9	Bromide	1.0	1.0	1.0
27154-33-2	Trichlorofluoroethane	1.0	1.0	1.0
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	1.0	14	24
319-84-6	alpha-BHC	1.0	1.2	1.1
319-85-7	beta-BHC	1.0	1.2	1.1
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	1.0	14	26
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	1.0	14	27
3268-87-9	Octachlorodibenzo(p)dioxin	1.0	6.4	4.5
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	1.0	13	19
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	1.0	8.2	7.8
3697-24-3	5-Methylchrysene	1.0	11	18
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	1.0	11	14
39001-02-0	Octachlorodibenzofuran	1.0	8.2	7.8
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	1.0	10	12
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	1.0	5.5	3.3
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	1.0	14	26
4170-30-3	2-Butenaldehyde (2-butenal)	1.0	1.0	1.0
41851-50-7	Chlorocyclopentadiene	1.0	1.0	1.0
460-19-5	Cyanogen	1.0	1.0	1.0
4786-20-3	2-Butenenitrile	1.0	1.0	1.0
50-00-0	Formaldehyde	1.0	1.0	1.0
50-32-8	Benzo(a)pyrene	1.0	11	16
506-68-3	Cyanogen bromide	1.0	1.0	1.0
506-77-4	Cyanogen chloride	1.0	1.0	1.0
51-28-5	2,4-Dinitrophenol	1.0	1.0	1.0
51-79-6	Ethyl carbamate (Urethane)	1.0	1.0	1.0
510-15-6	Chlorobenzilate	1.0	1.6	1.2
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	1.0	12	20
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	1.0	13	19
528-29-0	o-Dinitrobenzene	1.0	1.0	1.0
53-70-3	Dibenz[a,h]anthracene	1.0	14	25
532-27-4	2-Chloroacetophenone	1.0	1.0	1.0

Table 6-5 Food Chain Multipliers

CAS Registry Number	Constituent	Food Chain Multipliers [1]		
		FCM_2	FCM_3	FCM_4
534-52-1	4,6-Dinitro-o-cresol	1.0	1.0	1.0
5385-75-1	Dibenzo[a,e]fluoranthene	1.0	13	23
540-59-0	1,2-Dichloroethylene	1.0	1.0	1.0
540-73-8	1,2-Dimethylhydrazine	1.0	1.0	1.0
540-84-1	2,2,4-Trimethylpentane	1.0	1.3	1.1
541-73-1	1,3-Dichlorobenzene	1.0	1.1	1.0
542-75-6	1,3-Dichloropropene	1.0	1.0	1.0
542-88-1	Dichloromethyl ether	1.0	1.0	1.0
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	1.0	13	21
56-23-5	Carbon tetrachloride	1.0	1.0	1.0
56-49-5	3-Methylcholanthrene	1.0	14	25
56-55-3	Benzo[a]anthracene	1.0	8.0	10
57-12-5	Cyanide	1.0	1.0	1.0
57-24-9	Strychnine	1.0	1.0	1.0
57-74-9	Chlordane	1.0	12	20
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	1.0	14	25
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	1.0	14	27
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	1.0	14	26
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	1.0	14	24
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo(p)dioxin	1.0	13	23
58-89-9	gamma-BHC (g-Lindane)	1.0	1.4	1.1
58-90-2	2,3,4,6-Tetrachlorophenol	1.0	1.8	1.3
581-42-0	2,6-Dimethylnaphthalene	1.0	1.6	1.2
584-84-9	2,4-Toluene diisocyanate	1.0	1.2	1.0
589-38-8	3-Hexanone	1.0	1.0	1.0
59-50-7	4-Chloro-3-methylphenol	1.0	1.0	1.0
59-89-2	N-Nitrosomorpholine	1.0	1.0	1.0
591-50-4	Benzene, iodo-	1.0	1.1	1.0
591-78-6	2-Hexanone	1.0	1.0	1.0
593-60-2	Bromoethene	1.0	1.0	1.0
593-74-8	Dimethyl Mercury	1.0	1.0	1.0
60-11-7	Dimethyl aminoazobenzene	1.0	2.0	1.5
60-29-7	Ethyl ether	1.0	1.0	1.0
60-35-5	Acetamide	1.0	1.0	1.0
602-87-9	5-Nitroacenaphthene	1.0	1.2	1.1

Table 6-5 Food Chain Multipliers

CAS Registry Number	Constituent	Food Chain Multipliers [1]		
		FCM_2	FCM_3	FCM_4
606-20-2	2,6-Dinitrotoluene	1.0	1.0	1.0
608-93-5	Pentachlorobenzene	1.0	4.2	3.9
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	1.0	14	26
61626-71-9	Dichloropentadiene	1.0	1.0	1.0
62-50-0	Ethyl methanesulfonate	1.0	1.0	1.0
62-53-3	Aniline	1.0	1.0	1.0
62-75-9	N-Nitroso-N,N-dimethylamine	1.0	1.0	1.0
621-64-7	Di-n-propylnitrosamine	1.0	1.0	1.0
624-83-9	Methyl isocyanate	1.0	1.0	1.0
628-73-9	Hexanenitrile	1.0	1.0	1.0
630-08-0	Carbon monoxide	1.0	1.0	1.0
630-20-6	1,1,1,2-Tetrachloroethane	1.0	1.0	1.0
64-18-6	Formic acid	1.0	1.0	1.0
65-85-0	Benzoic acid	1.0	1.0	1.0
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	1.0	14	24
67-56-1	Methyl alcohol	1.0	1.0	1.0
67-63-0	2-Propyl alcohol	1.0	1.0	1.0
67-64-1	2-Propanone (acetone)	1.0	1.0	1.0
67-66-3	Chloroform	1.0	1.0	1.0
67-72-1	Hexachloroethane	1.0	1.3	1.1
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	1.0	13	21
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	1.0	12	17
70-30-4	Hexachlorophene	1.0	12	17
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	1.0	14	24
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	1.0	14	26
71-36-3	n-Butyl alcohol	1.0	1.0	1.0
71-43-2	Benzene	1.0	1.0	1.0
71-55-6	1,1,1-Trichloroethane	1.0	1.0	1.0
72-43-5	Methoxychlor	1.0	2.5	1.9
72-55-9	4,4'-DDE	1.0	8.0	10
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	1.0	14	26
74-83-9	Bromomethane	1.0	1.0	1.0
74-87-3	Chloromethane	1.0	1.0	1.0
74-88-4	Iodomethane	1.0	1.0	1.0
74-95-3	Methylene bromide	1.0	1.0	1.0

Table 6-5 Food Chain Multipliers

CAS Registry Number	Constituent	Food Chain Multipliers [1]		
		FCM_2	*FCM_3*	*FCM_4*
74-97-5	Bromochloromethane	1.0	1.0	1.0
7429-90-5	Aluminum	1.0	1.0	1.0
7439-89-6	Iron	1.0	1.0	1.0
7439-92-1	Lead	1.0	1.0	1.0
7439-93-2	Lithium	1.0	1.0	1.0
7439-95-4	Magnesium	1.0	1.0	1.0
7439-96-5	Manganese	1.0	1.0	1.0
7439-97-6	Mercury	1.0	1.0	1.0
7439-98-7	Molybdenum	1.0	1.0	1.0
7440-02-0	Nickel	1.0	1.0	1.0
7440-16-6	Rhodium	1.0	1.0	1.0
7440-22-4	Silver	1.0	1.0	1.0
7440-23-5	Sodium	1.0	1.0	1.0
7440-24-6	Strontium	1.0	1.0	1.0
7440-25-7	Tantalum	1.0	1.0	1.0
7440-28-0	Thallium	1.0	1.0	1.0
7440-31-5	Tin	1.0	1.0	1.0
7440-33-7	Tungsten	1.0	1.0	1.0
7440-36-0	Antimony	1.0	1.0	1.0
7440-38-2	Arsenic	1.0	1.0	1.0
7440-39-3	Barium	1.0	1.0	1.0
7440-41-7	Beryllium	1.0	1.0	1.0
7440-43-9	Cadmium	1.0	1.0	1.0
7440-47-3	Chromium	1.0	1.0	1.0
7440-48-4	Cobalt	1.0	1.0	1.0
7440-50-8	Copper	1.0	1.0	1.0
7440-61-1	Uranium	1.0	1.0	1.0
7440-62-2	Vanadium	1.0	1.0	1.0
7440-65-5	Yttrium	1.0	1.0	1.0
7440-66-6	Zinc	1.0	1.0	1.0
7440-67-7	Zirconium	1.0	1.0	1.0
7446-09-5	Sulfur dioxide	1.0	1.0	1.0
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	1.0	14	26
7487-94-7	Mercury (Hg^{+2})	1.0	1.0	1.0
75-00-3	Chloroethane	1.0	1.0	1.0

Table 6-5 Food Chain Multipliers

CAS Registry Number	Constituent	Food Chain Multipliers [1]		
		FCM_2	FCM_3	FCM_4
75-01-4	1-Chloroethene	1.0	1.0	1.0
75-02-5	Fluoroethene (vinyl fluoride)	1.0	1.0	1.0
75-05-8	Acetonitrile	1.0	1.0	1.0
75-07-0	Acetaldehyde	1.0	1.0	1.0
75-09-2	Dichloromethane	1.0	1.0	1.0
75-15-0	Carbon disulfide	1.0	1.0	1.0
75-21-8	Oxirane	1.0	1.0	1.0
75-25-2	Bromoform	1.0	1.0	1.0
75-27-4	Bromodichloromethane	1.0	1.0	1.0
75-29-6	2-Chloropropane	1.0	1.0	1.0
75-34-3	1,1-Dichloroethane	1.0	1.0	1.0
75-35-4	1,1-Dichloroethene	1.0	1.0	1.0
75-44-5	Phosgene	1.0	1.0	1.0
75-45-6	Chlorodifluoromethane	1.0	1.0	1.0
75-50-3	Trimethylamine	1.0	1.0	1.0
75-69-4	Trichlorofluoromethane	1.0	1.0	1.0
75-71-8	Dichlorodifluoromethane	1.0	1.0	1.0
76-01-7	Pentachloroethane	1.0	1.1	1.0
76-13-1	1,2,2-Trichloro-1,1,2-trifluoroethane	1.0	1.0	1.0
76-44-8	Heptachlor	1.0	1.5	12
764-41-0	1,4-Dichloro-2-butene	1.0	1.0	1.0
7647-01-0	Hydrogen chloride	1.0	1.0	1.0
765-34-4	Glycidylaldehyde	1.0	1.0	1.0
7664-39-3	Hydrogen fluoride	1.0	1.0	1.0
7664-41-7	Ammonia/Ammonium	1.0	1.0	1.0
77-47-4	Hexachlorocyclopentadiene	1.0	3.6	3.2
77-78-1	Dimethyl sulfate	1.0	1.0	1.0
7704-34-9	Total Sulfur (thermodynamically stable)	1.0	1.0	1.0
7723-14-0	Phosphorus	1.0	1.0	1.0
7782-41-4	Fluorine gas (F_2)	1.0	1.0	1.0
7782-49-2	Selenium	1.0	1.0	1.0
7782-50-5	Chlorine	1.0	1.0	1.0
78-83-1	2-Methylpropyl alcohol	1.0	1.0	1.0
78-87-5	1,2-Dichloropropane	1.0	1.0	1.0
78-93-3	2-Butanone	1.0	1.0	1.0

Table 6-5 Food Chain Multipliers

CAS Registry Number	Constituent	Food Chain Multipliers [1]		
		FCM_2	*FCM_3*	*FCM_4*
79-00-5	1,1,2-Trichloroethane	1.0	1.0	1.0
79-01-6	1,1,2-Trichloroethylene	1.0	1.0	1.0
79-10-7	2-Propenoic acid	1.0	1.0	1.0
79-34-5	1,1,2,2-Tetrachloroethane	1.0	1.0	1.0
79-46-9	2-Nitropropane	1.0	1.0	1.0
80-62-6	Methyl methacrylate	1.0	1.0	1.0
82-68-8	Pentachloronitrobenzene	1.0	2.2	1.6
822-06-0	Hexamethylene-1,5-diisocyanate	1.0	1.0	1.0
823-40-5	Toluene-2,6-diamine	1.0	1.0	1.0
83-32-9	Acenaphthene	1.0	1.2	1.1
832-69-9	1-Methylphenanthrene	1.0	3.6	3.2
84-66-2	Diethyl phthalate	1.0	1.0	1.0
84-74-2	Di-n-butylphthalate	1.0	2.2	1.6
85-01-8	Phenanthrene	1.0	1.8	1.3
85-44-9	Phthalic anhydride	1.0	1.0	1.0
85-68-7	Butylbenzylphthalate	1.0	2.8	2.2
86-73-7	Fluorene	1.0	1.4	1.1
87-61-6	1,2,3-Trichlorobenzene	1.0	1.3	1.1
87-68-3	Hexachlorobutadiene	1.0	2.5	1.9
87-86-5	Pentachlorophenol	1.0	4.2	3.9
88-06-2	2,4,6-Trichlorophenol	1.0	1.1	1.0
88-74-4	o-Nitroaniline	1.0	1.0	1.0
88-75-5	2-Nitrophenol	1.0	1.0	1.0
90-04-0	o-Anisidine	1.0	1.0	1.0
90-12-0	1-Methylnaphthalene	1.0	1.2	1.1
91-20-3	Naphthalene	1.0	1.1	1.0
91-22-5	Quinoline	1.0	1.0	1.0
91-57-6	2-Methylnaphthalene	1.0	1.2	1.1
91-58-7	2-Chloronaphthalene	1.0	1.1	1.0
91-94-1	3,3'-Dichlorobenzidine	1.0	1.1	1.0
92-52-4	1,1`-Biphenyl	1.0	1.3	1.1
924-16-3	N-Nitrosodi-n-butylamine	1.0	1.0	1.0
94-59-7	Safrole	1.0	1.0	1.0
94-75-7	2,4-D and esters	1.0	1.0	1.0
95-48-7	o-Cresol	1.0	1.0	1.0

Table 6-5 Food Chain Multipliers

CAS Registry Number	Constituent	Food Chain Multipliers [1]		
		FCM_2	FCM_3	FCM_4
95-49-8	2-Chlorotoluene	1.0	1.1	1.0
95-50-1	1,2-Dichlorobenzene	1.0	1.1	1.0
95-53-4	o-Toluidine	1.0	1.0	1.0
95-57-8	2-Chlorophenol	1.0	1.0	1.0
95-63-6	1,2,4-Trimethyl benzene	1.0	1.1	1.0
95-94-3	1,2,4,5-Tetrachlorobenzene	1.0	2.5	1.9
95-95-4	2,4,5-Trichlorophenol	1.0	1.2	1.0
96-12-8	1,2-Dibromo-3-chloropropane	1.0	1.0	1.0
96-18-4	1,2,3-Trichloropropane	1.0	1.0	1.0
96-45-7	Ethylene thiourea	1.0	1.0	1.0
97-63-2	Ethyl methacrylate	1.0	1.0	1.0
98-01-1	Furfural	1.0	1.0	1.0
98-06-6	tert-Butyl benzene	1.0	1.4	1.1
98-07-7	Benzotrichloride	1.0	1.2	1.1
98-82-8	Cumene	1.0	1.1	1.0
98-83-9	alpha-Methylstyrene	1.0	1.1	1.0
98-86-2	Acetophenone	1.0	1.0	1.0
98-95-3	Nitrobenzene	1.0	1.0	1.0
99-35-4	1,3,5-Trinitrobenzene	1.0	1.0	1.0
99-65-0	1,3-Dinitrobenzene	1.0	1.0	1.0
99-87-6	p-Cymene	1.0	1.3	1.1
Particulate matter		1.0	1.0	1.0
All radionuclides combined		1.0	1.0	1.0

Reference (source) for Food Chain Mulitpliers

EPA. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, Peer Review Draft, EPA 530-D-99-001. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC, USA (Table 5-2). (http://www.epa.gov/epaoswer/hazwaste/combust/ecorisk.htm)

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7 Toxicity Reference Values for Ecological Receptors

Table 7-1 presents known toxicity reference values (TRV) for terrestrial and aquatic plants, and terrestrial invertebrates. Toxicity of constituents to plants is assumed to be a result of uptake from soil or water and sediment into the terrestrial and aquatic plant tissues, respectively. Toxicity of constituents to terrestrial invertebrates is assumed to be a result of uptake from soil into the invertebrate's tissues. The TRV represents a threshold value below which a toxic effect is not expected to occur. Note that units vary, with concentration units for chemical consistuents, and units of rad per day for radioisotopes. Blank entries in the table indicate where data are not available.

Table 7-1 Plant and Invertebrate Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Value (*TRV*) of Plants	Units for of Direct Exposure *TRV* of Plants	Reference	Direct Exposure *TRV* of Terrestrial Invertebrates	Units for Direct Exposure *TRV* of Terrestrial Invertebrates	Reference
100-02-7	p-Nitrophenol	3.50E-01	mg/kg	[10]	7.00E+03	µg/kg	[21]
100-21-0	Phthalic acid				5.00E+01	mg/kg	[14]
100-25-4	1,4-Dinitrobenzene						
100-40-3	4-Ethenylcyclohexene						
100-41-4	Ethyl benzene						
100-42-5	Styrene	3.20E+05	µg/kg	[29]	4.40E+01	mg/kg	[15]
100-44-7	Benzyl chloride						
100-47-0	Benzonitrile						
100-51-6	Benzyl alcohol						
100-52-7	Benzaldehyde	3.20E+01	mg/kg	[21]			
10028-15-6	Ozone						
10028-17-8	Tritium	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
10045-97-3	Cesium-137	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
10061-01-5	cis-1,3-Dichloropropene						
10061-02-6	trans-1,3-Dichloropropene						
10098-91-6	Yttrium-90	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
10098-97-2	Strontium-90	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
101-55-3	4-Bromophenylphenyl ether						
101-77-9	4,4-Methylenedianiline						
10102-44-0	Nitrogen dioxide	3.00E-01	mg/kg	[16]			
10198-40-0	Cobalt-60	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
103-33-3	Azobenzene						

Table 7-1 Plant and Invertebrate Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Value (*TRV*) of Plants	Units for of Direct Exposure *TRV* of Plants	Reference	Direct Exposure *TRV* of Terrestrial Invertebrates	Units for Direct Exposure *TRV* of Terrestrial Invertebrates	Reference
103-65-1	n-Propyl benzene (isocumene)						
104-51-8	n-Butylbenzene						
104-76-7	2-Ethyl-1-hexanol						
105-67-9	2,4-Dimethylphenol						
10595-95-6	n-Nitrosomethylethylamine						
106-43-4	4-Chlorotoluene (p-tolyl chloride)						
106-44-5	p-Cresol (4-methyl phenol)				1.00E-02	mg/kg	[12]
106-46-7	1,4-Dichlorobenzene	1.00E+01	mg/kg	[21]	2.00E+04	µg/kg	[21]
106-47-8	p-Chloroaniline	6.65E-01	mg/kg	[5]	3.00E+04	µg/kg	[21]
106-49-0	p-Toluidine						
106-51-4	Quinone						
106-88-7	1,2-Epoxybutane						
106-89-8	Epichlorohydrin (1-chloro-2,3-epoxypropane)						
106-93-4	Ethylene dibromide						
106-99-0	1,3-Butadiene						
107-02-8	Acrolein	2.00E+01	mg/kg	[26]	5.00E+00	mg/kg	[18]
107-05-1	3-Chloropropene						
107-06-2	1,2-Dichloroethane						
107-12-0	Propionitrile						
107-13-1	Acrylonitrile						
107-19-7	Propargyl alcohol						
107-21-1	Ethylene glycol (1,2-ethanediol)						
107-98-2	Propylene glycol monomethyl ether						
108-05-4	Acetic acid vinyl ester						
108-10-1	4-Methyl-2-pentanone						
108-39-4	m-Cresol	3.20E+00	mg/kg	[21]			
108-60-1	bis(2-Chloroisopropyl)ether						
108-67-8	1,3,5-Trimethylbenzene						
108-86-1	Bromobenzene (phenyl bromide)						
108-87-2	Methylcyclohexane						

Table 7-1 Plant and Invertebrate Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Value (*TRV*) of Plants	Units for of Direct Exposure *TRV* of Plants	Reference	Direct Exposure *TRV* of Terrestrial Invertebrates	Units for Direct Exposure *TRV* of Terrestrial Invertebrates	Reference
108-88-3	Toluene	2.00E+05	µg/kg	[29]			
108-90-7	Chlorobenzene	1.00E+00	mg/kg	[21]	4.00E+04	µg/kg	[21]
108-94-1	Cyclohexanone						
108-95-2	Phenol	7.90E+04	µg/kg	[29]	3.00E+04	µg/kg	[21]
109-74-0	n-Butanenitrile						
109-75-1	3-Butenenitrile						
109-77-3	Malononitrile						
109-86-4	2-Methoxyethanol						
109-99-9	Tetrahydrofuran						
110-00-9	Furan	6.17E+00	mg/kg	[17]			
110-54-3	n-Hexane						
110-59-8	Pentanenitrile						
110-80-5	2-Ethoxyethanol						
110-82-7	Cyclohexane						
110-83-8	Cyclohexene						
110-86-1	Pyridine	1.00E+01	mg/kg	[21]			
111-15-9	Ethylene glycol monoethyl ether acetate						
111-44-4	bis(2-Chloroethyl)ether						
111-65-9	n-Octane	1.00E+01	mg/kg	[17]			
111-76-2	2-Butoxyethanol						
111-84-2	n-Nonane						
111-91-1	bis(2-Chloroethoxy)methane						
112-30-1	1-Decanol						
112-31-2	Decanal						
112-40-3	Dodecane						
1120-21-4	Undecane						
1120-71-4	1,3-Propane sultone						
117-81-7	bis(2-Ethylhexyl)phthalate	1.00E+01	mg/kg	[17]	1.86E+03	mg/kg	[13]
117-84-0	Di-n-octylphthalate						
118-74-1	Hexachlorobenzene	1.00E+01	mg/kg	[21]	1.00E+01	mg/kg	[6]

Table 7-1 Plant and Invertebrate Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Value (*TRV*) of Plants	Units for of Direct Exposure *TRV* of Plants	Reference	Direct Exposure *TRV* of Terrestrial Invertebrates	Units for Direct Exposure *TRV* of Terrestrial Invertebrates	Reference
119-90-4	3,3'-Dimethoxybenzidine				7.00E+02	mg/kg	[13]
120-12-7	Anthracene	1.00E-01	mg/kg	[24]	2.90E+04	µg/kg	[20]
120-82-1	1,2,4-Trichlorobenzene	1.00E+01	mg/kg	[21]	2.00E+04	µg/kg	[21]
120-83-2	2,4-Dichlorophenol	1.13E-01	mg/kg	[4]			
121-14-2	2,4-Dinitrotoluene	3.20E+00	mg/kg	[12]			
122-39-4	N,N-Diphenylamine						
122-66-7	1,2-Diphenylhydrazine						
123-33-1	Maleic hydrazide				5.00E+04	mg/kg	[3]
123-38-6	Propionaldehyde						
123-72-8	Butanal						
123-91-1	1,4-Dioxan						
124-18-5	Decane	1.00E+01	mg/kg	[20]			
124-38-9	Carbon dioxide						
124-48-1	Chlorodibromomethane						
126-73-8	Tributyl phosphate						
126-98-7	2-Methyl-2-propenenitrile				6.00E+02	mg/kg	[13]
127-18-4	1,1,2,2-Tetrachloroethene	1.00E+01	mg/kg	[17]			
128-37-0	2,6-bis(tert-butyl)-4-Methylphenol						
129-00-0	Pyrene	5.30E+00	mg/kg	[22]	5.00E+00	mg/kg	[17]
131-11-3	Dimethyl Phthalate				2.00E+05	µg/kg	[21]
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol						
132-64-9	Dibenzofuran						
133-06-2	Captan	2.50E+00	mg/kg	[18]	5.00E+03	mg/kg	[10]
1330-20-7	Xylenes (mixed isomers)						
1336-36-3	Polychlorinated biphenyls	1.00E+04	µg/kg	[27]	2.51E+03	µg/kg	[19]
134-32-7	alpha-Naphthylamine						
135-98-8	sec-Butylbenzene						
13966-29-5	Uranium-234	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
13967-48-1	Ruthenium-106	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
13967-70-9	Cesium-134	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
13968-55-3	Uranium-233	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]

Table 7-1 Plant and Invertebrate Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Value (*TRV*) of Plants	Units for of Direct Exposure *TRV* of Plants	Reference	Direct Exposure *TRV* of Terrestrial Invertebrates	Units for Direct Exposure *TRV* of Terrestrial Invertebrates	Reference
13981-15-2	Curium-244	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
13981-16-3	Plutonium-238	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
13981-37-8	Nickel-63	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
13982-10-0	Plutonium-242	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
13982-63-3	Radium-226	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
13982-70-2	Uranium-236	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
13994-20-2	Neptunium-237	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
141-78-6	Acetic acid ethyl ester						
14119-32-5	Plutonium-241	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
14119-33-6	Plutonium-240	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
14133-76-7	Technetium-99	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
14158-29-3	Uranium-232	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
14234-35-6	Antimony-125	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
14265-44-2	Phosphate						
14331-85-2	Protactinium-231	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
14336-70-0	Nickel-59	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
14391-16-3	Europium-155	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
145-73-3	Endothall						
14596-10-2	Americium-241	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
14683-23-9	Europium-152	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
14762-75-5	Carbon-14	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
14797-55-8	Nitrate						
14797-65-0	Nitrite						
14808-79-8	Sulfate						
14952-40-0	Actinium-227	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
14993-75-0	Americium-243	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
15046-84-1	Iodine-129	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
15117-48-3	Plutonium-239	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
15117-96-1	Uranium-235	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
15262-20-1	Radium-228	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
15510-73-3	Curium-242	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]

Table 7-1 Plant and Invertebrate Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Value (*TRV*) of Plants	Units for of Direct Exposure *TRV* of Plants	Reference	Direct Exposure *TRV* of Terrestrial Invertebrates	Units for Direct Exposure *TRV* of Terrestrial Invertebrates	Reference
15585-10-1	Europium-154	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
15594-54-4	Thorium-229	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
156-59-2	cis-1,2-Dichloroethene						
156-60-5	1,2-trans-Dichloroethene						
15715-94-3	Samarium-151	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
15751-77-6	Zirconium-93	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
15757-87-6	Curium-243	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
15758-45-9	Selenium-79	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
15832-50-5	Tin-126	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
1634-04-4	Methyl tert-butyl ether						
16887-00-6	Chloride						
16984-48-8	Fluoride	2.00E+02	mg/kg	[29]	3.00E+01	mg/kg	[22]
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)				5.00E+02	µg/kg	[19]
18540-29-9	Chromium(VI)	1.80E-02	mg/kg	[27]	2.00E-01	mg/kg	[19]
189-55-9	Dibenzo[a,i]pyrene						
189-64-0	Dibenzo[a,h]pyrene						
191-24-2	Benzo[g,h,i]perylene				1.80E+04	µg/kg	[20]
191-30-0	Dibenzo[a,l]pyrene						
192-65-4	Dibenzo[a,e]pyrene						
192-97-2	Benzo[e]pyrene						
193-39-5	Indeno[1,2,3-cd]pyrene	1.20E+03	µg/kg	[27]	2.50E+04	µg/kg	[19]
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin						
205-82-3	Benzo[j]fluoranthene						
205-99-2	Benzo[b]fluoranthene	1.20E+03	µg/kg	[27]	1.80E+04	µg/kg	[20]
206-44-0	Fluoranthene	7.10E+00	mg/kg	[23]	3.80E+01	mg/kg	[16]
207-08-9	Benzo[k]fluoranthene	1.20E+03	µg/kg	[27]	1.80E+04	µg/kg	[20]
208-96-8	Acenaphthylene						
218-01-9	Chrysene	1.20E+03	µg/kg	[27]	1.80E+04	µg/kg	[20]
224-42-0	Dibenz[a,j]acridine						

Table 7-1 Plant and Invertebrate Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Value (*TRV*) of Plants	Units for of Direct Exposure *TRV* of Plants	Reference	Direct Exposure *TRV* of Terrestrial Invertebrates	Units for Direct Exposure *TRV* of Terrestrial Invertebrates	Reference
2245-38-7	2,3,5-Trimethylnaphthalene						
226-36-8	Dibenz[a,h]acridine						
22967-92-6	Methyl mercury				2.50E+00	mg/kg	[19]
23950-58-5	Pronamide	1.25E+01	mg/kg	[1]			
24959-67-9	Bromide	1.00E+01	mg/kg	[29]			
27154-33-2	Trichlorofluoroethane						
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)						
319-84-6	alpha-BHC						
319-85-7	beta-BHC	1.00E+01	mg/kg	[17]			
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)						
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)						
3268-87-9	Octachlorodibenzo(p)dioxin						
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)						
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin						
3697-24-3	5-Methylchrysene						
378253-40-8	Barium-137m	1.00E+00	mg/kg	[30]	1.00E+00	mg/kg	[23]
378253-44-2	Cadmium-113m						
378782-82-2	Niobium-93m	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)						
39001-02-0	Octachlorodibenzofuran						
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo (p)dioxin						
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)						
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin						
4170-30-3	Crotonaldehyde (propylene aldehyde)						

Table 7-1 Plant and Invertebrate Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Value (*TRV*) of Plants	Units for of Direct Exposure *TRV* of Plants	Reference	Direct Exposure *TRV* of Terrestrial Invertebrates	Units for Direct Exposure *TRV* of Terrestrial Invertebrates	Reference
41851-50-7	Chlorocyclopentadiene						
460-19-5	Cyanogen (oxalonitrile)						
4786-20-3	2-Butenenitrile						
50-00-0	Formaldehyde						
50-32-8	Benzo[a]pyrene	1.20E+03	µg/kg	[27]	1.80E+04	µg/kg	[20]
506-68-3	Cyanogen bromide (bromocyanide)						
506-77-4	Cyanogen chloride						
51-28-5	2,4-Dinitrophenol	2.00E+04	µg/kg	[29]			
51-79-6	Ethyl carbamate (urethane)						
510-15-6	Chlorobenzilate						
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran						
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)						
528-29-0	1,2-Dinitrobenzene (o-dinitrobenzene)						
53-70-3	Dibenz[a,h]anthracene	1.20E+03	µg/kg	[27]	1.80E+04	µg/kg	[20]
532-27-4	2-Chloroacetophenone						
534-52-1	4,6-Dinitro-o-cresol	1.00E+00	mg/kg	[7]	2.10E-01	mg/kg	[7]
5385-75-1	Dibenzo[a,e]fluoranthene						
540-59-0	1,2-Dichloroethene (total)						
540-73-8	1,2-Dimethylhydrazine						
540-84-1	2,2,4-Trimethylpentane						
541-73-1	1,3-Dichlorobenzene						
542-75-6	1,3-Dichloropropene	5.00E+00	mg/kg	[3]			
542-88-1	bis(Chloromethyl)ether						
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran						
56-23-5	Carbon tetrachloride						
56-49-5	3-Methylcholanthrene						
56-55-3	Benzo[a]anthracene	1.20E+03	µg/kg	[27]	1.80E+04	µg/kg	[20]
57-12-5	Cyanide						
57-24-9	Strychnine						

Table 7-1 Plant and Invertebrate Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Value (*TRV*) of Plants	Units for of Direct Exposure *TRV* of Plants	Reference	Direct Exposure *TRV* of Terrestrial Invertebrates	Units for Direct Exposure *TRV* of Terrestrial Invertebrates	Reference
57-74-9	Chlordane				8.90E-03	mg/kg	[1]
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran						
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran						
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran						
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)						
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin						
58-89-9	gamma-BHC (Lindane)	1.00E+01	mg/kg	[15]	1.00E-02	mg/kg	[5]
58-90-2	2,3,4,6-Tetrachlorophenol						
581-42-0	2,6-Dimethylnaphthalene						
584-84-9	2,4-Toluene diisocyanate						
589-38-8	3-Hexanone						
59-50-7	4-Chloro-3-methylphenol						
59-89-2	N-Nitrosomorpholine						
591-50-4	Benzene, iodo-						
591-78-6	2-Hexanone						
593-60-2	Bromoethene (vinyl bromide)						
593-74-8	Dimethyl mercury						
60-11-7	Dimethyl aminoazobenzene						
60-29-7	Ethyl ether						
60-35-5	Acetamide						
602-87-9	5-Nitroacenaphthene						
606-20-2	2,6-Dinitrotoluene						
608-93-5	Pentachlorobenzene	3.20E+00	mg/kg	[21]	1.15E+03	µg/kg	[19]
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran						
61626-71-9	Dichloropentadiene						
62-50-0	Ethyl methanesulfonate						
62-53-3	Aniline	1.00E+01	mg/kg	[21]			
62-75-9	N-Nitroso-N,N-dimethylamine						

Table 7-1 Plant and Invertebrate Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Value (*TRV*) of Plants	Units for of Direct Exposure *TRV* of Plants	Reference	Direct Exposure *TRV* of Terrestrial Invertebrates	Units for Direct Exposure *TRV* of Terrestrial Invertebrates	Reference
621-64-7	N-Nitroso-di-n-propylamine						
624-83-9	Methyl isocyanate						
628-73-9	Hexanenitrile						
630-08-0	Carbon monoxide						
630-20-6	1,1,1,2-Tetrachloroethane						
64-18-6	Formic acid (methanoic acid)						
65-85-0	Benzoic acid						
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)						
67-56-1	Methyl alcohol	2.50E+04	mg/kg	[19]			
67-63-0	2-Propyl alcohol	1.00E+01	mg/kg	[17]			
67-64-1	2-Propanone (acetone)	2.50E+04	mg/kg	[19]			
67-66-3	Chloroform						
67-72-1	Hexachloroethane						
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran						
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)						
70-30-4	Hexachlorophene						
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)						
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran						
71-36-3	n-Butyl alcohol						
71-43-2	Benzene	1.00E+01	mg/kg	[6]	1.00E+01	mg/kg	[6]
71-55-6	1,1,1-Trichloroethane	1.00E+01	mg/kg	[14]			
72-43-5	Methoxychlor	3.00E+01	mg/kg	[2]	5.12E-01	mg/kg	[9]
72-55-9	4,4-DDE				6.10E-01	mg/kg	[4]
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran						
74-83-9	Bromomethane						
74-87-3	Chloromethane						
74-88-4	Iodomethane						

Table 7-1 Plant and Invertebrate Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Value (*TRV*) of Plants	Units for of Direct Exposure *TRV* of Plants	Reference	Direct Exposure *TRV* of Terrestrial Invertebrates	Units for Direct Exposure *TRV* of Terrestrial Invertebrates	Reference
74-95-3	Methylene bromide						
74-97-5	Bromochloromethane						
7429-90-5	Aluminum	5.00E+00	mg/kg	[27]			
7439-89-6	Iron						
7439-92-1	Lead	1.20E+02	mg/kg	[28]	1.70E+03	mg/kg	[20]
7439-93-2	Lithium	2.00E+00	mg/kg	[29]			
7439-95-4	Magnesium						
7439-96-5	Manganese	2.20E+02	mg/kg	[28]	4.50E+02	mg/kg	[20]
7439-97-6	Mercury						
7439-98-7	Molybdenum	2.00E+00	mg/kg	[29]			
7440-02-0	Nickel	3.80E+01	mg/kg	[28]	2.80E+02	mg/kg	[20]
7440-16-6	Rhodium						
7440-22-4	Silver	5.60E+02	mg/kg	[28]			
7440-23-5	Sodium						
7440-24-6	Strontium (total)						
7440-25-7	Tantalum						
7440-28-0	Thallium	1.00E-02	mg/kg	[27]			
7440-29-1	Thorium-232	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
7440-31-5	Tin	5.00E+01	mg/kg	[29]			
7440-33-7	Tungsten						
7440-36-0	Antimony	5.00E-01	mg/kg	[27]	7.80E+01	mg/kg	[20]
7440-38-2	Arsenic	1.80E+01	mg/kg	[28]	2.50E-01	mg/kg	[19]
7440-39-3	Barium	5.00E+00	mg/kg	[27]	3.30E+02	mg/kg	[20]
7440-41-7	Beryllium	1.00E-01	mg/kg	[27]	4.00E+01	mg/kg	[20]
7440-43-9	Cadmium	3.20E+01	mg/kg	[28]	1.40E+02	mg/kg	[20]
7440-47-3	Chromium						
7440-48-4	Cobalt	1.30E+01	mg/kg	[28]			
7440-50-8	Copper	7.00E+01	mg/kg	[28]	8.00E+01	mg/kg	[20]
7440-61-1	Uranium	5.00E+00	mg/kg	[29]			
7440-61-1R	Uranium-238	1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]
7440-62-2	Vanadium	2.00E+00	mg/kg	[29]			

Table 7-1 Plant and Invertebrate Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Value (*TRV*) of Plants	Units for of Direct Exposure *TRV* of Plants	Reference	Direct Exposure *TRV* of Terrestrial Invertebrates	Units for Direct Exposure *TRV* of Terrestrial Invertebrates	Reference
7440-65-5	Yttrium						
7440-66-6	Zinc	1.60E+02	mg/kg	[28]	1.20E+02	mg/kg	[20]
7440-67-7	Zirconium						
7446-09-5	Sulfur dioxide						
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)						
7487-94-7	Mercuric chloride ($HgCl_2$)	3.49E-01	mg/kg	[27]	2.50E+00	mg/kg	[19]
75-00-3	Chloroethane						
75-01-4	1-Chloroethene						
75-02-5	Fluoroethene (vinyl fluoride)						
75-05-8	Acetonitrile						
75-07-0	Acetaldehyde						
75-09-2	Dichloromethane (methylene chloride)						
75-15-0	Carbon disulfide						
75-21-8	Ethylene oxide (Oxirane)						
75-25-2	Bromoform						
75-27-4	Bromodichloromethane						
75-29-6	2-Chloropropane						
75-34-3	1,1-Dichloroethane						
75-35-4	1,1-Dichloroethene	1.00E+01	mg/kg	[15]	1.00E+01	mg/kg	[6]
75-44-5	Phosgene (hydrogen phosphide)						
75-45-6	Chlorodifluoromethane						
75-50-3	Trimethylamine						
75-69-4	Trichlorofluoromethane						
75-71-8	Dichlorodifluoromethane						
76-01-7	Pentachloroethane						
76-13-1	1,2,2-Trichlorotrifluoroethane						
76-44-8	Heptachlor	1.00E+03	µg/kg	[27]	1.00E-04	mg/kg	[2]
764-41-0	1,4-Dichloro-2-butene						
7647-01-0	Hydrogen chloride						
765-34-4	Glycidylaldehyde						

Table 7-1 Plant and Invertebrate Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Value (*TRV*) of Plants	Units for of Direct Exposure *TRV* of Plants	Reference	Direct Exposure *TRV* of Terrestrial Invertebrates	Units for Direct Exposure *TRV* of Terrestrial Invertebrates	Reference
7664-39-3	Hydrogen fluoride	2.00E+02	mg/kg	[29]	3.00E+01	mg/kg	[22]
7664-41-7	Ammonia/Ammonium						
77-47-4	Hexachlorocyclopentadiene	1.00E+02	µg/kg	[27]			
77-78-1	Dimethyl sulfate						
7704-34-9	Total Sulfur (thermodynamically stable)						
7723-14-0	Phosphorus						
7782-41-4	Fluorine gas (F_2)						
7782-49-2	Selenium	5.20E-01	mg/kg	[28]	4.10E+00	mg/kg	[20]
7782-50-5	Chlorine						
78-83-1	2-Methylpropyl alcohol	1.00E+02	mg/kg	[21]			
78-87-5	1,2-Dichloropropane				7.00E+05	µg/kg	[21]
78-93-3	2-Butanone						
79-00-5	1,1,2-Trichloroethane						
79-01-6	1,1,2-Trichloroethylene	1.00E+01	mg/kg	[15]	1.00E+01	mg/kg	[6]
79-10-7	2-Propenoic acid						
79-34-5	1,1,2,2-Tetrachloroethane						
79-46-9	2-Nitropropane						
80-62-6	Methyl methacrylate						
82-68-8	Pentachloronitrobenzene (PCNB)	2.00E+00	mg/kg	[13]	1.00E+01	mg/kg	[11]
822-06-0	Hexamethylene-1,5-diisocyanate						
823-40-5	Toluene-2,6-diamine						
83-32-9	Acenaphthene	2.00E+04	µg/kg	[29]	2.90E+04	µg/kg	[20]
832-69-9	1-Methylphenanthrene						
84-66-2	Diethyl phthalate	1.34E+05	µg/kg	[29]			
84-74-2	Di-n-butylphthalate	2.00E+05	µg/kg	[29]			
85-01-8	Phenanthrene	1.00E+02	mg/kg	[25]	2.90E+04	µg/kg	[20]
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)						
85-68-7	Butylbenzylphthalate						
86-73-7	Fluorene	3.60E+00	mg/kg	[23]	3.06E+04	µg/kg	[21]

Table 7-1 Plant and Invertebrate Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Value (*TRV*) of Plants	Units for of Direct Exposure *TRV* of Plants	Reference	Direct Exposure *TRV* of Terrestrial Invertebrates	Units for Direct Exposure *TRV* of Terrestrial Invertebrates	Reference
87-61-6	1,2,3-Trichlorobenzene	1.00E+00	mg/kg	[21]	2.00E+04	µg/kg	[21]
87-68-3	Hexachlorobutadiene						
87-86-5	Pentachlorophenol	5.00E+03	µg/kg	[28]	3.10E+04	µg/kg	[20]
88-06-2	2,4,6-Trichlorophenol	3.20E+01	mg/kg	[11]	1.00E+04	µg/kg	[21]
88-74-4	o-Nitroaniline (2-nitroaniline)						
88-75-5	2-Nitrophenol	5.20E-01	mg/kg	[9]	3.16E+02	mg/kg	[8]
90-04-0	o-Anisidine						
90-12-0	1-Methylnaphthalene						
91-20-3	Naphthalene	3.20E+01	mg/kg	[21]	2.90E+04	µg/kg	[20]
91-22-5	Quinoline						
91-57-6	2-Methylnaphthalene						
91-58-7	2-Chloronaphthalene						
91-94-1	3,3'-Dichlorobenzidine						
92-52-4	1,1`-Biphenyl	6.80E+04	µg/kg	[29]			
924-16-3	N-Nitroso-di-n-Buetylamine						
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)				7.50E+00	mg/kg	[13]
94-75-7	2,4-D	1.00E-02	mg/kg	[8]			
95-48-7	o-Cresol						
95-49-8	o-Chlorotoluene						
95-50-1	1,2-Dichlorobenzene						
95-53-4	o-Toluidine						
95-57-8	2-Chlorophenol						
95-63-6	1,2,4-Trimethyl benzene						
95-94-3	1,2,4,5-Tetrachlorobenzene						
95-95-4	2,4,5-Trichlorophenol	4.30E+03	µg/kg	[29]	9.00E+03	µg/kg	[21]
96-12-8	1,2-Dibromo-3-chloropropane						
96-18-4	1,2,3-Trichloropropane						
96-45-7	Ethylene thiourea						
97-63-2	Ethyl methacrylate						
98-01-1	Furfural						

Table 7-1 Plant and Invertebrate Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Value (*TRV*) of Plants	Units for of Direct Exposure *TRV* of Plants	Reference	Direct Exposure *TRV* of Terrestrial Invertebrates	Units for Direct Exposure *TRV* of Terrestrial Invertebrates	Reference
98-06-6	tert-Butyl benzene						
98-07-7	Benzotrichloride						
98-82-8	Cumene						
98-83-9	Methyl styrene (mixed isomers)						
98-86-2	Acetophenone						
98-95-3	Nitrobenzene				2.26E+03	µg/kg	[19]
99-35-4	1,3,5-Trinitrobenzene						
99-65-0	1,3-Dinitrobenzene				2.26E+03	µg/kg	[19]
99-87-6	p-Cymene						
All radionuclides combined (rad/day)		1.00E+00	rad/d	[30]	1.00E+00	rad/d	[23]

Reference	Reference (source) for Direct Exposure Toxicity Reference Values of Plants
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Reference	Reference (source) for Direct Exposure Toxicity Reference Values of Plants
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Reference	Reference (source) for Direct Exposure Toxicity Reference Values of Terrestrial Invertebrates
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Reference	Reference (source) for Direct Exposure Toxicity Reference Values of Terrestrial Invertebrates
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Reference	Reference (source) for Direct Exposure Toxicity Reference Values of Terrestrial Invertebrates
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Table 7-2 provides ingestion TRVs for the mule deer and the mourning dove. Note that units vary, with units of mass of contaminant per body weight (BW) of the receptor, per day for chemical consistuents, and units of rad per day for radioisotopes. Blank entries in the table indicate where data are not available.

Table 7-2 Mule Deer and Mourning Dove Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Mule Deer	Units for Mule Deer Ingestion *TRV*	Reference	Ingestion *TRV* of the Mourning Dove	Units for Mourning Dove Ingestion *TRV*	Reference
100-02-7	p-Nitrophenol						
100-21-0	Phthalic acid						
100-25-4	1,4-Dinitrobenzene						
100-40-3	4-Ethenylcyclohexene						
100-41-4	Ethyl benzene	9.71E+03	µg/kg BW /d	[3]			
100-42-5	Styrene	2.00E+04	µg/kg BW /d	[3]			
100-44-7	Benzyl chloride						
100-47-0	Benzonitrile						
100-51-6	Benzyl alcohol						
100-52-7	Benzaldehyde	1.43E+04	µg/kg BW /d	[3]			
10028-15-6	Ozone						
10028-17-8	Tritium	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
10045-97-3	Cesium-137	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
10061-01-5	cis-1,3-Dichloropropene						
10061-02-6	trans-1,3-Dichloropropene						
10098-91-6	Yttrium-90	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
10098-97-2	Strontium-90	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
101-55-3	4-Bromophenylphenyl ether						
101-77-9	4,4-Methylenedianiline						
10102-44-0	Nitrogen dioxide						
10198-40-0	Cobalt-60	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
103-33-3	Azobenzene						
103-65-1	n-Propyl benzene (isocumene)						
104-51-8	n-Butylbenzene						
104-76-7	2-Ethyl-1-hexanol						
105-67-9	2,4-Dimethylphenol	5.00E+03	µg/kg BW /d	[3]			
10595-95-6	n-Nitrosomethylethylamine						

Table 7-2 Mule Deer and Mourning Dove Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Mule Deer	Units for Mule Deer Ingestion *TRV*	Reference	Ingestion *TRV* of the Mourning Dove	Units for Mourning Dove Ingestion *TRV*	Reference
106-43-4	4-Chlorotoluene (p-tolyl chloride)						
106-44-5	p-Cresol (4-methyl phenol)						
106-46-7	1,4-Dichlorobenzene						
106-47-8	p-Chloroaniline	1.25E+03	µg/kg BW /d	[3]			
106-49-0	p-Toluidine						
106-51-4	Quinone						
106-88-7	1,2-Epoxybutane						
106-89-8	Epichlorohydrin (1-chloro-2,3-epoxypropane)						
106-93-4	Ethylene dibromide						
106-99-0	1,3-Butadiene						
107-02-8	Acrolein						
107-05-1	3-Chloropropene						
107-06-2	1,2-Dichloroethane	5.00E+04	µg/kg BW /d	[5]	1.72E+04	µg/kg BW /d	[5]
107-12-0	Propionitrile						
107-13-1	Acrylonitrile	4.60E+02	µg/kg BW /d	[2]			
107-19-7	Propargyl alcohol	5.00E+02	µg/kg BW /d	[3]			
107-21-1	Ethylene glycol (1,2-ethanediol)	2.00E+04	µg/kg BW /d	[3]			
107-98-2	Propylene glycol monomethyl ether						
108-05-4	Acetic acid vinyl ester						
108-10-1	4-Methyl-2-pentanone	2.50E+04	µg/kg BW /d	[5]			
108-39-4	m-Cresol	5.00E+03	µg/kg BW /d	[3]			
108-60-1	bis(2-Chloroisopropyl) ether						
108-67-8	1,3,5-Trimethylbenzene						
108-86-1	Bromobenzene (phenyl bromide)						
108-87-2	Methylcyclohexane						
108-88-3	Toluene	2.60E+04	µg/kg BW /d	[5]			
108-90-7	Chlorobenzene	1.90E+04	µg/kg BW /d	[3]			
108-94-1	Cyclohexanone						
108-95-2	Phenol	6.00E+04	µg/kg BW /d	[3]			

Table 7-2 Mule Deer and Mourning Dove Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Mule Deer	Units for Mule Deer Ingestion *TRV*	Reference	Ingestion *TRV* of the Mourning Dove	Units for Mourning Dove Ingestion *TRV*	Reference
109-74-0	n-Butanenitrile						
109-75-1	3-Butenenitrile						
109-77-3	Malononitrile						
109-86-4	2-Methoxyethanol						
109-99-9	Tetrahydrofuran						
110-00-9	Furan						
110-54-3	n-Hexane						
110-59-8	Pentanenitrile						
110-80-5	2-Ethoxyethanol						
110-82-7	Cyclohexane						
110-83-8	Cyclohexene						
110-86-1	Pyridine	1.00E+02	µg/kg BW /d	[3]			
111-15-9	Ethylene glycol monoethyl ether acetate						
111-44-4	bis(2-Chloroethyl)ether						
111-65-9	n-Octane						
111-76-2	2-Butoxyethanol	5.10E+02	µg/kg BW /d	[3]			
111-84-2	n-Nonane						
111-91-1	bis(2-Chloroethoxy)methane						
112-30-1	1-Decanol						
112-31-2	Decanal						
112-40-3	Dodecane						
1120-21-4	Undecane						
1120-71-4	1,3-Propane sultone						
117-81-7	bis(2-Ethylhexyl)phthalate	6.00E+04	µg/kg BW /d	[2]	1.11E+02	µg/kg BW /d	[2]
117-84-0	Di-n-octylphthalate	7.50E+06	µg/kg BW /d	[2]			
118-74-1	Hexachlorobenzene	1.60E+03	µg/kg BW /d	[2]	2.25E+02	µg/kg BW /d	[2]
119-90-4	3,3'-Dimethoxybenzidine						
120-12-7	Anthracene	1.00E+05	µg/kg BW /d	[3]			
120-82-1	1,2,4-Trichlorobenzene						

Table 7-2 Mule Deer and Mourning Dove Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Mule Deer	Units for Mule Deer Ingestion *TRV*	Reference	Ingestion *TRV* of the Mourning Dove	Units for Mourning Dove Ingestion *TRV*	Reference
120-83-2	2,4-Dichlorophenol	3.00E+01	µg/kg BW /d	[3]			
121-14-2	2,4-Dinitrotoluene	3.50E+04	µg/kg BW /d	[2]			
122-39-4	N,N-Diphenylamine	2.50E+02	µg/kg BW /d	[3]			
122-66-7	1,2-Diphenylhydrazine						
123-33-1	Maleic hydrazide	5.00E+04	µg/kg BW /d	[3]			
123-38-6	Propionaldehyde						
123-72-8	Butanal						
123-91-1	1,4-Dioxan	1.06E+05	µg/kg BW /d	[2]			
124-18-5	Decane						
124-38-9	Carbon dioxide						
124-48-1	Chlorodibromomethane	2.14E+03	µg/kg BW /d	[3]			
126-73-8	Tributyl phosphate						
126-98-7	2-Methyl-2-propenenitrile	3.40E+01	µg/kg BW /d	[3]			
127-18-4	1,1,2,2-Tetrachloroethene	1.40E+03	µg/kg BW /d	[3]			
128-37-0	2,6-bis(tert-butyl)-4-Methylphenol						
129-00-0	Pyrene	7.50E+03	µg/kg BW /d	[3]			
131-11-3	Dimethyl Phthalate						
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	2.00E+01	µg/kg BW /d	[3]			
132-64-9	Dibenzofuran						
133-06-2	Captan						
1330-20-7	Xylenes (mixed isomers)						
1336-36-3	Polychlorinated biphenyls	2.06E-01	µg/kg BW /d	[2]	7.20E+01	µg/kg BW /d	[2]
134-32-7	alpha-Naphthylamine						
135-98-8	sec-Butylbenzene						
13966-29-5	Uranium-234	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
13967-48-1	Ruthenium-106	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
13967-70-9	Cesium-134	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
13968-55-3	Uranium-233	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
13981-15-2	Curium-244	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
13981-16-3	Plutonium-238	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]

Table 7-2 Mule Deer and Mourning Dove Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Mule Deer	Units for Mule Deer Ingestion *TRV*	Reference	Ingestion *TRV* of the Mourning Dove	Units for Mourning Dove Ingestion *TRV*	Reference
13981-37-8	Nickel-63	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
13982-10-0	Plutonium-242	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
13982-63-3	Radium-226	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
13982-70-2	Uranium-236	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
13994-20-2	Neptunium-237	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
141-78-6	Acetic acid ethyl ester	9.00E+04	µg/kg BW /d	[3]			
14119-32-5	Plutonium-241	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
14119-33-6	Plutonium-240	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
14133-76-7	Technetium-99	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
14158-29-3	Uranium-232	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
14234-35-6	Antimony-125	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
14265-44-2	Phosphate						
14331-85-2	Protactinium-231	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
14336-70-0	Nickel-59	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
14391-16-3	Europium-155	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
145-73-3	Endothall	2.00E+03	µg/kg BW /d	[3]			
14596-10-2	Americium-241	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
14683-23-9	Europium-152	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
14762-75-5	Carbon-14	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
14797-55-8	Nitrate						
14797-65-0	Nitrite						
14808-79-8	Sulfate						
14952-40-0	Actinium-227	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
14993-75-0	Americium-243	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
15046-84-1	Iodine-129	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
15117-48-3	Plutonium-239	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
15117-96-1	Uranium-235	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
15262-20-1	Radium-228	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
15510-73-3	Curium-242	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
15585-10-1	Europium-154	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]

Table 7-2 Mule Deer and Mourning Dove Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Mule Deer	Units for Mule Deer Ingestion *TRV*	Reference	Ingestion *TRV* of the Mourning Dove	Units for Mourning Dove Ingestion *TRV*	Reference
15594-54-4	Thorium-229	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
156-59-2	cis-1,2-Dichloroethene						
156-60-5	1,2-trans-Dichloroethene	1.70E+03	µg/kg BW /d	[3]			
15715-94-3	Samarium-151	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
15751-77-6	Zirconium-93	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
15757-87-6	Curium-243	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
15758-45-9	Selenium-79	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
15832-50-5	Tin-126	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
1634-04-4	Methyl tert-butyl ether						
16887-00-6	Chloride						
16984-48-8	Fluoride	3.14E+01	mg/kg BW /d	[5]	7.80E+00	mg/kg BW /d	[5]
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1.00E-03	µg/kg BW /d	[5]	1.00E-02	µg/kg BW /d	[2]
18540-29-9	Chromium(VI)	3.50E+00	mg/kg BW /d	[2]	1.00E+00	mg/kg BW /d	[2]
189-55-9	Dibenzo[a,i]pyrene						
189-64-0	Dibenzo[a,h]pyrene						
191-24-2	Benzo[g,h,i]perylene						
191-30-0	Dibenzo[a,l]pyrene						
192-65-4	Dibenzo[a,e]pyrene						
192-97-2	Benzo[e]pyrene						
193-39-5	Indeno[1,2,3-cd]pyrene				1.00E+00	µg/kg BW /d	[2]
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin						
205-82-3	Benzo[j]fluoranthene						
205-99-2	Benzo[b]fluoranthene				1.40E-01	µg/kg BW /d	[2]
206-44-0	Fluoranthene	1.25E+04	µg/kg BW /d	[3]			
207-08-9	Benzo[k]fluoranthene				1.40E-01	µg/kg BW /d	[2]
208-96-8	Acenaphthylene						
218-01-9	Chrysene				1.00E+00	µg/kg BW /d	[2]
224-42-0	Dibenz[a,j]acridine						
2245-38-7	2,3,5-Trimethylnaphthalene						

Table 7-2 Mule Deer and Mourning Dove Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Mule Deer	Units for Mule Deer Ingestion *TRV*	Reference	Ingestion *TRV* of the Mourning Dove	Units for Mourning Dove Ingestion *TRV*	Reference
226-36-8	Dibenz[a,h]acridine						
22967-92-6	Methyl mercury	3.20E-02	mg/kg BW /d	[2]	6.40E-03	mg/kg BW /d	[2]
23950-58-5	Pronamide	7.50E+02	µg/kg BW /d	[3]			
24959-67-9	Bromide						
27154-33-2	Trichlorofluoroethane						
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)						
319-84-6	alpha-BHC						
319-85-7	beta-BHC	4.00E-01	µg/kg BW /d	[5]			
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)						
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)						
3268-87-9	Octachlorodibenzo(p)dioxin						
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)						
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin						
3697-24-3	5-Methylchrysene						
378253-40-8	Barium-137m	1.00E-01	mg/kg BW /d	[4]	1.00E-01	mg/kg BW /d	[4]
378253-44-2	Cadmium-113m						
378782-82-2	Niobium-93m	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)						
39001-02-0	Octachlorodibenzofuran						
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo (p)dioxin						
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)						
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin						
4170-30-3	Crotonaldehyde (propylene aldehyde)	8.00E+01	µg/kg BW /d	[2]			
41851-50-7	Chlorocyclopentadiene						

Table 7-2 Mule Deer and Mourning Dove Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Mule Deer	Units for Mule Deer Ingestion *TRV*	Reference	Ingestion *TRV* of the Mourning Dove	Units for Mourning Dove Ingestion *TRV*	Reference
460-19-5	Cyanogen (oxalonitrile)						
4786-20-3	2-Butenenitrile						
50-00-0	Formaldehyde	2.30E+03	µg/kg BW /d	[2]			
50-32-8	Benzo[a]pyrene	1.00E+02	µg/kg BW /d	[2]	1.00E+00	µg/kg BW /d	[2]
506-68-3	Cyanogen bromide (bromocyanide)	4.40E+03	µg/kg BW /d	[3]			
506-77-4	Cyanogen chloride	2.53E+03	µg/kg BW /d	[3]			
51-28-5	2,4-Dinitrophenol	2.00E+02	µg/kg BW /d	[3]			
51-79-6	Ethyl carbamate (urethane)						
510-15-6	Chlorobenzilate						
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran				1.00E-03	µg/kg BW /d	[5]
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)						
528-29-0	1,2-Dinitrobenzene (o-dinitrobenzene)						
53-70-3	Dibenz[a,h]anthracene	2.00E+00	µg/kg BW /d	[2]	3.90E-01	µg/kg BW /d	[2]
532-27-4	2-Chloroacetophenone						
534-52-1	4,6-Dinitro-o-cresol						
5385-75-1	Dibenzo[a,e]fluoranthene						
540-59-0	1,2-Dichloroethene (total)	4.52E+04	µg/kg BW /d	[5]			
540-73-8	1,2-Dimethylhydrazine						
540-84-1	2,2,4-Trimethylpentane						
541-73-1	1,3-Dichlorobenzene						
542-75-6	1,3-Dichloropropene	2.50E+03	µg/kg BW /d	[3]			
542-88-1	bis(Chloromethyl)ether						
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran						
56-23-5	Carbon tetrachloride	7.10E+01	µg/kg BW /d	[3]			
56-49-5	3-Methylcholanthrene						
56-55-3	Benzo[a]anthracene	1.67E+02	µg/kg BW /d	[2]	7.90E-01	µg/kg BW /d	[2]
57-12-5	Cyanide	2.40E+01	mg/kg BW /d	[2]	4.00E-02	mg/kg BW /d	[2]
57-24-9	Strychnine	2.50E+01	µg/kg BW /d	[3]	8.00E-02	mg/kg BW /d	[1]

Table 7-2 Mule Deer and Mourning Dove Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Mule Deer	Units for Mule Deer Ingestion *TRV*	Reference	Ingestion *TRV* of the Mourning Dove	Units for Mourning Dove Ingestion *TRV*	Reference
57-74-9	Chlordane	4.58E+03	µg/kg BW /d	[5]	2.14E+03	µg/kg BW /d	[5]
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	1.60E-02	µg/kg BW /d	[5]			
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	1.60E-01	µg/kg BW /d	[5]			
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	1.60E-01	µg/kg BW /d	[5]			
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)						
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin						
58-89-9	gamma-BHC (Lindane)	8.00E+03	µg/kg BW /d	[5]	2.00E+03	µg/kg BW /d	[5]
58-90-2	2,3,4,6-Tetrachlorophenol	2.50E+03	µg/kg BW /d	[3]			
581-42-0	2,6-Dimethylnaphthalene						
584-84-9	2,4-Toluene diisocyanate						
589-38-8	3-Hexanone						
59-50-7	4-Chloro-3-methylphenol						
59-89-2	N-Nitrosomorpholine						
591-50-4	Benzene, iodo-						
591-78-6	2-Hexanone						
593-60-2	Bromoethene (vinyl bromide)						
593-74-8	Dimethyl mercury						
60-11-7	Dimethyl aminoazobenzene						
60-29-7	Ethyl ether	5.00E+04	µg/kg BW /d	[3]			
60-35-5	Acetamide						
602-87-9	5-Nitroacenaphthene						
606-20-2	2,6-Dinitrotoluene	4.00E+01	µg/kg BW /d	[2]			
608-93-5	Pentachlorobenzene	7.25E+03	µg/kg BW /d	[2]			
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran						
61626-71-9	Dichloropentadiene						
62-50-0	Ethyl methanesulfonate						
62-53-3	Aniline						
62-75-9	N-Nitroso-N,N-dimethylamine						
621-64-7	N-Nitroso-di-n-propylamine						

Table 7-2 Mule Deer and Mourning Dove Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Mule Deer	Units for Mule Deer Ingestion *TRV*	Reference	Ingestion *TRV* of the Mourning Dove	Units for Mourning Dove Ingestion *TRV*	Reference
624-83-9	Methyl isocyanate						
628-73-9	Hexanenitrile						
630-08-0	Carbon monoxide						
630-20-6	1,1,1,2-Tetrachloroethane	8.93E+03	µg/kg BW /d	[3]			
64-18-6	Formic acid (methanoic acid)						
65-85-0	Benzoic acid	4.00E+03	µg/kg BW /d	[3]			
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)						
67-56-1	Methyl alcohol	5.00E+04	µg/kg BW /d	[3]			
67-63-0	2-Propyl alcohol						
67-64-1	2-Propanone (acetone)	1.00E+04	µg/kg BW /d	[2]	5.20E+04	µg/kg BW /d	[2]
67-66-3	Chloroform	6.00E+04	µg/kg BW /d	[2]			
67-72-1	Hexachloroethane	1.00E+02	µg/kg BW /d	[3]			
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran						
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)						
70-30-4	Hexachlorophene	5.60E+03	µg/kg BW /d	[2]	5.75E+03	µg/kg BW /d	[2]
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)						
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran						
71-36-3	n-Butyl alcohol	1.25E+04	µg/kg BW /d	[3]			
71-43-2	Benzene	2.64E+04	µg/kg BW /d	[5]			
71-55-6	1,1,1-Trichloroethane	1.00E+06	µg/kg BW /d	[5]			
72-43-5	Methoxychlor	5.01E+03	µg/kg BW /d	[3]	1.43E+00	mg/kg BW /d	[1]
72-55-9	4,4-DDE	1.00E+03	µg/kg BW /d	[2]	2.27E+02	µg/kg BW /d	[3]
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran						
74-83-9	Bromomethane	1.40E+02	µg/kg BW /d	[3]			
74-87-3	Chloromethane						
74-88-4	Iodomethane						
74-95-3	Methylene bromide						

Table 7-2 Mule Deer and Mourning Dove Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Mule Deer	Units for Mule Deer Ingestion *TRV*	Reference	Ingestion *TRV* of the Mourning Dove	Units for Mourning Dove Ingestion *TRV*	Reference
74-97-5	Bromochloromethane						
7429-90-5	Aluminum	1.93E+00	mg/kg BW /d	[2]	1.00E+02	mg/kg BW /d	[2]
7439-89-6	Iron						
7439-92-1	Lead	3.75E-02	mg/kg BW /d	[2]	1.63E+00	mg/kg BW /d	[3]
7439-93-2	Lithium	9.39E+00	mg/kg BW /d	[5]			
7439-95-4	Magnesium						
7439-96-5	Manganese	8.80E+01	mg/kg BW /d	[5]	1.79E+02	mg/kg BW /d	[3]
7439-97-6	Mercury						
7439-98-7	Molybdenum	2.58E-01	mg/kg BW /d	[5]	3.53E+00	mg/kg BW /d	[5]
7440-02-0	Nickel	5.00E+01	mg/kg BW /d	[2]	6.71E+00	mg/kg BW /d	[3]
7440-16-6	Rhodium						
7440-22-4	Silver	3.75E-01	mg/kg BW /d	[2]	2.02E+00	mg/kg BW /d	[3]
7440-23-5	Sodium						
7440-24-6	Strontium (total)	2.63E+02	mg/kg BW /d	[5]			
7440-25-7	Tantalum						
7440-28-0	Thallium	1.31E-02	mg/kg BW /d	[2]	3.50E-01	mg/kg BW /d	[2]
7440-29-1	Thorium-232	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
7440-31-5	Tin						
7440-33-7	Tungsten						
7440-36-0	Antimony	6.60E-02	mg/kg BW /d	[2]			
7440-38-2	Arsenic	1.25E+00	mg/kg BW /d	[2]	2.24E+00	mg/kg BW /d	[3]
7440-39-3	Barium	5.10E-01	mg/kg BW /d	[2]	2.08E+01	mg/kg BW /d	[2]
7440-41-7	Beryllium	6.60E-01	mg/kg BW /d	[2]			
7440-43-9	Cadmium	2.52E-02	mg/kg BW /d	[2]	1.47E+00	mg/kg BW /d	[3]
7440-47-3	Chromium				2.66E+00	mg/kg BW /d	[3]
7440-48-4	Cobalt	2.86E-01	mg/kg BW /d	[1]	7.61E+00	mg/kg BW /d	[3]
7440-50-8	Copper	1.20E+01	mg/kg BW /d	[2]	4.05E+00	mg/kg BW /d	[3]
7440-61-1	Uranium	3.07E+00	mg/kg BW /d	[5]	1.60E+01	mg/kg BW /d	[5]
7440-61-1R	Uranium-238	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]
7440-62-2	Vanadium	2.10E-01	mg/kg BW /d	[5]	3.44E-01	mg/kg BW /d	[3]

Table 7-2 Mule Deer and Mourning Dove Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Mule Deer	Units for Mule Deer Ingestion *TRV*	Reference	Ingestion *TRV* of the Mourning Dove	Units for Mourning Dove Ingestion *TRV*	Reference
7440-65-5	Yttrium						
7440-66-6	Zinc	1.04E+01	mg/kg BW /d	[2]	6.61E+01	mg/kg BW /d	[3]
7440-67-7	Zirconium	1.74E+00	mg/kg BW /d	[5]			
7446-09-5	Sulfur dioxide						
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)						
7487-94-7	Mercuric chloride ($HgCl_2$)	1.01E+00	mg/kg BW /d	[2]	3.25E+00	mg/kg BW /d	[2]
75-00-3	Chloroethane						
75-01-4	1-Chloroethene	1.70E+02	µg/kg BW /d	[2]			
75-02-5	Fluoroethene (vinyl fluoride)						
75-05-8	Acetonitrile						
75-07-0	Acetaldehyde						
75-09-2	Dichloromethane (methylene chloride)	6.16E+03	µg/kg BW /d	[3]			
75-15-0	Carbon disulfide	1.10E+04	µg/kg BW /d	[3]			
75-21-8	Ethylene oxide (Oxirane)						
75-25-2	Bromoform	1.79E+03	µg/kg BW /d	[3]			
75-27-4	Bromodichloromethane	1.79E+03	µg/kg BW /d	[3]			
75-29-6	2-Chloropropane						
75-34-3	1,1-Dichloroethane						
75-35-4	1,1-Dichloroethene	3.00E+04	µg/kg BW /d	[5]			
75-44-5	Phosgene (hydrogen phosphide)						
75-45-6	Chlorodifluoromethane						
75-50-3	Trimethylamine						
75-69-4	Trichlorofluoromethane	3.49E+04	µg/kg BW /d	[3]			
75-71-8	Dichlorodifluoromethane	1.50E+04	µg/kg BW /d	[3]			
76-01-7	Pentachloroethane						
76-13-1	1,2,2-Trichlorotrifluoroethane						
76-44-8	Heptachlor	2.50E+00	µg/kg BW /d	[2]	6.50E+01	µg/kg BW /d	[2]
764-41-0	1,4-Dichloro-2-butene						
7647-01-0	Hydrogen chloride	1.44E+01	mg/kg BW /d	[3]			

Table 7-2 Mule Deer and Mourning Dove Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Mule Deer	Units for Mule Deer Ingestion *TRV*	Reference	Ingestion *TRV* of the Mourning Dove	Units for Mourning Dove Ingestion *TRV*	Reference
765-34-4	Glycidylaldehyde	1.09E+02	µg/kg BW /d	[3]			
7664-39-3	Hydrogen fluoride	3.14E+01	mg/kg BW /d	[5]	7.80E+00	mg/kg BW /d	[5]
7664-41-7	Ammonia/Ammonium						
77-47-4	Hexachlorocyclopentadiene	3.80E+03	µg/kg BW /d	[2]			
77-78-1	Dimethyl sulfate						
7704-34-9	Total Sulfur (thermodynamically stable)						
7723-14-0	Phosphorus						
7782-41-4	Fluorine gas (F_2)						
7782-49-2	Selenium	7.60E-02	mg/kg BW /d	[2]	2.90E-01	mg/kg BW /d	[3]
7782-50-5	Chlorine	1.44E+01	mg/kg BW /d	[3]			
78-83-1	2-Methylpropyl alcohol	3.16E+04	µg/kg BW /d	[3]			
78-87-5	1,2-Dichloropropane						
78-93-3	2-Butanone	1.77E+06	µg/kg BW /d	[3]			
79-00-5	1,1,2-Trichloroethane						
79-01-6	1,1,2-Trichloroethylene	7.00E+02	µg/kg BW /d	[3]			
79-10-7	2-Propenoic acid	5.30E+03	µg/kg BW /d	[3]			
79-34-5	1,1,2,2-Tetrachloroethane						
79-46-9	2-Nitropropane						
80-62-6	Methyl methacrylate	1.36E+05	µg/kg BW /d	[3]			
82-68-8	Pentachloronitrobenzene (PCNB)	4.58E+05	µg/kg BW /d	[2]	6.88E+04	µg/kg BW /d	[2]
822-06-0	Hexamethylene-1,5-diisocyanate						
823-40-5	Toluene-2,6-diamine						
83-32-9	Acenaphthene	1.75E+04	µg/kg BW /d	[3]			
832-69-9	1-Methylphenanthrene						
84-66-2	Diethyl phthalate	4.58E+06	µg/kg BW /d	[5]			
84-74-2	Di-n-butylphthalate	5.50E+05	µg/kg BW /d	[5]	1.11E+02	µg/kg BW /d	[5]
85-01-8	Phenanthrene						
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	1.56E+05	µg/kg BW /d	[3]			

Table 7-2 Mule Deer and Mourning Dove Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Mule Deer	Units for Mule Deer Ingestion *TRV*	Reference	Ingestion *TRV* of the Mourning Dove	Units for Mourning Dove Ingestion *TRV*	Reference
85-68-7	Butylbenzylphthalate						
86-73-7	Fluorene	1.25E+04	µg/kg BW /d	[3]			
87-61-6	1,2,3-Trichlorobenzene						
87-68-3	Hexachlorobutadiene	2.00E+02	µg/kg BW /d	[2]	3.19E+03	µg/kg BW /d	[2]
87-86-5	Pentachlorophenol	3.00E+02	µg/kg BW /d	[2]	6.73E+03	µg/kg BW /d	[3]
88-06-2	2,4,6-Trichlorophenol						
88-74-4	o-Nitroaniline (2-nitroaniline)						
88-75-5	2-Nitrophenol						
90-04-0	o-Anisidine						
90-12-0	1-Methylnaphthalene						
91-20-3	Naphthalene	7.10E+03	µg/kg BW /d	[3]			
91-22-5	Quinoline						
91-57-6	2-Methylnaphthalene						
91-58-7	2-Chloronaphthalene	2.50E+05	µg/kg BW /d	[3]			
91-94-1	3,3'-Dichlorobenzidine						
92-52-4	1,1`-Biphenyl	5.00E+04	µg/kg BW /d	[3]			
924-16-3	N-Nitroso-di-n-Buetylamine						
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)						
94-75-7	2,4-D						
95-48-7	o-Cresol	5.00E+03	µg/kg BW /d	[3]			
95-49-8	o-Chlorotoluene	2.00E+04	µg/kg BW /d	[3]			
95-50-1	1,2-Dichlorobenzene	8.57E+04	µg/kg BW /d	[3]			
95-53-4	o-Toluidine						
95-57-8	2-Chlorophenol						
95-63-6	1,2,4-Trimethyl benzene						
95-94-3	1,2,4,5-Tetrachlorobenzene	3.40E+01	µg/kg BW /d	[3]			
95-95-4	2,4,5-Trichlorophenol	1.00E+04	µg/kg BW /d	[3]			
96-12-8	1,2-Dibromo-3-chloropropane						
96-18-4	1,2,3-Trichloropropane	5.71E+02	µg/kg BW /d	[3]			

Table 7-2 Mule Deer and Mourning Dove Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Mule Deer	Units for Mule Deer Ingestion *TRV*	Reference	Ingestion *TRV* of the Mourning Dove	Units for Mourning Dove Ingestion *TRV*	Reference
96-45-7	Ethylene thiourea	2.50E+01	µg/kg BW /d	[3]			
97-63-2	Ethyl methacrylate						
98-01-1	Furfural	7.90E+01	µg/kg BW /d	[3]			
98-06-6	tert-Butyl benzene						
98-07-7	Benzotrichloride						
98-82-8	Cumene	1.10E+05	µg/kg BW /d	[3]			
98-83-9	Methyl styrene (mixed isomers)						
98-86-2	Acetophenone	4.23E+04	µg/kg BW /d	[3]			
98-95-3	Nitrobenzene	4.60E+01	µg/kg BW /d	[3]			
99-35-4	1,3,5-Trinitrobenzene	2.68E+03	µg/kg BW /d	[3]			
99-65-0	1,3-Dinitrobenzene	1.05E+03	µg/kg BW /d	[2]	4.22E-01	µg/kg BW /d	[2]
99-87-6	p-Cymene						
All radionuclides combined		1.00E-01	rad/d	[4]	1.00E-01	rad/d	[4]

Reference **Reference (source) for Ingestion Toxicity Reference Values of the Mule Deer**

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[5] Sample BE, Opresko DM, and Suter II GW. 1996. *Toxicological Benchmarks for Wildlife: 1996 Revision*, ES/ER/TM-86/R3, Lockheed Martin Energy Systems, Inc., Oak Ridge National Laboratory, Oak Ridge, TN

Reference **Reference (source) for Ingestion Toxicity Reference Values of the Mourning Dove**

[1] 1984. Hudson,R.H., R.K. Tucker, and M.A. Haegele. "Handbook of Toxicity of Pesticides to Wildlife", Resource Publication 153, Fish and Wildlife Service, U.S. Department of the Interior:90 p. (California Quail LD50, ECOTOX Ref. #50386, accessed February 2013).

Reference	Reference (source) for Ingestion Toxicity Reference Values of the Mourning Dove
[2]	EPA. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Peer Review Draft*, EPA 530-D-99-001. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC, USA. (http://www.epa.gov/epaoswer/hazwaste/combust/ecorisk.htm)
[3]	EPA. 2005. *Guidance for Developing Ecological Soil Screening Levels*, OSWER Directive 9285.7-55, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC. (Dove/woodcock used as surrogate).
[4]	IAEA. 1992. "Effects of Ionizing Radiation on Plants and Animals at Levels Implied by Current Radiation Protection Standards," IAEA Technical Report Series 332, International Commission on Radiological Protection, Vienna, Austria.
[5]	Sample BE, Opresko DM, and Suter II GW. 1996. *Toxicological Benchmarks for Wildlife: 1996 Revision*, ES/ER/TM-86/R3, Lockheed Martin Energy Systems, Inc., Oak Ridge National Laboratory, Oak Ridge, TN

Table 7-3 provides ingestion TRVs for the great basin pocket mouse and the western meadowlark. Note that units vary, with units of mass of contaminant per body weight (BW) of the receptor, per day for chemical consistuents, and units of rad per day for radioisotopes. Blank entries in the table indicate where data are not available.

Table 7-3 Great Basin Pocket Mouse and Western Meadowlark Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Pocket Mouse	Units for Pocket Mouse Ingestion *TRV*	Reference	Ingestion *TRV* of the Meadowlark	Units for Meadowlark Ingestion *TRV*	Reference
100-02-7	p-Nitrophenol						
100-21-0	Phthalic acid						
100-25-4	1,4-Dinitrobenzene						
100-40-3	4-Ethenylcyclohexene						
100-41-4	Ethyl benzene	9.71E+03	µg/kg BW /d	[12]			
100-42-5	Styrene	2.00E+04	µg/kg BW /d	[12]			
100-44-7	Benzyl chloride						
100-47-0	Benzonitrile						
100-51-6	Benzyl alcohol						
100-52-7	Benzaldehyde	1.43E+04	µg/kg BW /d	[12]			
10028-15-6	Ozone						
10028-17-8	Tritium	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
10045-97-3	Cesium-137	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
10061-01-5	cis-1,3-Dichloropropene						
10061-02-6	trans-1,3-Dichloropropene						
10098-91-6	Yttrium-90	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
10098-97-2	Strontium-90	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
101-55-3	4-Bromophenylphenyl ether						
101-77-9	4,4-Methylenedianiline						
10102-44-0	Nitrogen dioxide						
10198-40-0	Cobalt-60	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
103-33-3	Azobenzene						
103-65-1	n-Propyl benzene (isocumene)						
104-51-8	n-Butylbenzene						
104-76-7	2-Ethyl-1-hexanol						
105-67-9	2,4-Dimethylphenol	5.00E+03	µg/kg BW /d	[12]			
10595-95-6	n-Nitrosomethylethylamine						
106-43-4	4-Chlorotoluene (p-tolyl chloride)						

Table 7-3 Great Basin Pocket Mouse and Western Meadowlark Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Pocket Mouse	Units for Pocket Mouse Ingestion *TRV*	Reference	Ingestion *TRV* of the Meadowlark	Units for Meadowlark Ingestion *TRV*	Reference
106-44-5	p-Cresol (4-methyl phenol)	6.55E+00	mg/kg BW /d	[8]			
106-46-7	1,4-Dichlorobenzene	3.00E+00	mg/kg BW /d	[6]			
106-47-8	p-Chloroaniline	1.25E+03	µg/kg BW /d	[12]			
106-49-0	p-Toluidine						
106-51-4	Quinone						
106-88-7	1,2-Epoxybutane						
106-89-8	Epichlorohydrin (1-chloro-2,3-epoxypropane)						
106-93-4	Ethylene dibromide						
106-99-0	1,3-Butadiene						
107-02-8	Acrolein	1.28E-02	mg/kg BW /d	[9]			
107-05-1	3-Chloropropene						
107-06-2	1,2-Dichloroethane	5.00E+04	µg/kg BW /d	[15]	1.72E+04	µg/kg BW /d	[4]
107-12-0	Propionitrile						
107-13-1	Acrylonitrile	4.60E+02	µg/kg BW /d	[11]			
107-19-7	Propargyl alcohol	5.00E+02	µg/kg BW /d	[12]			
107-21-1	Ethylene glycol (1,2-ethanediol)	2.00E+04	µg/kg BW /d	[12]			
107-98-2	Propylene glycol monomethyl ether						
108-05-4	Acetic acid vinyl ester						
108-10-1	4-Methyl-2-pentanone	2.50E+04	µg/kg BW /d	[15]			
108-39-4	m-Cresol	5.00E+03	µg/kg BW /d	[12]			
108-60-1	bis(2-Chloroisopropyl)ether						
108-67-8	1,3,5-Trimethylbenzene						
108-86-1	Bromobenzene (phenyl bromide)	4.00E+00	mg/kg BW /d	[4]			
108-87-2	Methylcyclohexane						
108-88-3	Toluene	2.60E+04	µg/kg BW /d	[15]			
108-90-7	Chlorobenzene	1.90E+04	µg/kg BW /d	[12]			
108-94-1	Cyclohexanone	3.03E+00	mg/kg BW /d	[1]			
108-95-2	Phenol	6.00E+04	µg/kg BW /d	[12]			
109-74-0	n-Butanenitrile						
109-75-1	3-Butenenitrile						
109-77-3	Malononitrile						

Table 7-3 Great Basin Pocket Mouse and Western Meadowlark Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Pocket Mouse	Units for Pocket Mouse Ingestion *TRV*	Reference	Ingestion *TRV* of the Meadowlark	Units for Meadowlark Ingestion *TRV*	Reference
109-86-4	2-Methoxyethanol						
109-99-9	Tetrahydrofuran						
110-00-9	Furan						
110-54-3	n-Hexane						
110-59-8	Pentanenitrile						
110-80-5	2-Ethoxyethanol						
110-82-7	Cyclohexane						
110-83-8	Cyclohexene						
110-86-1	Pyridine	1.00E+02	µg/kg BW /d	[12]			
111-15-9	Ethylene glycol monoethyl ether acetate						
111-44-4	bis(2-Chloroethyl)ether						
111-65-9	n-Octane						
111-76-2	2-Butoxyethanol	5.10E+02	µg/kg BW /d	[12]			
111-84-2	n-Nonane						
111-91-1	bis(2-Chloroethoxy)methane						
112-30-1	1-Decanol						
112-31-2	Decanal						
112-40-3	Dodecane						
1120-21-4	Undecane						
1120-71-4	1,3-Propane sultone						
117-81-7	bis(2-Ethylhexyl)phthalate	6.00E+04	µg/kg BW /d	[11]	1.11E+02	µg/kg BW /d	[1]
117-84-0	Di-n-octylphthalate	7.50E+06	µg/kg BW /d	[11]			
118-74-1	Hexachlorobenzene	1.60E+03	µg/kg BW /d	[11]	2.25E+02	µg/kg BW /d	[1]
119-90-4	3,3'-Dimethoxybenzidine						
120-12-7	Anthracene	6.56E+04	µg/kg BW /d	[13]			
120-82-1	1,2,4-Trichlorobenzene	4.92E-01	mg/kg BW /d	[1]			
120-83-2	2,4-Dichlorophenol	3.00E+01	µg/kg BW /d	[12]			
121-14-2	2,4-Dinitrotoluene	3.50E+04	µg/kg BW /d	[11]			
122-39-4	N,N-Diphenylamine	2.50E+02	µg/kg BW /d	[12]			
122-66-7	1,2-Diphenylhydrazine						
123-33-1	Maleic hydrazide	5.00E+04	µg/kg BW /d	[12]			

Table 7-3 Great Basin Pocket Mouse and Western Meadowlark Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Pocket Mouse	Units for Pocket Mouse Ingestion *TRV*	Reference	Ingestion *TRV* of the Meadowlark	Units for Meadowlark Ingestion *TRV*	Reference
123-38-6	Propionaldehyde						
123-72-8	Butanal						
123-91-1	1,4-Dioxan	1.06E+05	µg/kg BW /d	[11]			
124-18-5	Decane						
124-38-9	Carbon dioxide						
124-48-1	Chlorodibromomethane	2.14E+03	µg/kg BW /d	[12]			
126-73-8	Tributyl phosphate						
126-98-7	2-Methyl-2-propenenitrile	3.40E+01	µg/kg BW /d	[12]			
127-18-4	1,1,2,2-Tetrachloroethene	1.40E+03	µg/kg BW /d	[12]			
128-37-0	2,6-bis(tert-butyl)-4-Methylphenol						
129-00-0	Pyrene	7.50E+03	µg/kg BW /d	[12]			
131-11-3	Dimethyl Phthalate						
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	2.00E+01	µg/kg BW /d	[12]			
132-64-9	Dibenzofuran						
133-06-2	Captan	2.50E-02	mg/kg BW /d	[7]			
1330-20-7	Xylenes (mixed isomers)						
1336-36-3	Polychlorinated biphenyls	2.06E-01	µg/kg BW /d	[11]	7.20E+01	µg/kg BW /d	[1]
134-32-7	alpha-Naphthylamine						
135-98-8	sec-Butylbenzene						
13966-29-5	Uranium-234	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
13967-48-1	Ruthenium-106	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
13967-70-9	Cesium-134	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
13968-55-3	Uranium-233	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
13981-15-2	Curium-244	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
13981-16-3	Plutonium-238	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
13981-37-8	Nickel-63	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
13982-10-0	Plutonium-242	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
13982-63-3	Radium-226	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
13982-70-2	Uranium-236	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
13994-20-2	Neptunium-237	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
141-78-6	Acetic acid ethyl ester	9.00E+04	µg/kg BW /d	[12]			
14119-32-5	Plutonium-241	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]

Table 7-3 Great Basin Pocket Mouse and Western Meadowlark Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Pocket Mouse	Units for Pocket Mouse Ingestion *TRV*	Reference	Ingestion *TRV* of the Meadowlark	Units for Meadowlark Ingestion *TRV*	Reference
14119-33-6	Plutonium-240	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
14133-76-7	Technetium-99	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
14158-29-3	Uranium-232	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
14234-35-6	Antimony-125	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
14265-44-2	Phosphate						
14331-85-2	Protactinium-231	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
14336-70-0	Nickel-59	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
14391-16-3	Europium-155	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
145-73-3	Endothall	2.00E+03	µg/kg BW /d	[12]			
14596-10-2	Americium-241	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
14683-23-9	Europium-152	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
14762-75-5	Carbon-14	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
14797-55-8	Nitrate						
14797-65-0	Nitrite						
14808-79-8	Sulfate						
14952-40-0	Actinium-227	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
14993-75-0	Americium-243	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
15046-84-1	Iodine-129	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
15117-48-3	Plutonium-239	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
15117-96-1	Uranium-235	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
15262-20-1	Radium-228	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
15510-73-3	Curium-242	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
15585-10-1	Europium-154	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
15594-54-4	Thorium-229	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
156-59-2	cis-1,2-Dichloroethene						
156-60-5	1,2-trans-Dichloroethene	1.70E+03	µg/kg BW /d	[12]			
15715-94-3	Samarium-151	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
15751-77-6	Zirconium-93	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
15757-87-6	Curium-243	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
15758-45-9	Selenium-79	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
15832-50-5	Tin-126	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
1634-04-4	Methyl tert-butyl ether						

Table 7-3 Great Basin Pocket Mouse and Western Meadowlark Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Pocket Mouse	Units for Pocket Mouse Ingestion *TRV*	Reference	Ingestion *TRV* of the Meadowlark	Units for Meadowlark Ingestion *TRV*	Reference
16887-00-6	Chloride						
16984-48-8	Fluoride	3.14E+01	mg/kg BW /d	[15]	7.80E+00	mg/kg BW /d	[4]
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1.00E-03	µg/kg BW /d	[15]	1.00E-02	µg/kg BW /d	[1]
18540-29-9	Chromium(VI)	3.50E+00	mg/kg BW /d	[11]	1.00E+00	mg/kg BW /d	[1]
189-55-9	Dibenzo[a,i]pyrene						
189-64-0	Dibenzo[a,h]pyrene						
191-24-2	Benzo[g,h,i]perylene	6.15E+02	µg/kg BW /d	[13]			
191-30-0	Dibenzo[a,l]pyrene						
192-65-4	Dibenzo[a,e]pyrene						
192-97-2	Benzo[e]pyrene						
193-39-5	Indeno[1,2,3-cd]pyrene				1.00E+00	µg/kg BW /d	[1]
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin						
205-82-3	Benzo[j]fluoranthene						
205-99-2	Benzo[b]fluoranthene	6.15E+02	µg/kg BW /d	[13]	1.40E-01	µg/kg BW /d	[1]
206-44-0	Fluoranthene	1.25E+04	µg/kg BW /d	[12]			
207-08-9	Benzo[k]fluoranthene				1.40E-01	µg/kg BW /d	[1]
208-96-8	Acenaphthylene						
218-01-9	Chrysene	6.15E+02	µg/kg BW /d	[13]	1.00E+00	µg/kg BW /d	[1]
224-42-0	Dibenz[a,j]acridine						
2245-38-7	2,3,5-Trimethylnaphthalene						
226-36-8	Dibenz[a,h]acridine						
22967-92-6	Methyl mercury	3.20E-02	mg/kg BW /d	[11]	6.40E-03	mg/kg BW /d	[1]
23950-58-5	Pronamide	7.50E+03	µg/kg BW /d	[12]			
24959-67-9	Bromide						
27154-33-2	Trichlorofluoroethane						
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)						
319-84-6	alpha-BHC						
319-85-7	beta-BHC	4.00E-01	µg/kg BW /d	[15]			
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)						

Table 7-3 Great Basin Pocket Mouse and Western Meadowlark Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Pocket Mouse	Units for Pocket Mouse Ingestion *TRV*	Reference	Ingestion *TRV* of the Meadowlark	Units for Meadowlark Ingestion *TRV*	Reference
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)						
3268-87-9	Octachlorodibenzo(p)dioxin						
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)						
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin						
3697-24-3	5-Methylchrysene						
378253-40-8	Barium-137m	1.00E-01	mg/kg BW /d	[14]	1.00E-01	mg/kg BW /d	[3]
378253-44-2	Cadmium-113m						
378782-82-2	Niobium-93m	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)						
39001-02-0	Octachlorodibenzofuran						
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo (p)dioxin						
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)						
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin						
4170-30-3	Crotonaldehyde (propylene aldehyde)	8.00E+01	µg/kg BW /d	[11]			
41851-50-7	Chlorocyclopentadiene						
460-19-5	Cyanogen (oxalonitrile)						
4786-20-3	2-Butenenitrile						
50-00-0	Formaldehyde	2.30E+03	µg/kg BW /d	[11]			
50-32-8	Benzo[a]pyrene	6.15E+02	µg/kg BW /d	[13]	1.00E+00	µg/kg BW /d	[1]
506-68-3	Cyanogen bromide (bromocyanide)	4.40E+03	µg/kg BW /d	[12]			
506-77-4	Cyanogen chloride	2.53E+03	µg/kg BW /d	[12]			
51-28-5	2,4-Dinitrophenol	2.00E+02	µg/kg BW /d	[12]			
51-79-6	Ethyl carbamate (urethane)	1.33E+01	mg/kg BW /d	[5]			
510-15-6	Chlorobenzilate						
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran				1.00E-03	µg/kg BW /d	[4]

Table 7-3 Great Basin Pocket Mouse and Western Meadowlark Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Pocket Mouse	Units for Pocket Mouse Ingestion *TRV*	Reference	Ingestion *TRV* of the Meadowlark	Units for Meadowlark Ingestion *TRV*	Reference
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)						
528-29-0	1,2-Dinitrobenzene (o-dinitrobenzene)						
53-70-3	Dibenz[a,h]anthracene	6.15E+02	µg/kg BW /d	[13]	3.90E-01	µg/kg BW /d	[1]
532-27-4	2-Chloroacetophenone						
534-52-1	4,6-Dinitro-o-cresol						
5385-75-1	Dibenzo[a,e]fluoranthene						
540-59-0	1,2-Dichloroethene (total)	4.52E+04	µg/kg BW /d	[15]			
540-73-8	1,2-Dimethylhydrazine						
540-84-1	2,2,4-Trimethylpentane						
541-73-1	1,3-Dichlorobenzene	6.00E-01	mg/kg BW /d	[6]			
542-75-6	1,3-Dichloropropene	2.50E+03	µg/kg BW /d	[12]			
542-88-1	bis(Chloromethyl)ether						
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran						
56-23-5	Carbon tetrachloride	7.10E+01	µg/kg BW /d	[12]			
56-49-5	3-Methylcholanthrene	1.71E+00	mg/kg BW /d	[10]			
56-55-3	Benzo[a]anthracene	6.15E+02	µg/kg BW /d	[13]	7.90E-01	µg/kg BW /d	[1]
57-12-5	Cyanide	2.40E+01	mg/kg BW /d	[11]	4.00E-02	mg/kg BW /d	[1]
57-24-9	Strychnine	2.50E+01	µg/kg BW /d	[12]			
57-74-9	Chlordane	4.58E+03	µg/kg BW /d	[15]	2.14E+03	µg/kg BW /d	[4]
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	1.60E-02	µg/kg BW /d	[15]			
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	1.60E-01	µg/kg BW /d	[15]			
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	1.60E-01	µg/kg BW /d	[15]			
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)						
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin						
58-89-9	gamma-BHC (Lindane)	8.00E+03	µg/kg BW /d	[15]	2.00E+03	µg/kg BW /d	[4]
58-90-2	2,3,4,6-Tetrachlorophenol	2.50E+03	µg/kg BW /d	[12]			
581-42-0	2,6-Dimethylnaphthalene						
584-84-9	2,4-Toluene diisocyanate						

Table 7-3 Great Basin Pocket Mouse and Western Meadowlark Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Pocket Mouse	Units for Pocket Mouse Ingestion *TRV*	Reference	Ingestion *TRV* of the Meadowlark	Units for Meadowlark Ingestion *TRV*	Reference
589-38-8	3-Hexanone						
59-50-7	4-Chloro-3-methylphenol						
59-89-2	N-Nitrosomorpholine						
591-50-4	Benzene, iodo-						
591-78-6	2-Hexanone						
593-60-2	Bromoethene (vinyl bromide)						
593-74-8	Dimethyl mercury						
60-11-7	Dimethyl aminoazobenzene						
60-29-7	Ethyl ether	5.00E+04	µg/kg BW /d	[12]			
60-35-5	Acetamide						
602-87-9	5-Nitroacenaphthene						
606-20-2	2,6-Dinitrotoluene	4.00E+01	µg/kg BW /d	[11]			
608-93-5	Pentachlorobenzene	7.25E+03	µg/kg BW /d	[11]			
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran						
61626-71-9	Dichloropentadiene						
62-50-0	Ethyl methanesulfonate	1.04E+01	mg/kg BW /d	[3]			
62-53-3	Aniline						
62-75-9	N-Nitroso-N,N-dimethylamine						
621-64-7	N-Nitroso-di-n-propylamine						
624-83-9	Methyl isocyanate						
628-73-9	Hexanenitrile						
630-08-0	Carbon monoxide						
630-20-6	1,1,1,2-Tetrachloroethane	8.93E+03	µg/kg BW /d	[12]			
64-18-6	Formic acid (methanoic acid)						
65-85-0	Benzoic acid	4.00E+03	µg/kg BW /d	[12]			
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)						
67-56-1	Methyl alcohol	5.00E+04	µg/kg BW /d	[12]			
67-63-0	2-Propyl alcohol						
67-64-1	2-Propanone (acetone)	1.00E+04	µg/kg BW /d	[11]	5.20E+04	µg/kg BW /d	[1]
67-66-3	Chloroform	6.00E+04	µg/kg BW /d	[11]			
67-72-1	Hexachloroethane	1.00E+02	µg/kg BW /d	[12]			

Table 7-3 Great Basin Pocket Mouse and Western Meadowlark Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Pocket Mouse	Units for Pocket Mouse Ingestion *TRV*	Reference	Ingestion *TRV* of the Meadowlark	Units for Meadowlark Ingestion *TRV*	Reference
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran						
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)						
70-30-4	Hexachlorophene	5.60E+03	µg/kg BW /d	[11]	5.75E+03	µg/kg BW /d	[1]
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)						
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran						
71-36-3	n-Butyl alcohol	1.25E+04	µg/kg BW /d	[12]			
71-43-2	Benzene	2.64E+04	µg/kg BW /d	[15]			
71-55-6	1,1,1-Trichloroethane	1.00E+06	µg/kg BW /d	[15]			
72-43-5	Methoxychlor	5.01E+03	µg/kg BW /d	[12]			
72-55-9	4,4-DDE	1.47E+02	µg/kg BW /d	[13]	2.27E+02	µg/kg BW /d	[2]
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran						
74-83-9	Bromomethane	1.40E+02	µg/kg BW /d	[12]			
74-87-3	Chloromethane						
74-88-4	Iodomethane						
74-95-3	Methylene bromide						
74-97-5	Bromochloromethane						
7429-90-5	Aluminum	1.93E+00	mg/kg BW /d	[11]	1.00E+02	mg/kg BW /d	[1]
7439-89-6	Iron						
7439-92-1	Lead	4.70E+00	mg/kg BW /d	[13]	1.63E+00	mg/kg BW /d	[2]
7439-93-2	Lithium	9.39E+00	mg/kg BW /d	[15]			
7439-95-4	Magnesium						
7439-96-5	Manganese	5.15E+01	mg/kg BW /d	[13]	1.79E+02	mg/kg BW /d	[2]
7439-97-6	Mercury						
7439-98-7	Molybdenum	2.58E-01	mg/kg BW /d	[15]	3.53E+00	mg/kg BW /d	[4]
7440-02-0	Nickel	1.70E+00	mg/kg BW /d	[13]	6.71E+00	mg/kg BW /d	[2]
7440-16-6	Rhodium						
7440-22-4	Silver	6.02E+00	mg/kg BW /d	[13]	2.02E+00	mg/kg BW /d	[2]
7440-23-5	Sodium						
7440-24-6	Strontium (total)	2.63E+02	mg/kg BW /d	[15]			
7440-25-7	Tantalum						

Table 7-3 Great Basin Pocket Mouse and Western Meadowlark Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Pocket Mouse	Units for Pocket Mouse Ingestion *TRV*	Reference	Ingestion *TRV* of the Meadowlark	Units for Meadowlark Ingestion *TRV*	Reference
7440-28-0	Thallium	1.31E-02	mg/kg BW /d	[11]	3.50E-01	mg/kg BW /d	[1]
7440-29-1	Thorium-232	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
7440-31-5	Tin						
7440-33-7	Tungsten						
7440-36-0	Antimony	5.90E-02	mg/kg BW /d	[13]			
7440-38-2	Arsenic	1.04E+00	mg/kg BW /d	[13]	2.24E+00	mg/kg BW /d	[2]
7440-39-3	Barium	5.18E+01	mg/kg BW /d	[13]	2.08E+01	mg/kg BW /d	[1]
7440-41-7	Beryllium	5.32E-01	mg/kg BW /d	[13]			
7440-43-9	Cadmium	7.70E-01	mg/kg BW /d	[13]	1.47E+00	mg/kg BW /d	[2]
7440-47-3	Chromium	2.40E+00	mg/kg BW /d	[13]	2.66E+00	mg/kg BW /d	[2]
7440-48-4	Cobalt	7.33E+00	mg/kg BW /d	[13]	7.61E+00	mg/kg BW /d	[2]
7440-50-8	Copper	5.60E+00	mg/kg BW /d	[13]	4.05E+00	mg/kg BW /d	[2]
7440-61-1	Uranium	3.07E+00	mg/kg BW /d	[15]	1.60E+01	mg/kg BW /d	[4]
7440-61-1R	Uranium-238	1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]
7440-62-2	Vanadium	4.16E+00	mg/kg BW /d	[13]	3.44E-01	mg/kg BW /d	[2]
7440-65-5	Yttrium						
7440-66-6	Zinc	7.54E+01	mg/kg BW /d	[13]	6.61E+01	mg/kg BW /d	[2]
7440-67-7	Zirconium	1.74E+00	mg/kg BW /d	[15]			
7446-09-5	Sulfur dioxide						
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)						
7487-94-7	Mercuric chloride ($HgCl_2$)	1.01E+00	mg/kg BW /d	[11]	3.25E+00	mg/kg BW /d	[1]
75-00-3	Chloroethane						
75-01-4	1-Chloroethene	1.70E+02	µg/kg BW /d	[11]			
75-02-5	Fluoroethene (vinyl fluoride)						
75-05-8	Acetonitrile						
75-07-0	Acetaldehyde						
75-09-2	Dichloromethane (methylene chloride)	6.16E+03	µg/kg BW /d	[12]			
75-15-0	Carbon disulfide	1.10E+04	µg/kg BW /d	[12]			
75-21-8	Ethylene oxide (Oxirane)						
75-25-2	Bromoform	1.79E+03	µg/kg BW /d	[12]			
75-27-4	Bromodichloromethane	1.79E+03	µg/kg BW /d	[12]			

Table 7-3 Great Basin Pocket Mouse and Western Meadowlark Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Pocket Mouse	Units for Pocket Mouse Ingestion *TRV*	Reference	Ingestion *TRV* of the Meadowlark	Units for Meadowlark Ingestion *TRV*	Reference
75-29-6	2-Chloropropane						
75-34-3	1,1-Dichloroethane						
75-35-4	1,1-Dichloroethene	3.00E+04	µg/kg BW /d	[15]			
75-44-5	Phosgene (hydrogen phosphide)						
75-45-6	Chlorodifluoromethane						
75-50-3	Trimethylamine						
75-69-4	Trichlorofluoromethane	3.49E+04	µg/kg BW /d	[12]			
75-71-8	Dichlorodifluoromethane	1.50E+04	µg/kg BW /d	[12]			
76-01-7	Pentachloroethane						
76-13-1	1,2,2-Trichlorotrifluoroethane						
76-44-8	Heptachlor	2.50E+00	µg/kg BW /d	[11]	6.50E+01	µg/kg BW /d	[1]
764-41-0	1,4-Dichloro-2-butene						
7647-01-0	Hydrogen chloride	1.44E+01	mg/kg BW /d	[12]			
765-34-4	Glycidylaldehyde	1.09E+02	µg/kg BW /d	[12]			
7664-39-3	Hydrogen fluoride	3.14E+01	mg/kg BW /d	[15]	7.80E+00	mg/kg BW /d	[4]
7664-41-7	Ammonia/Ammonium						
77-47-4	Hexachlorocyclopentadiene	3.80E+03	µg/kg BW /d	[11]			
77-78-1	Dimethyl sulfate						
7704-34-9	Total Sulfur (thermodynamically stable)						
7723-14-0	Phosphorus						
7782-41-4	Fluorine gas (F_2)						
7782-49-2	Selenium	1.43E-01	mg/kg BW /d	[13]	2.90E-01	mg/kg BW /d	[2]
7782-50-5	Chlorine	1.44E+01	mg/kg BW /d	[12]			
78-83-1	2-Methylpropyl alcohol	3.16E+04	µg/kg BW /d	[12]			
78-87-5	1,2-Dichloropropane	1.73E-01	mg/kg BW /d	[2]			
78-93-3	2-Butanone	1.77E+06	µg/kg BW /d	[12]			
79-00-5	1,1,2-Trichloroethane						
79-01-6	1,1,2-Trichloroethylene	7.00E+02	µg/kg BW /d	[12]			
79-10-7	2-Propenoic acid	5.30E+03	µg/kg BW /d	[12]			
79-34-5	1,1,2,2-Tetrachloroethane						
79-46-9	2-Nitropropane						

Table 7-3 Great Basin Pocket Mouse and Western Meadowlark Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Pocket Mouse	Units for Pocket Mouse Ingestion *TRV*	Reference	Ingestion *TRV* of the Meadowlark	Units for Meadowlark Ingestion *TRV*	Reference
80-62-6	Methyl methacrylate	1.36E+05	µg/kg BW /d	[12]			
82-68-8	Pentachloronitrobenzene (PCNB)	4.58E+05	µg/kg BW /d	[11]	6.88E+04	µg/kg BW /d	[1]
822-06-0	Hexamethylene-1,5-diisocyanate						
823-40-5	Toluene-2,6-diamine						
83-32-9	Acenaphthene	6.56E+04	µg/kg BW /d	[13]			
832-69-9	1-Methylphenanthrene						
84-66-2	Diethyl phthalate	4.58E+06	µg/kg BW /d	[15]			
84-74-2	Di-n-butylphthalate	5.50E+05	µg/kg BW /d	[15]	1.11E+02	µg/kg BW /d	[4]
85-01-8	Phenanthrene	6.56E+04	µg/kg BW /d	[13]			
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	1.56E+05	µg/kg BW /d	[12]			
85-68-7	Butylbenzylphthalate						
86-73-7	Fluorene	1.25E+04	µg/kg BW /d	[12]			
87-61-6	1,2,3-Trichlorobenzene						
87-68-3	Hexachlorobutadiene	2.00E+02	µg/kg BW /d	[11]	3.19E+03	µg/kg BW /d	[1]
87-86-5	Pentachlorophenol	8.42E+03	µg/kg BW /d	[13]	6.73E+03	µg/kg BW /d	[2]
88-06-2	2,4,6-Trichlorophenol						
88-74-4	o-Nitroaniline (2-nitroaniline)						
88-75-5	2-Nitrophenol						
90-04-0	o-Anisidine						
90-12-0	1-Methylnaphthalene						
91-20-3	Naphthalene	6.56E+04	µg/kg BW /d	[13]			
91-22-5	Quinoline						
91-57-6	2-Methylnaphthalene						
91-58-7	2-Chloronaphthalene	2.50E+05	µg/kg BW /d	[12]			
91-94-1	3,3'-Dichlorobenzidine						
92-52-4	1,1`-Biphenyl	5.00E+04	µg/kg BW /d	[12]			
924-16-3	N-Nitroso-di-n-Buetylamine						
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)						
94-75-7	2,4-D						
95-48-7	o-Cresol	5.00E+03	µg/kg BW /d	[12]			

Table 7-3 Great Basin Pocket Mouse and Western Meadowlark Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Pocket Mouse	Units for Pocket Mouse Ingestion *TRV*	Reference	Ingestion *TRV* of the Meadowlark	Units for Meadowlark Ingestion *TRV*	Reference
95-49-8	o-Chlorotoluene	2.00E+04	µg/kg BW /d	[12]			
95-50-1	1,2-Dichlorobenzene	8.57E+04	µg/kg BW /d	[12]			
95-53-4	o-Toluidine						
95-57-8	2-Chlorophenol						
95-63-6	1,2,4-Trimethyl benzene						
95-94-3	1,2,4,5-Tetrachlorobenzene	3.40E+01	µg/kg BW /d	[12]			
95-95-4	2,4,5-Trichlorophenol	1.00E+04	µg/kg BW /d	[12]			
96-12-8	1,2-Dibromo-3-chloropropane						
96-18-4	1,2,3-Trichloropropane	5.71E+02	µg/kg BW /d	[12]			
96-45-7	Ethylene thiourea	2.50E+01	µg/kg BW /d	[12]			
97-63-2	Ethyl methacrylate						
98-01-1	Furfural	7.90E+01	µg/kg BW /d	[12]			
98-06-6	tert-Butyl benzene						
98-07-7	Benzotrichloride						
98-82-8	Cumene	1.10E+05	µg/kg BW /d	[12]			
98-83-9	Methyl styrene (mixed isomers)						
98-86-2	Acetophenone	4.23E+04	µg/kg BW /d	[12]			
98-95-3	Nitrobenzene	4.60E+01	µg/kg BW /d	[12]			
99-35-4	1,3,5-Trinitrobenzene	2.68E+03	µg/kg BW /d	[12]			
99-65-0	1,3-Dinitrobenzene	1.05E+03	µg/kg BW /d	[11]	4.22E-01	µg/kg BW /d	[1]
99-87-6	p-Cymene						
All radionuclides combined [rad/day]		1.00E-01	rad/d	[14]	1.00E-01	rad/d	[3]

Reference	Reference (source) for Ingestion Toxicity Reference Values of the Great Basin Pocket Mouse
[1]	1984. Gray,L.E.,Jr., and R.J. Kavlock. "An Extended Evaluation of an In Vivo Teratology Screen Utilizing Postnatal Growth and Viability in the Mouse", Teratog. Carcinog. Mutagen.4:403-426 (House Mouse NOEL, ECOTOX Ref. #65506, accessed February 2013).
[2]	1986. National Toxicology Program (NTP). "Toxicology and Carcinogenesis Studies of 1,2-Dichloropropane (Propylene Dichloride) (Cas No. 78-87-5) in F344/N Rats and B6C3F1 Mice (Gavage Studies)", NTP Tech.Rep.Ser.No.263, No.86-2519:182 p. (House Mouse NOEL, ECOTOX Ref. #93608, accessed February 2013).
[3]	1988. Hemavathy,K.C., and N.B. Krishnamurthy. "Cytogenetic Effects of Cuman L, a Dithiocarbamate Fungicide", Mutat. Res.208(1): 57-60 (House Mouse NOEL, ECOTOX Ref. #98592, accessed February 2013).

Reference	Reference (source) for Ingestion Toxicity Reference Values of the Great Basin Pocket Mouse
[4]	1991. Szymanska,J.A., E.A. Swietlicka, and J.K. Piotrowski. "Protective Effect of Zinc in the Hepatotoxicity of Bromobenzene and Acetaminophen", Toxicology66(1): 81-91 (House Mouse NOEL, ECOTOX Ref. #85557, accessed February 2013).
[5]	1994. Taubeneck,M.W., G.P. Daston, J.M. Rogers, and C.L. Keen. "Altered Maternal Zinc Metabolism Following Exposure to Diverse Developmental Toxicants", Reprod. Toxicol.8(1): 25-40 (Norway Rat NOEL, ECOTOX Ref. #78721, accessed February 2013).
[6]	1996. Umemura,T., M. Saito, A. Takagi, and Y. Kurokawa. "Isomer-Specific Acute Toxicity and Cell Proliferation in Livers of B6C3F1 Mice Exposed to Dichlorobenzene", Toxicol. Appl. Pharmacol.137(2): 268-274 (House Mouse NOEL, ECOTOX Ref. #85933, accessed February 2013).
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[8]	2000. EPA/OTS. "Dominant Assays in Mice with Ortho- and Para-Cresol and Single Acute Exposure Dose Selection Studies on Ortho- and Para-Cresol (Final Reports) W-Attachment & Cover Letter 070689", EPA/OTS; Doc #40-8960307:165 p. (House Mouse NOEL, ECOTOX Ref. #117102, accessed February 2013).
[9]	2008. Auerbach,S.S., J. Mahler, G.S. Travlos, and R.D. Irwin. "A Comparative 90-Day Toxicity Study of Allyl Acetate, Allyl Alcohol and Acrolein", Toxicology253(1-3): 79-88 (Norway Rat NOEL, ECOTOX Ref. #115934, accessed February 2013).
[10]	2008. Takeuchi,S., M. Iida, H. Yabushita, T. Matsuda, and H. Kojima. "In Vitro Screening for Aryl Hydrocarbon Receptor Agonistic Activity in 200 Pesticides Using a Highly Sensitive Reporter Cell Line, DR-EcoScreen Cells, and In Vivo Mouse Liver Cytochrome P450-1A Induction by Propanil, Diu", Chemosphere74(1): 155-165 (House Mouse LOEL, ECOTOX Ref. #116103, accessed February 2013).
[11]	EPA. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Peer Review Draft*, EPA 530-D-99-001. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC, USA. (http://www.epa.gov/epaoswer/hazwaste/combust/ecorisk.htm)
[12]	EPA. 2004. *Integrated Risk Information System (IRIS)*. US Environmental Protection Agency, Office of Research and Development, National Center for Environmental Assessment, Washington, DC (http://www.epa.gov/iris/). Accessed 2004.
[13]	EPA. 2005. *Guidance for Developing Ecological Soil Screening Levels*, OSWER Directive 9285.7-55, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC. (Vole/Shrew used as surrogate).
[14]	IAEA. 1992. "Effects of Ionizing Radiation on Plants and Animals at Levels Implied by Current Radiation Protection Standards," IAEA Technical Report Series 332, International Commission on Radiological Protection, Vienna, Austria.
[15]	Sample BE, Opresko DM, and Suter II GW. 1996. *Toxicological Benchmarks for Wildlife: 1996 Revision*, ES/ER/TM-86/R3, Lockheed Martin Energy Systems, Inc., Oak Ridge National Laboratory, Oak Ridge, TN

Reference	Reference (source) for Ingestion Toxicity Reference Values of the Western Meadowlark
[1]	EPA. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Peer Review Draft*, EPA 530-D-99-001. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC, USA. (http://www.epa.gov/epaoswer/hazwaste/combust/ecorisk.htm)

Reference	Reference (source) for Ingestion Toxicity Reference Values of the Western Meadowlark
[2]	EPA. 2005. Guidance *for Developing Ecological Soil Screening Levels*, OSWER Directive 9285.7-55, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC. (Dove/woodcock used as surrogate).
[3]	IAEA. 1992. "Effects of Ionizing Radiation on Plants and Animals at Levels Implied by Current Radiation Protection Standards," IAEA Technical Report Series 332, International Commission on Radiological Protection, Vienna, Austria.
[4]	Sample BE, Opresko DM, and Suter II GW. 1996. *Toxicological Benchmarks for Wildlife: 1996 Revision*, ES/ER/TM-86/R3, Lockheed Martin Energy Systems, Inc., Oak Ridge National Laboratory, Oak Ridge, TN

Table 7-4 provides ingestion TRVs for the coyote, red-tailed hawk, and the burrowing owl. Note that units vary, with units of mass of contaminant per body weight (BW) of the receptor, per day for chemical consistuents, and units of rad per day for radioisotopes. Blank entries in the table indicate where data are not available.

Table 7-4 Coyote, Red-Tailed Hawk, and Burrowing Owl Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Coyote	Units for Coyote Ingestion *TRV*	Reference	Ingestion *TRV* of Red-the Tailed Hawk	Units for Red-Tailed Hawk Ingestion *TRV*	Reference	Ingestion *TRV* of the Burrowing Owl	Units for Burrowing Owl Ingestion *TRV*	Reference
100-02-7	p-Nitrophenol									
100-21-0	Phthalic acid									
100-25-4	1,4-Dinitrobenzene									
100-40-3	4-Ethenylcyclohexene									
100-41-4	Ethyl benzene	9.71E+03	µg/kg BW /d	[2]						
100-42-5	Styrene	2.00E+04	µg/kg BW /d	[2]						
100-44-7	Benzyl chloride									
100-47-0	Benzonitrile									
100-51-6	Benzyl alcohol									
100-52-7	Benzaldehyde	1.43E+04	µg/kg BW /d	[2]						
10028-15-6	Ozone									
10028-17-8	Tritium	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
10045-97-3	Cesium-137	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
10061-01-5	cis-1,3-Dichloropropene									
10061-02-6	trans-1,3-Dichloropropene									
10098-91-6	Yttrium-90	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
10098-97-2	Strontium-90	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
101-55-3	4-Bromophenylphenyl ether									
101-77-9	4,4-Methylenedianiline									
10102-44-0	Nitrogen dioxide									
10198-40-0	Cobalt-60	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
103-33-3	Azobenzene									
103-65-1	n-Propyl benzene (isocumene)									
104-51-8	n-Butylbenzene									
104-76-7	2-Ethyl-1-hexanol									

Table 7-4 Coyote, Red-Tailed Hawk, and Burrowing Owl Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Coyote	Units for Coyote Ingestion *TRV*	Reference	Ingestion *TRV* of Red-the Tailed Hawk	Units for Red-Tailed Hawk Ingestion *TRV*	Reference	Ingestion *TRV* of the Burrowing Owl	Units for Burrowing Owl Ingestion *TRV*	Reference
105-67-9	2,4-Dimethylphenol	5.00E+03	µg/kg BW /d	[2]						
10595-95-6	n-Nitrosomethylethylamine									
106-43-4	4-Chlorotoluene (p-tolyl chloride)									
106-44-5	p-Cresol (4-methyl phenol)									
106-46-7	1,4-Dichlorobenzene									
106-47-8	p-Chloroaniline	1.25E+03	µg/kg BW /d	[2]						
106-49-0	p-Toluidine									
106-51-4	Quinone									
106-88-7	1,2-Epoxybutane									
106-89-8	Epichlorohydrin (1-chloro-2,3-epoxypropane)									
106-93-4	Ethylene dibromide									
106-99-0	1,3-Butadiene									
107-02-8	Acrolein									
107-05-1	3-Chloropropene									
107-06-2	1,2-Dichloroethane	5.00E+04	µg/kg BW /d	[5]	1.72E+04	µg/kg BW /d	[4]	1.72E+04	µg/kg BW /d	[3]
107-12-0	Propionitrile									
107-13-1	Acrylonitrile	4.60E+02	µg/kg BW /d	[1]						
107-19-7	Propargyl alcohol	5.00E+02	µg/kg BW /d	[2]						
107-21-1	Ethylene glycol (1,2-ethanediol)	2.00E+04	µg/kg BW /d	[2]						
107-98-2	Propylene glycol monomethyl ether									
108-05-4	Acetic acid vinyl ester									
108-10-1	4-Methyl-2-pentanone	2.50E+04	µg/kg BW /d	[5]						
108-39-4	m-Cresol	5.00E+03	µg/kg BW /d	[2]						
108-60-1	bis(2-Chloroisopropyl) ether									

Table 7-4 Coyote, Red-Tailed Hawk, and Burrowing Owl Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Coyote	Units for Coyote Ingestion *TRV*	Reference	Ingestion *TRV* of Red-the Tailed Hawk	Units for Red-Tailed Hawk Ingestion *TRV*	Reference	Ingestion *TRV* of the Burrowing Owl	Units for Burrowing Owl Ingestion *TRV*	Reference
108-67-8	1,3,5-Trimethylbenzene									
108-86-1	Bromobenzene (phenyl bromide)									
108-87-2	Methylcyclohexane									
108-88-3	Toluene	2.60E+04	µg/kg BW /d	[5]						
108-90-7	Chlorobenzene	1.90E+04	µg/kg BW /d	[2]						
108-94-1	Cyclohexanone									
108-95-2	Phenol	6.00E+04	µg/kg BW /d	[2]						
109-74-0	n-Butanenitrile									
109-75-1	3-Butenenitrile									
109-77-3	Malononitrile									
109-86-4	2-Methoxyethanol									
109-99-9	Tetrahydrofuran									
110-00-9	Furan									
110-54-3	n-Hexane									
110-59-8	Pentanenitrile									
110-80-5	2-Ethoxyethanol									
110-82-7	Cyclohexane									
110-83-8	Cyclohexene									
110-86-1	Pyridine	1.00E+02	µg/kg BW /d	[2]						
111-15-9	Ethylene glycol monoethyl ether acetate									
111-44-4	bis(2-Chloroethyl)ether									
111-65-9	n-Octane									
111-76-2	2-Butoxyethanol	5.10E+02	µg/kg BW /d	[2]						
111-84-2	n-Nonane									
111-91-1	bis(2-Chloroethoxy)methane									
112-30-1	1-Decanol									
112-31-2	Decanal									
112-40-3	Dodecane									

Table 7-4 Coyote, Red-Tailed Hawk, and Burrowing Owl Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Coyote	Units for Coyote Ingestion *TRV*	Reference	Ingestion *TRV* of Red-the Tailed Hawk	Units for Red-Tailed Hawk Ingestion *TRV*	Reference	Ingestion *TRV* of the Burrowing Owl	Units for Burrowing Owl Ingestion *TRV*	Reference
1120-21-4	Undecane									
1120-71-4	1,3-Propane sultone									
117-81-7	bis(2-Ethylhexyl)phthalate	6.00E+04	µg/kg BW /d	[1]	1.11E+02	µg/kg BW /d	[1]	1.11E+02	µg/kg BW /d	[1]
117-84-0	Di-n-octylphthalate	7.50E+06	µg/kg BW /d	[1]						
118-74-1	Hexachlorobenzene	1.60E+03	µg/kg BW /d	[1]	2.25E+02	µg/kg BW /d	[1]	2.25E+02	µg/kg BW /d	[1]
119-90-4	3,3'-Dimethoxybenzidine									
120-12-7	Anthracene	6.56E+04	µg/kg BW /d	[3]						
120-82-1	1,2,4-Trichlorobenzene									
120-83-2	2,4-Dichlorophenol	3.00E+01	µg/kg BW /d	[2]						
121-14-2	2,4-Dinitrotoluene	3.50E+04	µg/kg BW /d	[1]						
122-39-4	N,N-Diphenylamine	2.50E+02	µg/kg BW /d	[2]						
122-66-7	1,2-Diphenylhydrazine									
123-33-1	Maleic hydrazide	5.00E+04	µg/kg BW /d	[2]						
123-38-6	Propionaldehyde									
123-72-8	Butanal									
123-91-1	1,4-Dioxan	1.06E+05	µg/kg BW /d	[1]						
124-18-5	Decane									
124-38-9	Carbon dioxide									
124-48-1	Chlorodibromomethane	2.14E+03	µg/kg BW /d	[2]						
126-73-8	Tributyl phosphate									
126-98-7	2-Methyl-2-propenenitrile	3.40E+01	µg/kg BW /d	[2]						
127-18-4	1,1,2,2-Tetrachloroethene	1.40E+03	µg/kg BW /d	[2]						
128-37-0	2,6-bis(tert-butyl)-4-Methylphenol									
129-00-0	Pyrene	7.50E+03	µg/kg BW /d	[2]						
131-11-3	Dimethyl Phthalate									
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	2.00E+01	µg/kg BW /d	[2]						
132-64-9	Dibenzofuran									
133-06-2	Captan									

Table 7-4 Coyote, Red-Tailed Hawk, and Burrowing Owl Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Coyote	Units for Coyote Ingestion *TRV*	Reference	Ingestion *TRV* of Red-the Tailed Hawk	Units for Red-Tailed Hawk Ingestion *TRV*	Reference	Ingestion *TRV* of the Burrowing Owl	Units for Burrowing Owl Ingestion *TRV*	Reference
1330-20-7	Xylenes (mixed isomers)									
1336-36-3	Polychlorinated biphenyls	2.06E-01	µg/kg BW /d	[1]	7.20E+01	µg/kg BW /d	[1]	7.20E+01	µg/kg BW /d	[1]
134-32-7	alpha-Naphthylamine									
135-98-8	sec-Butylbenzene									
13966-29-5	Uranium-234	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
13967-48-1	Ruthenium-106	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
13967-70-9	Cesium-134	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
13968-55-3	Uranium-233	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
13981-15-2	Curium-244	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
13981-16-3	Plutonium-238	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
13981-37-8	Nickel-63	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
13982-10-0	Plutonium-242	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
13982-63-3	Radium-226	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
13982-70-2	Uranium-236	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
13994-20-2	Neptunium-237	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
141-78-6	Acetic acid ethyl ester	9.00E+04	µg/kg BW /d	[2]						
14119-32-5	Plutonium-241	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
14119-33-6	Plutonium-240	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
14133-76-7	Technetium-99	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
14158-29-3	Uranium-232	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
14234-35-6	Antimony-125	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
14265-44-2	Phosphate									
14331-85-2	Protactinium-231	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
14336-70-0	Nickel-59	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
14391-16-3	Europium-155	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
145-73-3	Endothall	2.00E+03	µg/kg BW /d	[2]						
14596-10-2	Americium-241	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
14683-23-9	Europium-152	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
14762-75-5	Carbon-14	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
14797-55-8	Nitrate									

Table 7-4 Coyote, Red-Tailed Hawk, and Burrowing Owl Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Coyote	Units for Coyote Ingestion *TRV*	Reference	Ingestion *TRV* of Red-the Tailed Hawk	Units for Red-Tailed Hawk Ingestion *TRV*	Reference	Ingestion *TRV* of the Burrowing Owl	Units for Burrowing Owl Ingestion *TRV*	Reference
14797-65-0	Nitrite									
14808-79-8	Sulfate									
14952-40-0	Actinium-227	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
14993-75-0	Americium-243	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
15046-84-1	Iodine-129	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
15117-48-3	Plutonium-239	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
15117-96-1	Uranium-235	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
15262-20-1	Radium-228	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
15510-73-3	Curium-242	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
15585-10-1	Europium-154	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
15594-54-4	Thorium-229	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
156-59-2	cis-1,2-Dichloroethene									
156-60-5	1,2-trans-Dichloroethene	1.70E+03	µg/kg BW /d	[2]						
15715-94-3	Samarium-151	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
15751-77-6	Zirconium-93	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
15757-87-6	Curium-243	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
15758-45-9	Selenium-79	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
15832-50-5	Tin-126	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
1634-04-4	Methyl tert-butyl ether									
16887-00-6	Chloride									
16984-48-8	Fluoride	3.14E+01	mg/kg BW /d	[5]	7.80E+00	mg/kg BW /d	[4]	7.80E+00	mg/kg BW /d	[3]
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p) dioxin (TCDD)	1.00E-03	µg/kg BW /d	[5]	1.00E-02	µg/kg BW /d	[1]	1.00E-02	µg/kg BW /d	[1]
18540-29-9	Chromium(VI)	3.50E+00	mg/kg BW /d	[1]	1.00E+00	mg/kg BW /d	[1]	1.00E+00	mg/kg BW /d	[1]
189-55-9	Dibenzo[a,i]pyrene									
189-64-0	Dibenzo[a,h]pyrene									
191-24-2	Benzo[g,h,i]perylene	6.15E+02	µg/kg BW /d	[3]						
191-30-0	Dibenzo[a,l]pyrene									

Table 7-4 Coyote, Red-Tailed Hawk, and Burrowing Owl Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Coyote	Units for Coyote Ingestion *TRV*	Reference	Ingestion *TRV* of Red-the Tailed Hawk	Units for Red-Tailed Hawk Ingestion *TRV*	Reference	Ingestion *TRV* of the Burrowing Owl	Units for Burrowing Owl Ingestion *TRV*	Reference
192-65-4	Dibenzo[a,e]pyrene									
192-97-2	Benzo[e]pyrene									
193-39-5	Indeno[1,2,3-cd]pyrene				1.00E+00	µg/kg BW /d	[1]	1.00E+00	µg/kg BW /d	[1]
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p) dioxin									
205-82-3	Benzo[j]fluoranthene									
205-99-2	Benzo[b]fluoranthene				1.40E-01	µg/kg BW /d	[1]	1.40E-01	µg/kg BW /d	[1]
206-44-0	Fluoranthene	1.25E+04	µg/kg BW /d	[2]						
207-08-9	Benzo[k]fluoranthene	6.15E+02	µg/kg BW /d	[3]	1.40E-01	µg/kg BW /d	[1]	1.40E-01	µg/kg BW /d	[1]
208-96-8	Acenaphthylene									
218-01-9	Chrysene	6.15E+02	µg/kg BW /d	[3]	1.00E+00	µg/kg BW /d	[1]	1.00E+00	µg/kg BW /d	[1]
224-42-0	Dibenz[a,j]acridine									
2245-38-7	2,3,5-Trimethylnaphthalene									
226-36-8	Dibenz[a,h]acridine									
22967-92-6	Methyl mercury	3.20E-02	mg/kg BW /d	[1]	6.40E-03	mg/kg BW /d	[1]	6.40E-03	mg/kg BW /d	[1]
23950-58-5	Pronamide	7.50E+02	µg/kg BW /d	[2]						
24959-67-9	Bromide									
27154-33-2	Trichlorofluoroethane									
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)									
319-84-6	alpha-BHC									
319-85-7	beta-BHC	4.00E-01	µg/kg BW /d	[5]						
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)									
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)									

Table 7-4 Coyote, Red-Tailed Hawk, and Burrowing Owl Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Coyote	Units for Coyote Ingestion *TRV*	Reference	Ingestion *TRV* of Red-the Tailed Hawk	Units for Red-Tailed Hawk Ingestion *TRV*	Reference	Ingestion *TRV* of the Burrowing Owl	Units for Burrowing Owl Ingestion *TRV*	Reference
3268-87-9	Octachlorodibenzo(p) dioxin									
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)									
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p) dioxin									
3697-24-3	5-Methylchrysene									
378253-40-8	Barium-137m	1.00E-01	mg/kg BW /d	[4]	1.00E-01	mg/kg BW /d	[3]	1.00E-01	mg/kg BW /d	[2]
378253-44-2	Cadmium-113m									
378782-82-2	Niobium-93m	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)									
39001-02-0	Octachlorodibenzofuran									
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo (p)dioxin									
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)									
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p) dioxin									
4170-30-3	Crotonaldehyde (propylene aldehyde)	8.00E+01	µg/kg BW /d	[1]						
41851-50-7	Chlorocyclopentadiene									
460-19-5	Cyanogen (oxalonitrile)									
4786-20-3	2-Butenenitrile									
50-00-0	Formaldehyde	2.30E+03	µg/kg BW /d	[1]						
50-32-8	Benzo[a]pyrene	6.15E+02	µg/kg BW /d	[3]	1.00E+00	µg/kg BW /d	[1]	1.00E+00	µg/kg BW /d	[1]

Table 7-4 Coyote, Red-Tailed Hawk, and Burrowing Owl Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Coyote	Units for Coyote Ingestion *TRV*	Reference	Ingestion *TRV* of Red-the Tailed Hawk	Units for Red-Tailed Hawk Ingestion *TRV*	Reference	Ingestion *TRV* of the Burrowing Owl	Units for Burrowing Owl Ingestion *TRV*	Reference
506-68-3	Cyanogen bromide (bromocyanide)	4.40E+03	µg/kg BW /d	[2]						
506-77-4	Cyanogen chloride	2.53E+03	µg/kg BW /d	[2]						
51-28-5	2,4-Dinitrophenol	2.00E+02	µg/kg BW /d	[2]						
51-79-6	Ethyl carbamate (urethane)									
510-15-6	Chlorobenzilate									
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran				1.00E-03	µg/kg BW /d	[4]	1.00E-03	µg/kg BW /d	[3]
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)									
528-29-0	1,2-Dinitrobenzene (o-dinitrobenzene)									
53-70-3	Dibenz[a,h]anthracene	6.15E+02	µg/kg BW /d	[3]	3.90E-01	µg/kg BW /d	[1]	3.90E-01	µg/kg BW /d	[1]
532-27-4	2-Chloroacetophenone									
534-52-1	4,6-Dinitro-o-cresol									
5385-75-1	Dibenzo[a,e]fluoranthene									
540-59-0	1,2-Dichloroethene (total)	4.52E+04	µg/kg BW /d	[5]						
540-73-8	1,2-Dimethylhydrazine									
540-84-1	2,2,4-Trimethylpentane									
541-73-1	1,3-Dichlorobenzene									
542-75-6	1,3-Dichloropropene	2.50E+03	µg/kg BW /d	[2]						
542-88-1	bis(Chloromethyl)ether									
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran									
56-23-5	Carbon tetrachloride	7.10E+01	µg/kg BW /d	[2]						
56-49-5	3-Methylcholanthrene									
56-55-3	Benzo[a]anthracene	6.15E+02	µg/kg BW /d	[3]	7.90E-01	µg/kg BW /d	[1]	7.90E-01	µg/kg BW /d	[1]
57-12-5	Cyanide	2.40E+01	mg/kg BW /d	[1]	4.00E-02	mg/kg BW /d	[1]	4.00E-02	mg/kg BW /d	[1]
57-24-9	Strychnine	2.50E+01	µg/kg BW /d	[2]						

Table 7-4 Coyote, Red-Tailed Hawk, and Burrowing Owl Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Coyote	Units for Coyote Ingestion *TRV*	Reference	Ingestion *TRV* of Red-the Tailed Hawk	Units for Red-Tailed Hawk Ingestion *TRV*	Reference	Ingestion *TRV* of the Burrowing Owl	Units for Burrowing Owl Ingestion *TRV*	Reference
57-74-9	Chlordane	4.58E+03	µg/kg BW /d	[5]	2.14E+03	µg/kg BW /d	[4]	2.14E+03	µg/kg BW /d	[3]
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	1.60E-02	µg/kg BW /d	[5]						
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	1.60E-01	µg/kg BW /d	[5]						
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	1.60E-01	µg/kg BW /d	[5]						
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)									
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p) dioxin									
58-89-9	gamma-BHC (Lindane)	8.00E+03	µg/kg BW /d	[5]	2.00E+03	µg/kg BW /d	[4]	2.00E+03	µg/kg BW /d	[3]
58-90-2	2,3,4,6-Tetrachlorophenol	2.50E+03	µg/kg BW /d	[2]						
581-42-0	2,6-Dimethylnaphthalene									
584-84-9	2,4-Toluene diisocyanate									
589-38-8	3-Hexanone									
59-50-7	4-Chloro-3-methylphenol									
59-89-2	N-Nitrosomorpholine									
591-50-4	Benzene, iodo-									
591-78-6	2-Hexanone									
593-60-2	Bromoethene (vinyl bromide)									
593-74-8	Dimethyl mercury									
60-11-7	Dimethyl aminoazobenzene									
60-29-7	Ethyl ether	5.00E+04	µg/kg BW /d	[2]						
60-35-5	Acetamide									
602-87-9	5-Nitroacenaphthene									
606-20-2	2,6-Dinitrotoluene	4.00E+01	µg/kg BW /d	[1]						
608-93-5	Pentachlorobenzene	7.25E+03	µg/kg BW /d	[1]						

Table 7-4 Coyote, Red-Tailed Hawk, and Burrowing Owl Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Coyote	Units for Coyote Ingestion *TRV*	Reference	Ingestion *TRV* of Red-the Tailed Hawk	Units for Red-Tailed Hawk Ingestion *TRV*	Reference	Ingestion *TRV* of the Burrowing Owl	Units for Burrowing Owl Ingestion *TRV*	Reference
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran									
61626-71-9	Dichloropentadiene									
62-50-0	Ethyl methanesulfonate									
62-53-3	Aniline									
62-75-9	N-Nitroso-N,N-dimethylamine									
621-64-7	N-Nitroso-di-n-propylamine									
624-83-9	Methyl isocyanate									
628-73-9	Hexanenitrile									
630-08-0	Carbon monoxide									
630-20-6	1,1,1,2-Tetrachloroethane	8.93E+03	µg/kg BW /d	[2]						
64-18-6	Formic acid (methanoic acid)									
65-85-0	Benzoic acid	4.00E+03	µg/kg BW /d	[2]						
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)									
67-56-1	Methyl alcohol	5.00E+04	µg/kg BW /d	[2]						
67-63-0	2-Propyl alcohol									
67-64-1	2-Propanone (acetone)	1.00E+04	µg/kg BW /d	[1]	5.20E+04	µg/kg BW /d	[1]	5.20E+04	µg/kg BW /d	[1]
67-66-3	Chloroform	6.00E+04	µg/kg BW /d	[1]						
67-72-1	Hexachloroethane	1.00E+02	µg/kg BW /d	[2]						
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran									
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)									
70-30-4	Hexachlorophene	5.60E+03	µg/kg BW /d	[1]	5.75E+03	µg/kg BW /d	[1]	5.75E+03	µg/kg BW /d	[1]
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)									

Table 7-4 Coyote, Red-Tailed Hawk, and Burrowing Owl Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Coyote	Units for Coyote Ingestion *TRV*	Reference	Ingestion *TRV* of Red-the Tailed Hawk	Units for Red-Tailed Hawk Ingestion *TRV*	Reference	Ingestion *TRV* of the Burrowing Owl	Units for Burrowing Owl Ingestion *TRV*	Reference
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran									
71-36-3	n-Butyl alcohol	1.25E+04	µg/kg BW /d	[2]						
71-43-2	Benzene	2.64E+04	µg/kg BW /d	[5]						
71-55-6	1,1,1-Trichloroethane	1.00E+06	µg/kg BW /d	[5]						
72-43-5	Methoxychlor	5.01E+03	µg/kg BW /d	[2]						
72-55-9	4,4-DDE	1.47E+02	µg/kg BW /d	[3]	2.27E+02	µg/kg BW /d	[2]	8.45E+02	µg/kg BW /d	[1]
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran									
74-83-9	Bromomethane	1.40E+02	µg/kg BW /d	[2]						
74-87-3	Chloromethane									
74-88-4	Iodomethane									
74-95-3	Methylene bromide									
74-97-5	Bromochloromethane									
7429-90-5	Aluminum	1.93E+00	mg/kg BW /d	[1]	1.00E+02	mg/kg BW /d	[1]	1.00E+02	mg/kg BW /d	[1]
7439-89-6	Iron									
7439-92-1	Lead	4.70E+00	mg/kg BW /d	[3]	1.63E+00	mg/kg BW /d	[2]	2.50E-02	mg/kg BW /d	[1]
7439-93-2	Lithium	9.39E+00	mg/kg BW /d	[5]						
7439-95-4	Magnesium									
7439-96-5	Manganese	5.15E+01	mg/kg BW /d	[3]	1.79E+02	mg/kg BW /d	[2]	9.77E+02	mg/kg BW /d	[3]
7439-97-6	Mercury									
7439-98-7	Molybdenum	2.58E-01	mg/kg BW /d	[5]	3.53E+00	mg/kg BW /d	[4]	3.53E+00	mg/kg BW /d	[3]
7440-02-0	Nickel	1.70E+00	mg/kg BW /d	[3]	6.71E+00	mg/kg BW /d	[2]	6.50E+01	mg/kg BW /d	[1]
7440-16-6	Rhodium									
7440-22-4	Silver	6.02E+00	mg/kg BW /d	[3]	2.02E+00	mg/kg BW /d	[2]	1.78E+02	mg/kg BW /d	[1]
7440-23-5	Sodium									

Table 7-4 Coyote, Red-Tailed Hawk, and Burrowing Owl Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Coyote	Units for Coyote Ingestion *TRV*	Reference	Ingestion *TRV* of Red-the Tailed Hawk	Units for Red-Tailed Hawk Ingestion *TRV*	Reference	Ingestion *TRV* of the Burrowing Owl	Units for Burrowing Owl Ingestion *TRV*	Reference
7440-24-6	Strontium (total)	2.63E+02	mg/kg BW /d	[5]						
7440-25-7	Tantalum									
7440-28-0	Thallium	1.31E-02	mg/kg BW /d	[1]	3.50E-01	mg/kg BW /d	[1]	3.50E-01	mg/kg BW /d	[1]
7440-29-1	Thorium-232	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
7440-31-5	Tin									
7440-33-7	Tungsten									
7440-36-0	Antimony	5.90E-02	mg/kg BW /d	[3]						
7440-38-2	Arsenic	1.04E+00	mg/kg BW /d	[3]	2.24E+00	mg/kg BW /d	[2]	2.46E+00	mg/kg BW /d	[1]
7440-39-3	Barium	5.18E+01	mg/kg BW /d	[3]	2.08E+01	mg/kg BW /d	[1]	2.08E+01	mg/kg BW /d	[1]
7440-41-7	Beryllium	5.32E-01	mg/kg BW /d	[3]						
7440-43-9	Cadmium	7.70E-01	mg/kg BW /d	[3]	1.47E+00	mg/kg BW /d	[2]	1.45E+00	mg/kg BW /d	[1]
7440-47-3	Chromium	2.40E+00	mg/kg BW /d	[3]	2.66E+00	mg/kg BW /d	[2]			
7440-48-4	Cobalt	7.33E+00	mg/kg BW /d	[3]	7.61E+00	mg/kg BW /d	[2]			
7440-50-8	Copper	5.60E+00	mg/kg BW /d	[3]	4.05E+00	mg/kg BW /d	[2]	4.70E+01	mg/kg BW /d	[1]
7440-61-1	Uranium	3.07E+00	mg/kg BW /d	[5]	1.60E+01	mg/kg BW /d	[4]	1.60E+01	mg/kg BW /d	[3]
7440-61-1R	Uranium-238	1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
7440-62-2	Vanadium	4.16E+00	mg/kg BW /d	[3]	3.44E-01	mg/kg BW /d	[2]	1.14E+01	mg/kg BW /d	[3]
7440-65-5	Yttrium									
7440-66-6	Zinc	7.54E+01	mg/kg BW /d	[3]	6.61E+01	mg/kg BW /d	[2]	1.31E+02	mg/kg BW /d	[1]
7440-67-7	Zirconium	1.74E+00	mg/kg BW /d	[5]						
7446-09-5	Sulfur dioxide									

Table 7-4 Coyote, Red-Tailed Hawk, and Burrowing Owl Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Coyote	Units for Coyote Ingestion *TRV*	Reference	Ingestion *TRV* of Red-the Tailed Hawk	Units for Red-Tailed Hawk Ingestion *TRV*	Reference	Ingestion *TRV* of the Burrowing Owl	Units for Burrowing Owl Ingestion *TRV*	Reference
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)									
7487-94-7	Mercuric chloride ($HgCl_2$)	1.01E+00	mg/kg BW /d	[1]	3.25E+00	mg/kg BW /d	[1]	3.25E+00	mg/kg BW /d	[1]
75-00-3	Chloroethane									
75-01-4	1-Chloroethene	1.70E+02	µg/kg BW /d	[1]						
75-02-5	Fluoroethene (vinyl fluoride)									
75-05-8	Acetonitrile									
75-07-0	Acetaldehyde									
75-09-2	Dichloromethane (methylene chloride)	6.16E+03	µg/kg BW /d	[2]						
75-15-0	Carbon disulfide	1.10E+04	µg/kg BW /d	[2]						
75-21-8	Ethylene oxide (Oxirane)									
75-25-2	Bromoform	1.79E+03	µg/kg BW /d	[2]						
75-27-4	Bromodichloromethane	1.79E+03	µg/kg BW /d	[2]						
75-29-6	2-Chloropropane									
75-34-3	1,1-Dichloroethane									
75-35-4	1,1-Dichloroethene	3.00E+04	µg/kg BW /d	[5]						
75-44-5	Phosgene (hydrogen phosphide)									
75-45-6	Chlorodifluoromethane									
75-50-3	Trimethylamine									
75-69-4	Trichlorofluoromethane	3.49E+04	µg/kg BW /d	[2]						
75-71-8	Dichlorodifluoromethane	1.50E+04	µg/kg BW /d	[2]						
76-01-7	Pentachloroethane									
76-13-1	1,2,2-Trichlorotrifluoroethane									
76-44-8	Heptachlor	2.50E+00	µg/kg BW /d	[1]	6.50E+01	µg/kg BW /d	[1]	6.50E+01	µg/kg BW /d	[1]
764-41-0	1,4-Dichloro-2-butene									

Table 7-4 Coyote, Red-Tailed Hawk, and Burrowing Owl Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Coyote	Units for Coyote Ingestion *TRV*	Reference	Ingestion *TRV* of Red-the Tailed Hawk	Units for Red-Tailed Hawk Ingestion *TRV*	Reference	Ingestion *TRV* of the Burrowing Owl	Units for Burrowing Owl Ingestion *TRV*	Reference
7647-01-0	Hydrogen chloride	1.44E+01	mg/kg BW /d	[2]						
765-34-4	Glycidylaldehyde	1.09E+02	µg/kg BW /d	[2]						
7664-39-3	Hydrogen fluoride	3.14E+01	mg/kg BW /d	[5]	7.80E+00	mg/kg BW /d	[4]	7.80E+00	mg/kg BW /d	[3]
7664-41-7	Ammonia/Ammonium									
77-47-4	Hexachlorocyclopenta diene	3.80E+03	µg/kg BW /d	[1]						
77-78-1	Dimethyl sulfate									
7704-34-9	Total Sulfur (thermodynamically stable)									
7723-14-0	Phosphorus									
7782-41-4	Fluorine gas (F_2)									
7782-49-2	Selenium	1.43E-01	mg/kg BW /d	[3]	2.90E-01	mg/kg BW /d	[2]	5.00E-01	mg/kg BW /d	[1]
7782-50-5	Chlorine	1.44E+01	mg/kg BW /d	[2]						
78-83-1	2-Methylpropyl alcohol	3.16E+04	µg/kg BW /d	[2]						
78-87-5	1,2-Dichloropropane									
78-93-3	2-Butanone	1.77E+06	µg/kg BW /d	[2]						
79-00-5	1,1,2-Trichloroethane									
79-01-6	1,1,2-Trichloroethylene	7.00E+02	µg/kg BW /d	[2]						
79-10-7	2-Propenoic acid	5.30E+03	µg/kg BW /d	[2]						
79-34-5	1,1,2,2-Tetrachloroethane									
79-46-9	2-Nitropropane									
80-62-6	Methyl methacrylate	1.36E+05	µg/kg BW /d	[2]						
82-68-8	Pentachloronitrobenzene (PCNB)	4.58E+05	µg/kg BW /d	[1]	6.88E+04	µg/kg BW /d	[1]	6.88E+04	µg/kg BW /d	[1]
822-06-0	Hexamethylene-1,5-diisocyanate									
823-40-5	Toluene-2,6-diamine									
83-32-9	Acenaphthene	6.56E+04	µg/kg BW /d	[3]						
832-69-9	1-Methylphenanthrene									
84-66-2	Diethyl phthalate	4.58E+06	µg/kg BW /d	[5]						

Table 7-4 Coyote, Red-Tailed Hawk, and Burrowing Owl Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Coyote	Units for Coyote Ingestion *TRV*	Reference	Ingestion *TRV* of Red-the Tailed Hawk	Units for Red-Tailed Hawk Ingestion *TRV*	Reference	Ingestion *TRV* of the Burrowing Owl	Units for Burrowing Owl Ingestion *TRV*	Reference
84-74-2	Di-n-butylphthalate	5.50E+05	µg/kg BW /d	[5]	1.11E+02	µg/kg BW /d	[4]	1.11E+02	µg/kg BW /d	[3]
85-01-8	Phenanthrene	6.56E+04	µg/kg BW /d	[3]						
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	1.56E+05	µg/kg BW /d	[2]						
85-68-7	Butylbenzylphthalate									
86-73-7	Fluorene	1.25E+04	µg/kg BW /d	[2]						
87-61-6	1,2,3-Trichlorobenzene									
87-68-3	Hexachlorobutadiene	2.00E+02	µg/kg BW /d	[1]	3.19E+03	µg/kg BW /d	[1]	3.19E+03	µg/kg BW /d	[1]
87-86-5	Pentachlorophenol	8.42E+03	µg/kg BW /d	[3]	6.73E+03	µg/kg BW /d	[2]	4.03E+03	µg/kg BW /d	[1]
88-06-2	2,4,6-Trichlorophenol									
88-74-4	o-Nitroaniline (2-nitroaniline)									
88-75-5	2-Nitrophenol									
90-04-0	o-Anisidine									
90-12-0	1-Methylnaphthalene									
91-20-3	Naphthalene	6.56E+04	µg/kg BW /d	[3]						
91-22-5	Quinoline									
91-57-6	2-Methylnaphthalene									
91-58-7	2-Chloronaphthalene	2.50E+05	µg/kg BW /d	[2]						
91-94-1	3,3'-Dichlorobenzidine									
92-52-4	1,1`-Biphenyl	5.00E+04	µg/kg BW /d	[2]						
924-16-3	N-Nitroso-di-n-Buetylamine									
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)									
94-75-7	2,4-D									
95-48-7	o-Cresol	5.00E+03	µg/kg BW /d	[2]						
95-49-8	o-Chlorotoluene	2.00E+04	µg/kg BW /d	[2]						
95-50-1	1,2-Dichlorobenzene	8.57E+04	µg/kg BW /d	[2]						
95-53-4	o-Toluidine									

Table 7-4 Coyote, Red-Tailed Hawk, and Burrowing Owl Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Coyote	Units for Coyote Ingestion *TRV*	Reference	Ingestion *TRV* of Red-the Tailed Hawk	Units for Red-Tailed Hawk Ingestion *TRV*	Reference	Ingestion *TRV* of the Burrowing Owl	Units for Burrowing Owl Ingestion *TRV*	Reference
95-57-8	2-Chlorophenol									
95-63-6	1,2,4-Trimethyl benzene									
95-94-3	1,2,4,5-Tetrachlorobenzene	3.40E+01	µg/kg BW /d	[2]						
95-95-4	2,4,5-Trichlorophenol	1.00E+04	µg/kg BW /d	[2]						
96-12-8	1,2-Dibromo-3-chloropropane									
96-18-4	1,2,3-Trichloropropane	5.71E+02	µg/kg BW /d	[2]						
96-45-7	Ethylene thiourea	2.50E+01	µg/kg BW /d	[2]						
97-63-2	Ethyl methacrylate									
98-01-1	Furfural	7.90E+01	µg/kg BW /d	[2]						
98-06-6	tert-Butyl benzene									
98-07-7	Benzotrichloride									
98-82-8	Cumene	1.10E+05	µg/kg BW /d	[2]						
98-83-9	Methyl styrene (mixed isomers)									
98-86-2	Acetophenone	4.23E+04	µg/kg BW /d	[2]						
98-95-3	Nitrobenzene	4.60E+01	µg/kg BW /d	[2]						
99-35-4	1,3,5-Trinitrobenzene	2.68E+03	µg/kg BW /d	[2]						
99-65-0	1,3-Dinitrobenzene	1.05E+03	µg/kg BW /d	[1]	4.22E-01	µg/kg BW /d	[1]	4.22E-01	µg/kg BW /d	[1]
99-87-6	p-Cymene									
All radionuclides combined		1.00E-01	rad/d	[4]	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]

Reference **Reference (source) for Ingestion Toxicity Reference Values of the Coyote**

[1] EPA. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Peer Review Draft*, EPA 530-D-99-001. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC, USA. (http://www.epa.gov/epaoswer/hazwaste/combust/ecorisk.htm)

[2] EPA. 2004. *Integrated Risk Information System (IRIS)*. US Environmental Protection Agency, Office of Research and Development, National Center for Environmental Assessment, Washington, DC (http://www.epa.gov/iris/). Accessed 2004.

[3] EPA. 2005. *Guidance for Developing Ecological Soil Screening Levels*, OSWER Directive 9285.7-55, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC. (Weasel used as surrogate).

Reference	Reference (source) for Ingestion Toxicity Reference Values of the Coyote
[4]	IAEA. 1992. "Effects of Ionizing Radiation on Plants and Animals at Levels Implied by Current Radiation Protection Standards," IAEA Technical Report Series 332, International Commission on Radiological Protection, Vienna, Austria.
[5]	Sample BE, Opresko DM, and Suter II GW. 1996. *Toxicological Benchmarks for Wildlife: 1996 Revision*, ES/ER/TM-86/R3, Lockheed Martin Energy Systems, Inc., Oak Ridge National Laboratory, Oak Ridge, TN

Reference	Reference (source) for Ingestion Toxicity Reference Values of the Red Tailed Hawk
[1]	EPA. 1999 *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Peer Review Draft*, EPA 530-D-99-001. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC, USA. (http://www.epa.gov/epaoswer/hazwaste/combust/ecorisk.htm)
[2]	EPA. 2005. *Guidance for Developing Ecological Soil Screening Levels*, OSWER Directive 9285.7-55, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC. (Hawk used as surrogate).
[3]	IAEA. 1992. "Effects of Ionizing Radiation on Plants and Animals at Levels Implied by Current Radiation Protection Standards," IAEA Technical Report Series 332, International Commission on Radiological Protection, Vienna, Austria.
[4]	Sample BE, Opresko DM, and Suter II GW. 1996. *Toxicological Benchmarks for Wildlife: 1996 Revision*, ES/ER/TM-86/R3, Lockheed Martin Energy Systems, Inc., Oak Ridge National Laboratory, Oak Ridge, TN

Reference	Reference (source) for Ingestion Toxicity Reference Values of the Burrowing Owl
[1]	EPA. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Peer Review Draft*, EPA 530-D-99-001. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC, USA. (http://www.epa.gov/epaoswer/hazwaste/combust/ecorisk.htm)
[2]	IAEA. 1992. "Effects of Ionizing Radiation on Plants and Animals at Levels Implied by Current Radiation Protection Standards," IAEA Technical Report Series 332, International Commission on Radiological Protection, Vienna, Austria.
[3]	Sample BE, Opresko DM, and Suter II GW. 1996. *Toxicological Benchmarks for Wildlife: 1996 Revision*, ES/ER/TM-86/R3, Lockheed Martin Energy Systems, Inc., Oak Ridge National Laboratory, Oak Ridge, TN

Table 7-5 presents known toxicity reference values (TRV) for benthic invertebrates and aquatic biota. Toxicity of constituents to benthic invertebrates is assumed to be a result of uptake from sediment or sediment porewater into the receptor's tissues. Toxicity of constituents to aquatic biota is assumed to be a result of uptake from water into the receptor's tissues. Note that units vary, with concentration units for chemical consistuents, and units of rad per day for radioisotopes. Blank entries in the table indicate where data are not available.

Table 7-5 Benthic Invertebrate and Aquatic Biota Direct Exposure Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Values (*TRV*) of Benthic Invertebrate	Units for Benthic Invert. Direct Exposure *TRV*	Reference	Direct Exposure Toxicity Reference Values (*TRV*) of Aquatic Biota	Units for Aquatic Biota Direct Exposure *TRV*	Reference
100-02-7	p-Nitrophenol	5.24E+02	µg/L	[21]	3.00E+02	µg/L	[9]
100-21-0	Phthalic acid						
100-25-4	1,4-Dinitrobenzene						
100-40-3	4-Ethenylcyclohexene						
100-41-4	Ethyl benzene	7.30E+00	µg/L	[17]	7.30E+00	µg/L	[3]
100-42-5	Styrene						
100-44-7	Benzyl chloride						
100-47-0	Benzonitrile						
100-51-6	Benzyl alcohol	3.51E+00	µg/L	[21]	8.60E+00	µg/L	[9]
100-52-7	Benzaldehyde						
10028-15-6	Ozone						
10028-17-8	Tritium	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
10045-97-3	Cesium-137	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
10061-01-5	cis-1,3-Dichloropropene						
10061-02-6	trans-1,3-Dichloropropene						
10098-91-6	Yttrium-90	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
10098-97-2	Strontium-90	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
101-55-3	4-Bromophenylphenyl ether	1.50E+00	µg/L	[17]	1.50E+00	µg/L	[3]
101-77-9	4,4-Methylenedianiline						
10102-44-0	Nitrogen dioxide						
10198-40-0	Cobalt-60	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
103-33-3	Azobenzene						
103-65-1	n-Propyl benzene (isocumene)						
104-51-8	n-Butylbenzene						
104-76-7	2-Ethyl-1-hexanol						

Table 7-5 Benthic Invertebrate and Aquatic Biota Direct Exposure Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Values (*TRV*) of Benthic Invertebrate	Units for Benthic Invert. Direct Exposure *TRV*	Reference	Direct Exposure Toxicity Reference Values (*TRV*) of Aquatic Biota	Units for Aquatic Biota Direct Exposure *TRV*	Reference
105-67-9	2,4-Dimethylphenol				2.12E+01	µg/L	[1]
10595-95-6	n-Nitrosomethylethylamine						
106-43-4	4-Chlorotoluene (p-tolyl chloride)						
106-44-5	p-Cresol (4-methyl phenol)						
106-46-7	1,4-Dichlorobenzene	1.50E+01	µg/L	[17]	1.50E+01	µg/L	[3]
106-47-8	p-Chloroaniline						
106-49-0	p-Toluidine						
106-51-4	Quinone						
106-88-7	1,2-Epoxybutane						
106-89-8	Epichlorohydrin (1-chloro-2,3-epoxypropane)						
106-93-4	Ethylene dibromide						
106-99-0	1,3-Butadiene						
107-02-8	Acrolein	1.17E-01	µg/L	[21]	2.10E+00	µg/L	[1]
107-05-1	3-Chloropropene						
107-06-2	1,2-Dichloroethane	7.13E+02	µg/L	[21]	9.10E+02	µg/L	[9]
107-12-0	Propionitrile						
107-13-1	Acrylonitrile	2.31E+01	µg/L	[14]	2.60E+02	µg/L	[10]
107-19-7	Propargyl alcohol						
107-21-1	Ethylene glycol (1,2-ethanediol)						
107-98-2	Propylene glycol monomethyl ether						
108-05-4	Acetic acid vinyl ester	3.18E+00	µg/L	[21]	1.60E+01	µg/L	[9]
108-10-1	4-Methyl-2-pentanone	8.16E+01	µg/L	[21]	1.70E+02	µg/L	[9]
108-39-4	m-Cresol						
108-60-1	bis(2-Chloroisopropyl) ether						
108-67-8	1,3,5-Trimethylbenzene						
108-86-1	Bromobenzene (phenyl bromide)						
108-87-2	Methylcyclohexane						
108-88-3	Toluene	9.80E+00	µg/L	[17]	9.80E+00	µg/L	[3]
108-90-7	Chlorobenzene	6.40E+01	µg/L	[17]	6.40E+01	µg/L	[3]
108-94-1	Cyclohexanone						

Table 7-5 Benthic Invertebrate and Aquatic Biota Direct Exposure Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Values (*TRV*) of Benthic Invertebrate	Units for Benthic Invert. Direct Exposure *TRV*	Reference	Direct Exposure Toxicity Reference Values (*TRV*) of Aquatic Biota	Units for Aquatic Biota Direct Exposure *TRV*	Reference
108-95-2	Phenol	4.80E+01	µg/L	[19]	1.10E+02	µg/L	[6]
109-74-0	n-Butanenitrile						
109-75-1	3-Butenenitrile						
109-77-3	Malononitrile						
109-86-4	2-Methoxyethanol						
109-99-9	Tetrahydrofuran						
110-00-9	Furan						
110-54-3	n-Hexane	3.29E+04	µg/L	[7]	5.80E-01	µg/L	[9]
110-59-8	Pentanenitrile						
110-80-5	2-Ethoxyethanol						
110-82-7	Cyclohexane						
110-83-8	Cyclohexene						
110-86-1	Pyridine	1.15E+04	µg/L	[4]			
111-15-9	Ethylene glycol monoethyl ether acetate						
111-44-4	bis(2-Chloroethyl)ether						
111-65-9	n-Octane						
111-76-2	2-Butoxyethanol						
111-84-2	n-Nonane						
111-91-1	bis(2-Chloroethoxy)methane						
112-30-1	1-Decanol						
112-31-2	Decanal						
112-40-3	Dodecane						
1120-21-4	Undecane						
1120-71-4	1,3-Propane sultone						
117-81-7	bis(2-Ethylhexyl)phthalate	1.33E+04	µg/L	[14]	3.00E+00	µg/L	[10]
117-84-0	Di-n-octylphthalate	1.16E+10	µg/L	[14]	3.20E+02	µg/L	[10]
118-74-1	Hexachlorobenzene	2.00E+01	µg/L	[14]	3.68E+00	µg/L	[10]
119-90-4	3,3'-Dimethoxybenzidine						
120-12-7	Anthracene	2.07E+01	µg/L	[16]	2.07E+01	µg/L	[2]
120-82-1	1,2,4-Trichlorobenzene	1.10E+02	µg/L	[17]	1.10E+02	µg/L	[3]

Table 7-5 Benthic Invertebrate and Aquatic Biota Direct Exposure Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Values (*TRV*) of Benthic Invertebrate	Units for Benthic Invert. Direct Exposure *TRV*	Reference	Direct Exposure Toxicity Reference Values (*TRV*) of Aquatic Biota	Units for Aquatic Biota Direct Exposure *TRV*	Reference
120-83-2	2,4-Dichlorophenol				3.65E+01	µg/L	[1]
121-14-2	2,4-Dinitrotoluene	4.69E+01	µg/L	[14]	2.30E+01	µg/L	[10]
122-39-4	N,N-Diphenylamine						
122-66-7	1,2-Diphenylhydrazine				2.70E+00	µg/L	[1]
123-33-1	Maleic hydrazide						
123-38-6	Propionaldehyde						
123-72-8	Butanal						
123-91-1	1,4-Dioxan	2.17E+03	µg/L	[14]	6.21E+04	µg/L	[10]
124-18-5	Decane						
124-38-9	Carbon dioxide						
124-48-1	Chlorodibromomethane						
126-73-8	Tributyl phosphate	6.00E+00	µg/L	[6]			
126-98-7	2-Methyl-2-propenenitrile						
127-18-4	1,1,2,2-Tetrachloroethene	9.80E+01	µg/L	[17]	9.80E+01	µg/L	[3]
128-37-0	2,6-bis(tert-butyl)-4-Methylphenol						
129-00-0	Pyrene	1.01E+01	µg/L	[16]	1.01E+01	µg/L	[2]
131-11-3	Dimethyl Phthalate						
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol						
132-64-9	Dibenzofuran	3.70E+00	µg/L	[17]	3.70E+00	µg/L	[3]
133-06-2	Captan						
1330-20-7	Xylenes (mixed isomers)	6.70E+01	µg/L	[18]	6.70E+01	µg/L	[4]
1336-36-3	Polychlorinated biphenyls	7.00E+01	µg/L	[23]	1.40E-01	µg/L	[9]
134-32-7	alpha-Naphthylamine						
135-98-8	sec-Butylbenzene						
13966-29-5	Uranium-234	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
13967-48-1	Ruthenium-106	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
13967-70-9	Cesium-134	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
13968-55-3	Uranium-233	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
13981-15-2	Curium-244	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
13981-16-3	Plutonium-238	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
13981-37-8	Nickel-63	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]

Table 7-5 Benthic Invertebrate and Aquatic Biota Direct Exposure Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Values (*TRV*) of Benthic Invertebrate	Units for Benthic Invert. Direct Exposure *TRV*	Reference	Direct Exposure Toxicity Reference Values (*TRV*) of Aquatic Biota	Units for Aquatic Biota Direct Exposure *TRV*	Reference
13982-10-0	Plutonium-242	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
13982-63-3	Radium-226	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
13982-70-2	Uranium-236	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
13994-20-2	Neptunium-237	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
141-78-6	Acetic acid ethyl ester	1.00E+00	µg/L	[8]			
14119-32-5	Plutonium-241	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
14119-33-6	Plutonium-240	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
14133-76-7	Technetium-99	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
14158-29-3	Uranium-232	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
14234-35-6	Antimony-125	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
14265-44-2	Phosphate						
14331-85-2	Protactinium-231	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
14336-70-0	Nickel-59	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
14391-16-3	Europium-155	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
145-73-3	Endothall						
14596-10-2	Americium-241	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
14683-23-9	Europium-152	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
14762-75-5	Carbon-14	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
14797-55-8	Nitrate						
14797-65-0	Nitrite						
14808-79-8	Sulfate						
14952-40-0	Actinium-227	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
14993-75-0	Americium-243	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
15046-84-1	Iodine-129	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
15117-48-3	Plutonium-239	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
15117-96-1	Uranium-235	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
15262-20-1	Radium-228	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
15510-73-3	Curium-242	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
15585-10-1	Europium-154	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
15594-54-4	Thorium-229	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
156-59-2	cis-1,2-Dichloroethene						

Table 7-5 Benthic Invertebrate and Aquatic Biota Direct Exposure Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Values (*TRV*) of Benthic Invertebrate	Units for Benthic Invert. Direct Exposure *TRV*	Reference	Direct Exposure Toxicity Reference Values (*TRV*) of Aquatic Biota	Units for Aquatic Biota Direct Exposure *TRV*	Reference
156-60-5	1,2-trans-Dichloroethene						
15715-94-3	Samarium-151	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
15751-77-6	Zirconium-93	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
15757-87-6	Curium-243	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
15758-45-9	Selenium-79	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
15832-50-5	Tin-126	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
1634-04-4	Methyl tert-butyl ether						
16887-00-6	Chloride				2.30E+02	mg/L	[7]
16984-48-8	Fluoride						
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	4.10E-01	µg/L	[14]	3.80E-06	µg/L	[10]
18540-29-9	Chromium(VI)	2.60E+01	mg/L	[14]	1.10E-02	mg/L	[10]
189-55-9	Dibenzo[a,i]pyrene						
189-64-0	Dibenzo[a,h]pyrene						
191-24-2	Benzo[g,h,i]perylene	4.39E-01	µg/L	[16]	4.39E-01	µg/L	[2]
191-30-0	Dibenzo[a,l]pyrene						
192-65-4	Dibenzo[a,e]pyrene						
192-97-2	Benzo[e]pyrene	9.01E-01	µg/L	[16]	9.01E-01	µg/L	[2]
193-39-5	Indeno[1,2,3-cd]pyrene	2.75E-01	µg/L	[16]	2.75E-01	µg/L	[2]
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin						
205-82-3	Benzo[j]fluoranthene	6.42E-01	µg/L	[16]	6.42E-01	µg/L	[2]
205-99-2	Benzo[b]fluoranthene	6.77E-01	µg/L	[16]	6.77E-01	µg/L	[2]
206-44-0	Fluoranthene	7.11E+00	µg/L	[16]	7.11E+00	µg/L	[2]
207-08-9	Benzo[k]fluoranthene	6.42E-01	µg/L	[16]	6.42E-01	µg/L	[2]
208-96-8	Acenaphthylene	3.07E+02	µg/L	[16]	3.07E+02	µg/L	[2]
218-01-9	Chrysene	2.04E+00	µg/L	[16]	2.04E+00	µg/L	[2]
224-42-0	Dibenz[a,j]acridine						
2245-38-7	2,3,5-Trimethylnaphthalene	9.79E+00	µg/L	[16]	9.79E+00	µg/L	[2]
226-36-8	Dibenz[a,h]acridine						
22967-92-6	Methyl mercury	2.00E-01	mg/L	[14]	2.80E-06	mg/L	[10]

Table 7-5 Benthic Invertebrate and Aquatic Biota Direct Exposure Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Values (*TRV*) of Benthic Invertebrate	Units for Benthic Invert. Direct Exposure *TRV*	Reference	Direct Exposure Toxicity Reference Values (*TRV*) of Aquatic Biota	Units for Aquatic Biota Direct Exposure *TRV*	Reference
23950-58-5	Pronamide						
24959-67-9	Bromide						
27154-33-2	Trichlorofluoroethane						
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)						
319-84-6	alpha-BHC	6.00E+00	µg/L	[23]	2.20E+00	µg/L	[9]
319-85-7	beta-BHC	5.00E+00	µg/L	[23]	2.20E+00	µg/L	[9]
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)						
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)						
3268-87-9	Octachlorodibenzo(p)dioxin						
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)						
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin						
3697-24-3	5-Methylchrysene	8.56E-01	µg/L	[16]	8.56E-01	µg/L	[2]
378253-40-8	Barium-137m	1.00E+00	mg/L	[22]	1.00E+00	mg/L	[5]
378253-44-2	Cadmium-113m						
378782-82-2	Niobium-93m	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)						
39001-02-0	Octachlorodibenzofuran						
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo (p)dioxin						
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)						
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin						
4170-30-3	Crotonaldehyde (propylene aldehyde)				3.50E+01	µg/L	[10]
41851-50-7	Chlorocyclopentadiene						
460-19-5	Cyanogen (oxalonitrile)						
4786-20-3	2-Butenenitrile						
50-00-0	Formaldehyde	5.20E+00	µg/L	[14]	4.96E+01	µg/L	[10]
50-32-8	Benzo[a]pyrene	9.57E-01	µg/L	[16]	9.57E-01	µg/L	[2]

Table 7-5 Benthic Invertebrate and Aquatic Biota Direct Exposure Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Values (*TRV*) of Benthic Invertebrate	Units for Benthic Invert. Direct Exposure *TRV*	Reference	Direct Exposure Toxicity Reference Values (*TRV*) of Aquatic Biota	Units for Aquatic Biota Direct Exposure *TRV*	Reference
506-68-3	Cyanogen bromide (bromocyanide)						
506-77-4	Cyanogen chloride						
51-28-5	2,4-Dinitrophenol						
51-79-6	Ethyl carbamate (urethane)						
510-15-6	Chlorobenzilate						
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran						
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)						
528-29-0	1,2-Dinitrobenzene (o-dinitrobenzene)						
53-70-3	Dibenz[a,h]anthracene	2.83E-01	µg/L	[16]	2.83E-01	µg/L	[2]
532-27-4	2-Chloroacetophenone						
534-52-1	4,6-Dinitro-o-cresol	5.80E+01	µg/L	[1]			
5385-75-1	Dibenzo[a,e]fluoranthene						
540-59-0	1,2-Dichloroethene (total)	6.78E+01	µg/L	[21]	5.90E+02	µg/L	[9]
540-73-8	1,2-Dimethylhydrazine						
540-84-1	2,2,4-Trimethylpentane						
541-73-1	1,3-Dichlorobenzene	7.10E+01	µg/L	[17]	7.10E+01	µg/L	[3]
542-75-6	1,3-Dichloropropene	5.94E-02	µg/L	[21]	5.50E-02	µg/L	[9]
542-88-1	bis(Chloromethyl)ether						
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran						
56-23-5	Carbon tetrachloride	2.40E+02	µg/L	[17]	2.40E+02	µg/L	[3]
56-49-5	3-Methylcholanthrene						
56-55-3	Benzo[a]anthracene	2.23E+00	µg/L	[16]	2.23E+00	µg/L	[2]
57-12-5	Cyanide	1.00E-01	mg/L	[14]	5.20E-03	mg/L	[10]
57-24-9	Strychnine	1.00E-06	µg/L	[12]			
57-74-9	Chlordane	7.00E+00	µg/L	[23]	1.70E-01	µg/L	[6]
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran						
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran						
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran						
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)						

Table 7-5 Benthic Invertebrate and Aquatic Biota Direct Exposure Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Values (*TRV*) of Benthic Invertebrate	Units for Benthic Invert. Direct Exposure *TRV*	Reference	Direct Exposure Toxicity Reference Values (*TRV*) of Aquatic Biota	Units for Aquatic Biota Direct Exposure *TRV*	Reference
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin						
58-89-9	gamma-BHC (Lindane)	8.00E-02	µg/L	[17]	8.00E-02	µg/L	[3]
58-90-2	2,3,4,6-Tetrachlorophenol						
581-42-0	2,6-Dimethylnaphthalene	2.58E+01	µg/L	[16]	2.58E+01	µg/L	[2]
584-84-9	2,4-Toluene diisocyanate						
589-38-8	3-Hexanone						
59-50-7	4-Chloro-3-methylphenol	4.45E+00	µg/L	[21]	3.00E-01	µg/L	[1]
59-89-2	N-Nitrosomorpholine						
591-50-4	Benzene, iodo-						
591-78-6	2-Hexanone	8.42E+00	µg/L	[21]	9.90E+01	µg/L	[9]
593-60-2	Bromoethene (vinyl bromide)						
593-74-8	Dimethyl mercury						
60-11-7	Dimethyl aminoazobenzene						
60-29-7	Ethyl ether						
60-35-5	Acetamide						
602-87-9	5-Nitroacenaphthene						
606-20-2	2,6-Dinitrotoluene	1.01E+02	µg/L	[14]	6.00E+01	µg/L	[10]
608-93-5	Pentachlorobenzene	4.70E-01	µg/L	[17]	4.70E-01	µg/L	[3]
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran						
61626-71-9	Dichloropentadiene						
62-50-0	Ethyl methanesulfonate						
62-53-3	Aniline	1.10E+01	µg/L	[6]			
62-75-9	N-Nitroso-N,N-dimethylamine	1.37E+04	µg/L	[2]			
621-64-7	N-Nitroso-di-n-propylamine						
624-83-9	Methyl isocyanate						
628-73-9	Hexanenitrile						
630-08-0	Carbon monoxide						
630-20-6	1,1,1,2-Tetrachloroethane						
64-18-6	Formic acid (methanoic acid)	4.40E-03	µg/L	[8]			
65-85-0	Benzoic acid	2.38E-02	µg/L	[8]	4.20E+01	µg/L	[9]

Table 7-5 Benthic Invertebrate and Aquatic Biota Direct Exposure Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Values (*TRV*) of Benthic Invertebrate	Units for Benthic Invert. Direct Exposure *TRV*	Reference	Direct Exposure Toxicity Reference Values (*TRV*) of Aquatic Biota	Units for Aquatic Biota Direct Exposure *TRV*	Reference
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)						
67-56-1	Methyl alcohol	7.00E+00	µg/L	[11]			
67-63-0	2-Propyl alcohol	6.55E-02	µg/L	[13]	7.50E+00	µg/L	[9]
67-64-1	2-Propanone (acetone)	5.71E+01	µg/L	[14]	1.50E+03	µg/L	[10]
67-66-3	Chloroform	5.94E+01	µg/L	[14]	2.80E+01	µg/L	[10]
67-72-1	Hexachloroethane	1.20E+01	µg/L	[17]	1.20E+01	µg/L	[3]
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran						
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)						
70-30-4	Hexachlorophene	6.34E+04	µg/L	[14]	8.80E-01	µg/L	[10]
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)						
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran						
71-36-3	n-Butyl alcohol						
71-43-2	Benzene	1.30E+02	µg/L	[17]	1.30E+02	µg/L	[3]
71-55-6	1,1,1-Trichloroethane	1.10E+01	µg/L	[17]	1.10E+01	µg/L	[3]
72-43-5	Methoxychlor	1.90E-02	µg/L	[17]	1.90E-02	µg/L	[3]
72-55-9	4,4-DDE	5.00E+00	µg/L	[14]	1.05E+01	µg/L	[10]
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran						
74-83-9	Bromomethane						
74-87-3	Chloromethane						
74-88-4	Iodomethane						
74-95-3	Methylene bromide						
74-97-5	Bromochloromethane						
7429-90-5	Aluminum	1.40E+04	mg/L	[14]	8.70E-02	mg/L	[10]
7439-89-6	Iron	2.00E+04	mg/L	[23]	1.00E+00	mg/L	[9]
7439-92-1	Lead	3.10E+01	mg/L	[14]	2.50E-03	mg/L	[10]
7439-93-2	Lithium				1.40E-02	mg/L	[9]
7439-95-4	Magnesium						
7439-96-5	Manganese	4.60E+02	mg/L	[23]	1.20E-01	mg/L	[9]
7439-97-6	Mercury						

Table 7-5 Benthic Invertebrate and Aquatic Biota Direct Exposure Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Values (*TRV*) of Benthic Invertebrate	Units for Benthic Invert. Direct Exposure *TRV*	Reference	Direct Exposure Toxicity Reference Values (*TRV*) of Aquatic Biota	Units for Aquatic Biota Direct Exposure *TRV*	Reference
7439-98-7	Molybdenum				3.70E-01	mg/L	[9]
7440-02-0	Nickel	1.60E+01	mg/L	[14]	5.20E-02	mg/L	[10]
7440-16-6	Rhodium						
7440-22-4	Silver	4.50E+00	mg/L	[14]	1.20E-04	mg/L	[10]
7440-23-5	Sodium						
7440-24-6	Strontium (total)				1.50E+00	mg/L	[9]
7440-25-7	Tantalum						
7440-28-0	Thallium				4.00E-03	mg/L	[10]
7440-29-1	Thorium-232	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
7440-31-5	Tin				7.30E-02	mg/L	[9]
7440-33-7	Tungsten						
7440-36-0	Antimony	6.40E+01	mg/L	[14]	3.00E-02	mg/L	[10]
7440-38-2	Arsenic	6.00E+00	mg/L	[14]	1.50E-01	mg/L	[10]
7440-39-3	Barium	2.00E+01	mg/L	[14]	4.00E-03	mg/L	[9]
7440-41-7	Beryllium				6.60E-04	mg/L	[10]
7440-43-9	Cadmium	6.00E-01	mg/L	[14]	2.20E-03	mg/L	[10]
7440-47-3	Chromium						
7440-48-4	Cobalt				2.30E-02	mg/L	[9]
7440-50-8	Copper	1.60E+01	mg/L	[14]	9.00E-03	mg/L	[10]
7440-61-1	Uranium				2.60E-03	mg/L	[9]
7440-61-1R	Uranium-238	1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]
7440-62-2	Vanadium				2.00E-02	mg/L	[9]
7440-65-5	Yttrium						
7440-66-6	Zinc	1.10E+02	mg/L	[14]	1.18E-01	mg/L	[10]
7440-67-7	Zirconium				1.70E-02	mg/L	[9]
7446-09-5	Sulfur dioxide						
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)						
7487-94-7	Mercuric chloride ($HgCl_2$)	2.00E-01	mg/L	[14]	7.70E-04	mg/L	[10]
75-00-3	Chloroethane						
75-01-4	1-Chloroethene	1.72E+03	µg/L	[15]	3.88E+03	µg/L	[10]

Table 7-5 Benthic Invertebrate and Aquatic Biota Direct Exposure Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Values (*TRV*) of Benthic Invertebrate	Units for Benthic Invert. Direct Exposure *TRV*	Reference	Direct Exposure Toxicity Reference Values (*TRV*) of Aquatic Biota	Units for Aquatic Biota Direct Exposure *TRV*	Reference
75-02-5	Fluoroethene (vinyl fluoride)						
75-05-8	Acetonitrile	1.00E+03	µg/L	[5]			
75-07-0	Acetaldehyde						
75-09-2	Dichloromethane (methylene chloride)	8.80E+02	µg/L	[21]	2.20E+03	µg/L	[9]
75-15-0	Carbon disulfide	1.89E+00	µg/L	[21]	9.20E-01	µg/L	[9]
75-21-8	Ethylene oxide (Oxirane)						
75-25-2	Bromoform	3.20E+02	µg/L	[17]	3.20E+02	µg/L	[3]
75-27-4	Bromodichloromethane						
75-29-6	2-Chloropropane						
75-34-3	1,1-Dichloroethane	9.96E+01	µg/L	[21]	4.70E+01	µg/L	[9]
75-35-4	1,1-Dichloroethene	6.50E+01	µg/L	[21]	2.50E+01	µg/L	[9]
75-44-5	Phosgene (hydrogen phosphide)						
75-45-6	Chlorodifluoromethane						
75-50-3	Trimethylamine						
75-69-4	Trichlorofluoromethane						
75-71-8	Dichlorodifluoromethane						
76-01-7	Pentachloroethane				3.90E+01	µg/L	[1]
76-13-1	1,2,2-Trichlorotrifluoroethane						
76-44-8	Heptachlor	3.08E-01	µg/L	[14]	3.80E-03	µg/L	[10]
764-41-0	1,4-Dichloro-2-butene						
7647-01-0	Hydrogen chloride				2.30E+02	mg/L	[8]
765-34-4	Glycidylaldehyde						
7664-39-3	Hydrogen fluoride						
7664-41-7	Ammonia/Ammonium	9.30E+02	mg/L	[20]			
77-47-4	Hexachlorocyclopentadiene	1.98E+02	µg/L	[14]	5.20E-01	µg/L	[10]
77-78-1	Dimethyl sulfate						
7704-34-9	Total Sulfur (thermodynamically stable)						
7723-14-0	Phosphorus						
7782-41-4	Fluorine gas (F_2)						
7782-49-2	Selenium	1.00E-01	mg/L	[14]	5.00E-03	mg/L	[10]

Table 7-5 Benthic Invertebrate and Aquatic Biota Direct Exposure Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Values (*TRV*) of Benthic Invertebrate	Units for Benthic Invert. Direct Exposure *TRV*	Reference	Direct Exposure Toxicity Reference Values (*TRV*) of Aquatic Biota	Units for Aquatic Biota Direct Exposure *TRV*	Reference
7782-50-5	Chlorine				1.10E-02	mg/L	[7]
78-83-1	2-Methylpropyl alcohol	2.53E-02	µg/L	[13]			
78-87-5	1,2-Dichloropropane						
78-93-3	2-Butanone	1.31E+03	µg/L	[21]	1.40E+04	µg/L	[9]
79-00-5	1,1,2-Trichloroethane	3.60E+03	µg/L	[21]	1.20E+03	µg/L	[9]
79-01-6	1,1,2-Trichloroethylene	4.70E+01	µg/L	[17]	4.70E+01	µg/L	[3]
79-10-7	2-Propenoic acid						
79-34-5	1,1,2,2-Tetrachloroethane	6.10E+02	µg/L	[17]	6.10E+02	µg/L	[3]
79-46-9	2-Nitropropane						
80-62-6	Methyl methacrylate						
82-68-8	Pentachloronitrobenzene (PCNB)	2.36E+03	µg/L	[14]	1.00E+01	µg/L	[10]
822-06-0	Hexamethylene-1,5-diisocyanate						
823-40-5	Toluene-2,6-diamine						
83-32-9	Acenaphthene	5.59E+01	µg/L	[16]	5.59E+01	µg/L	[2]
832-69-9	1-Methylphenanthrene	7.49E+00	µg/L	[16]	7.49E+00	µg/L	[2]
84-66-2	Diethyl phthalate	2.70E+02	µg/L	[17]	2.70E+02	µg/L	[3]
84-74-2	Di-n-butylphthalate	3.50E+01	µg/L	[17]	3.50E+01	µg/L	[3]
85-01-8	Phenanthrene	1.91E+01	µg/L	[16]	1.91E+01	µg/L	[2]
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)						
85-68-7	Butylbenzylphthalate	1.90E+01	µg/L	[17]	1.90E+01	µg/L	[3]
86-73-7	Fluorene	3.93E+01	µg/L	[16]	3.93E+01	µg/L	[2]
87-61-6	1,2,3-Trichlorobenzene						
87-68-3	Hexachlorobutadiene	2.58E+02	µg/L	[14]	9.30E-01	µg/L	[10]
87-86-5	Pentachlorophenol	7.00E+03	µg/L	[14]	1.50E+01	µg/L	[10]
88-06-2	2,4,6-Trichlorophenol	8.50E+00	µg/L	[6]	9.70E+00	µg/L	[1]
88-74-4	o-Nitroaniline (2-nitroaniline)						
88-75-5	2-Nitrophenol	1.70E+01	µg/L	[6]			
90-04-0	o-Anisidine						
90-12-0	1-Methylnaphthalene	7.54E+01	µg/L	[16]	7.54E+01	µg/L	[2]
91-20-3	Naphthalene	1.94E+02	µg/L	[16]	1.94E+02	µg/L	[2]

Table 7-5 Benthic Invertebrate and Aquatic Biota Direct Exposure Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Values (*TRV*) of Benthic Invertebrate	Units for Benthic Invert. Direct Exposure *TRV*	Reference	Direct Exposure Toxicity Reference Values (*TRV*) of Aquatic Biota	Units for Aquatic Biota Direct Exposure *TRV*	Reference
91-22-5	Quinoline						
91-57-6	2-Methylnaphthalene	7.22E+01	µg/L	[16]	7.22E+01	µg/L	[2]
91-58-7	2-Chloronaphthalene						
91-94-1	3,3'-Dichlorobenzidine						
92-52-4	1,1`-Biphenyl	1.40E+01	µg/L	[17]	1.40E+01	µg/L	[3]
924-16-3	N-Nitroso-di-n-Buetylamine						
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)						
94-75-7	2,4-D	1.22E+03	µg/L	[3]			
95-48-7	o-Cresol	2.78E+01	µg/L	[21]	1.30E+01	µg/L	[9]
95-49-8	o-Chlorotoluene						
95-50-1	1,2-Dichlorobenzene	1.40E+01	µg/L	[17]	1.40E+01	µg/L	[3]
95-53-4	o-Toluidine						
95-57-8	2-Chlorophenol						
95-63-6	1,2,4-Trimethyl benzene						
95-94-3	1,2,4,5-Tetrachlorobenzene						
95-95-4	2,4,5-Trichlorophenol						
96-12-8	1,2-Dibromo-3-chloropropane						
96-18-4	1,2,3-Trichloropropane						
96-45-7	Ethylene thiourea	5.00E+02	µg/L	[9]			
97-63-2	Ethyl methacrylate						
98-01-1	Furfural	1.30E+02	µg/L	[10]			
98-06-6	tert-Butyl benzene						
98-07-7	Benzotrichloride						
98-82-8	Cumene						
98-83-9	Methyl styrene (mixed isomers)						
98-86-2	Acetophenone						
98-95-3	Nitrobenzene	1.28E+03	µg/L	[14]	2.70E+02	µg/L	[10]
99-35-4	1,3,5-Trinitrobenzene						
99-65-0	1,3-Dinitrobenzene	2.14E+01	µg/L	[14]	2.60E+01	µg/L	[10]
99-87-6	p-Cymene						

Table 7-5 Benthic Invertebrate and Aquatic Biota Direct Exposure Toxicity Reference Values

CAS Registry Number	Constituent	Direct Exposure Toxicity Reference Values (*TRV*) of Benthic Invertebrate	Units for Benthic Invert. Direct Exposure *TRV*	Reference	Direct Exposure Toxicity Reference Values (*TRV*) of Aquatic Biota	Units for Aquatic Biota Direct Exposure *TRV*	Reference
All radionuclides combined		1.00E+00	rad/d	[22]	1.00E+00	rad/d	[5]

Reference	Reference (source) for Direct Exposure Toxicity Reference Values of Benthic Invertebrates
[1]	1973. Voronkin,A.S., and Y.T. Loshakov. "Toxic Effect of Pesticides on Tubifex tubifex", Exp. Water Toxicol. (Eksp. Vodn. Toksikol.)5:169-178 (Tubificid Worm LC50, ECOTOX Ref. #9015, accessed February 2013).
[2]	1979. Draper III,A.C., and W.S. Brewer. "Measurement of the Aquatic Toxicity of Volatile Nitrosamines", J. Toxicol. Environ. Health5:985-993 (Turbellarian, Flatworm LC50, ECOTOX Ref. #479, accessed February 2013).
[3]	1980. Bailey,H.C., and D.H.W. Liu. "Lumbriculus variegatus, a Benthic Oligochaete, as a Bioassay Organism", In: J.C.Eaton, P.R.Parrish, and A.C.Hendricks (Eds.), Aquatic Toxicology and Hazard Assessment, 3rd Symposium, ASTM STP 707, Philadelphia, PA:205-215 (Oligochaete, Worm LC50, ECOTOX Ref. #6502, accessed February 2013).
[4]	1983. Slooff,W.. "Benthic Macroinvertebrates and Water Quality Assessment: Some Toxicological Considerations", Aquat. Toxicol.4:73-82 (Hydra LC50, ECOTOX Ref. #15788, accessed February 2013).
[5]	1986. Ewell,W.S., J.W. Gorsuch, R.O. Kringle, K.A. Robillard, and R.C. Spiegel. "Simultaneous Evaluation of the Acute Effects of Chemicals on Seven Aquatic Species", Environ. Toxicol. Chem.5(9): 831-840 (Oligochaete, Worm LC50, ECOTOX Ref. #11951, accessed February 2013).
[6]	1986. Yoshioka,Y., Y. Ose, and T. Sato. "Correlation of the Five Test Methods to Assess Chemical Toxicity and Relation to Physical Properties", Ecotoxicol. Environ. Saf.12(1): 15-21 (Flatworm EC50, ECOTOX Ref. #12513, accessed February 2013).
[7]	1988. Ghatak,D.B., M.M. Hossain, and S.K. Konar. "Acute Toxicity of n-Heptane and n-Hexane on Worm and Fish", Environ. Ecol.6(4):943-947 (Oligochaete LC50, ECOTOX Ref. #771, accessed February 2013).
[8]	1994. Djian,C., M. Ponchet, and J.C. Cayrol. "Nematocidal Properties of Carboxylic Acids and Derivatives", Pestic. Biochem. Physiol.50(3): 229-239 (Peanut Root-Knot Nematode LC50, ECOTOX Ref. #96598, accessed February 2013).
[9]	1999. Guven,K., R.S. Power, S. Avramides, R. Allender, and D.I. De Pomerai. "The Toxicity of Dithiocarbamate Fungicides to Soil Nematodes, Assessed Using a Stress-Inducible Transgenic Strain of Caenorhabditis elegans", J. Biochem. Mol. Toxicol.13(6): 324-333 (Nematode LOEL, ECOTOX Ref. #64567, accessed February 2013).
[10]	2001. Oka,Y.. "Nematicidal Activity of Essential Oil Components Against the Root-Knot Nematode Meloidogyne javanica", Nematology3(2): 159-164 (Javanese Root-Knot Nematode EC50, ECOTOX Ref. #75973, accessed February 2013).
[11]	2004. Morley,N.J., K.M.Y. Leung, D. Morritt, and M. Crane. "Toxicity of Anti-Fouling Biocides to Encysted Metacercariae of Echinoparyphium recurvatum (Digenea: Echinostomatidae) and Their Snail Hosts", Chemosphere56(4): 353-358 (Trematode NOEC, ECOTOX Ref. #80004, accessed February 2013).

Reference	Reference (source) for Direct Exposure Toxicity Reference Values of Benthic Invertebrates
[12]	2004. Ruggieri,R.D., P. Pierobon, and G. Kass-Simon. "Pacemaker Activity in Hydra is Modulated by Glycine Receptor Ligands", Comp. Biochem. Physiol. A Mol. Integr. Physiol.138(2): 193-202 (Hydra LOEL, ECOTOX Ref. #108849, accessed February 2013).
[13]	2005. Thompson,G., and D.I. De Pomerai. "Toxicity of Short-Chain Alcohols to the Nematode Caenorhabditis elegans: A Comparison of Endpoints", J. Biochem. Mol. Toxicol.19(2): 87-95 (Nematode LC50, ECOTOX Ref. #114242, accessed February 2013).
[14]	EPA. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Peer Review Draft*, EPA 530-D-99-001A. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC (Table E-3).
[15]	EPA. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Peer Review Draft*, EPA 530-D-99-001A. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC (equilibrium partitioning approach used per Eq. E-1).
[16]	EPA. 2003. *Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures*, EPA/600/R-02/013, U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC.
[17]	EPA. 2008. *Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Compendium of Tier 2 Values for Nonionic Organics*, EPA/600/R-02/016, U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC.
[18]	EPA. 2008. *Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Compendium of Tier 2 Values for Nonionic Organics*, EPA/600/R-02/016, U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC. (benchmark value for m-Xylene)
[19]	Ecology. 1994. *Creation of Freshwater Sediment Quality Database and Preliminary Analysis of Freshwater Apparent Effects Thresholds, June 1994*. Washington State Department of Ecology, Olympia, Washington, USA.
[20]	Ecology. 1997. *1997 Model Toxics Control Act Annual Report*, Publication 97-606. Washington State Department of Ecology, Olympia, Washington, USA.
[21]	Jones DS, Suter G W II, and Hull RN. 1997. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Sediment-Associated Biota, 1997 Revision*, ES/ER/TM-95/R3. Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA. (equilibrium partitioning approach used per Eq. E-1)
[22]	NCRP. 1991. "Effects of Ionizing Radiation on Aquatic Organisms," NCRP Report No. 109. National Council on Radiation Protection and Measurements, Bethesda, Maryland, USA.
[23]	Persaud D, Jaagumagi R, and Hayton A. 1993. *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario*. Ontario Ministry of the Environment and Energy, Ontario, Canada.

Reference	Reference (source) for Ingestion Toxicity Reference Values of Aquatic Receptors
[1]	EPA. 1987. *Quality Criteria for Water 1986 and Update no. 1 and Update no. 2 (May 1, 1987)*, EPA-440/5-86-001. US Environmental Protection Agency, Washington, DC, USA.
[2]	EPA. 2003. *Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures*, EPA/600/R-02/013, U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC.
[3]	EPA. 2008. *Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Compendium of Tier 2 Values for Nonionic Organics*, EPA/600/R-02/016, U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC.

Reference	Reference (source) for Ingestion Toxicity Reference Values of Aquatic Receptors
[4]	EPA. 2008. *Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Compendium of Tier 2 Values for Nonionic Organics*, EPA/600/R-02/016, U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC. (benchmark value for m-Xylene)
[5]	NCRP. 1991. "Effects of Ionizing Radiation on Aquatic Organisms," NCRP Report No. 109. National Council on Radiation Protection and Measurements, Bethesda, Maryland, USA.
[6]	Suter II GW and Tsao CL. 1996. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision, ES/ER/TM 96/R2. Lockheed Martin Energy Systems, Inc., Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA. (NAWQC chronic value)
[7]	Suter II GW and Tsao CL. 1996. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision, ES/ER/TM 96/R2. Lockheed Martin Energy Systems, Inc., Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA. (Region IV chronic screening value)
[8]	Suter II GW and Tsao CL. 1996. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision*, ES/ER/TM 96/R2. Lockheed Martin Energy Systems, Inc., Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA. (TRV for chloride used as surrogate, Region IV chronic screening value)
[9]	Suter II GW and Tsao CL. 1996. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision*, ES/ER/TM 96/R2. Lockheed Martin Energy Systems, Inc., Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA. (Tier II Chronic)
[10]	Table E-1 from EPA. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Peer Review Draft*, EPA 530-D-99-001. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC, USA. (http://www.epa.gov/epaoswer/hazwaste/combust/ecorisk.htm)

Table 7-6 provides ingestion TRVs for the Canadian goose and the spotted sandpiper. Note that units vary, with units of mass of contaminant per body weight (BW) of the receptor, per day for chemical consistuents, and units of rad per day for radioisotopes. Blank entries in the table indicate where data are not available.

Table 7-6 Canadian Goose and Spotted Sandpiper Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Canadian Goose	Units for Canadian Goose Ingestion *TRV*	Reference	Ingestion *TRV* of the Spotted Sandpiper	Units for Spotted Sandpiper Ingestion *TRV*	Reference
100-02-7	p-Nitrophenol						
100-21-0	Phthalic acid						
100-25-4	1,4-Dinitrobenzene						
100-40-3	4-Ethenylcyclohexene						
100-41-4	Ethyl benzene						
100-42-5	Styrene						
100-44-7	Benzyl chloride						
100-47-0	Benzonitrile						
100-51-6	Benzyl alcohol						
100-52-7	Benzaldehyde						
10028-15-6	Ozone						
10028-17-8	Tritium	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
10045-97-3	Cesium-137	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
10061-01-5	cis-1,3-Dichloropropene						
10061-02-6	trans-1,3-Dichloropropene						
10098-91-6	Yttrium-90	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
10098-97-2	Strontium-90	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
101-55-3	4-Bromophenylphenyl ether						
101-77-9	4,4-Methylenedianiline						
10102-44-0	Nitrogen dioxide						
10198-40-0	Cobalt-60	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
103-33-3	Azobenzene						
103-65-1	n-Propyl benzene (isocumene)						
104-51-8	n-Butylbenzene						
104-76-7	2-Ethyl-1-hexanol						

Table 7-6 Canadian Goose and Spotted Sandpiper Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Canadian Goose	Units for Canadian Goose Ingestion *TRV*	Reference	Ingestion *TRV* of the Spotted Sandpiper	Units for Spotted Sandpiper Ingestion *TRV*	Reference
105-67-9	2,4-Dimethylphenol						
10595-95-6	n-Nitrosomethylethylamine						
106-43-4	4-Chlorotoluene (p-tolyl chloride)						
106-44-5	p-Cresol (4-methyl phenol)						
106-46-7	1,4-Dichlorobenzene						
106-47-8	p-Chloroaniline						
106-49-0	p-Toluidine						
106-51-4	Quinone						
106-88-7	1,2-Epoxybutane						
106-89-8	Epichlorohydrin (1-chloro-2,3-epoxypropane)						
106-93-4	Ethylene dibromide						
106-99-0	1,3-Butadiene						
107-02-8	Acrolein	6.51E-03	mg/kg BW /d	[1]			
107-05-1	3-Chloropropene						
107-06-2	1,2-Dichloroethane	1.72E+04	µg/kg BW /d	[4]	1.72E+04	µg/kg BW /d	[3]
107-12-0	Propionitrile						
107-13-1	Acrylonitrile						
107-19-7	Propargyl alcohol						
107-21-1	Ethylene glycol (1,2-ethanediol)						
107-98-2	Propylene glycol monomethyl ether						
108-05-4	Acetic acid vinyl ester						
108-10-1	4-Methyl-2-pentanone						
108-39-4	m-Cresol						
108-60-1	bis(2-Chloroisopropyl) ether						
108-67-8	1,3,5-Trimethylbenzene						
108-86-1	Bromobenzene (phenyl bromide)						
108-87-2	Methylcyclohexane						
108-88-3	Toluene						

Table 7-6 Canadian Goose and Spotted Sandpiper Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Canadian Goose	Units for Canadian Goose Ingestion *TRV*	Reference	Ingestion *TRV* of the Spotted Sandpiper	Units for Spotted Sandpiper Ingestion *TRV*	Reference
108-90-7	Chlorobenzene						
108-94-1	Cyclohexanone						
108-95-2	Phenol						
109-74-0	n-Butanenitrile						
109-75-1	3-Butenenitrile						
109-77-3	Malononitrile						
109-86-4	2-Methoxyethanol						
109-99-9	Tetrahydrofuran						
110-00-9	Furan						
110-54-3	n-Hexane						
110-59-8	Pentanenitrile						
110-80-5	2-Ethoxyethanol						
110-82-7	Cyclohexane						
110-83-8	Cyclohexene						
110-86-1	Pyridine						
111-15-9	Ethylene glycol monoethyl ether acetate						
111-44-4	bis(2-Chloroethyl)ether						
111-65-9	n-Octane						
111-76-2	2-Butoxyethanol						
111-84-2	n-Nonane						
111-91-1	bis(2-Chloroethoxy)methane						
112-30-1	1-Decanol						
112-31-2	Decanal						
112-40-3	Dodecane						
1120-21-4	Undecane						
1120-71-4	1,3-Propane sultone						
117-81-7	bis(2-Ethylhexyl)phthalate	1.11E+02	µg/kg BW /d	[2]	1.11E+02	µg/kg BW /d	[1]
117-84-0	Di-n-octylphthalate						

Table 7-6 Canadian Goose and Spotted Sandpiper Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Canadian Goose	Units for Canadian Goose Ingestion *TRV*	Reference	Ingestion *TRV* of the Spotted Sandpiper	Units for Spotted Sandpiper Ingestion *TRV*	Reference
118-74-1	Hexachlorobenzene	2.25E+02	µg/kg BW /d	[2]	2.25E+02	µg/kg BW /d	[1]
119-90-4	3,3'-Dimethoxybenzidine						
120-12-7	Anthracene						
120-82-1	1,2,4-Trichlorobenzene						
120-83-2	2,4-Dichlorophenol						
121-14-2	2,4-Dinitrotoluene						
122-39-4	N,N-Diphenylamine						
122-66-7	1,2-Diphenylhydrazine						
123-33-1	Maleic hydrazide						
123-38-6	Propionaldehyde						
123-72-8	Butanal						
123-91-1	1,4-Dioxan						
124-18-5	Decane						
124-38-9	Carbon dioxide						
124-48-1	Chlorodibromomethane						
126-73-8	Tributyl phosphate						
126-98-7	2-Methyl-2-propenenitrile						
127-18-4	1,1,2,2-Tetrachloroethene						
128-37-0	2,6-bis(tert-butyl)-4-Methylphenol						
129-00-0	Pyrene						
131-11-3	Dimethyl Phthalate						
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol						
132-64-9	Dibenzofuran						
133-06-2	Captan	1.43E+00	mg/kg BW /d	[1]			
1330-20-7	Xylenes (mixed isomers)						
1336-36-3	Polychlorinated biphenyls	7.20E+01	µg/kg BW /d	[2]	7.20E+01	µg/kg BW /d	[1]
134-32-7	alpha-Naphthylamine						
135-98-8	sec-Butylbenzene						
13966-29-5	Uranium-234	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]

Table 7-6 Canadian Goose and Spotted Sandpiper Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Canadian Goose	Units for Canadian Goose Ingestion *TRV*	Reference	Ingestion *TRV* of the Spotted Sandpiper	Units for Spotted Sandpiper Ingestion *TRV*	Reference
13967-48-1	Ruthenium-106	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
13967-70-9	Cesium-134	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
13968-55-3	Uranium-233	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
13981-15-2	Curium-244	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
13981-16-3	Plutonium-238	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
13981-37-8	Nickel-63	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
13982-10-0	Plutonium-242	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
13982-63-3	Radium-226	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
13982-70-2	Uranium-236	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
13994-20-2	Neptunium-237	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
141-78-6	Acetic acid ethyl ester						
14119-32-5	Plutonium-241	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
14119-33-6	Plutonium-240	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
14133-76-7	Technetium-99	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
14158-29-3	Uranium-232	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
14234-35-6	Antimony-125	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
14265-44-2	Phosphate						
14331-85-2	Protactinium-231	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
14336-70-0	Nickel-59	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
14391-16-3	Europium-155	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
145-73-3	Endothall	1.64E-01	mg/kg BW /d	[1]			
14596-10-2	Americium-241	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
14683-23-9	Europium-152	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
14762-75-5	Carbon-14	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
14797-55-8	Nitrate						
14797-65-0	Nitrite						
14808-79-8	Sulfate						
14952-40-0	Actinium-227	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
14993-75-0	Americium-243	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]

Table 7-6 Canadian Goose and Spotted Sandpiper Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Canadian Goose	Units for Canadian Goose Ingestion *TRV*	Reference	Ingestion *TRV* of the Spotted Sandpiper	Units for Spotted Sandpiper Ingestion *TRV*	Reference
15046-84-1	Iodine-129	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
15117-48-3	Plutonium-239	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
15117-96-1	Uranium-235	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
15262-20-1	Radium-228	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
15510-73-3	Curium-242	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
15585-10-1	Europium-154	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
15594-54-4	Thorium-229	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
156-59-2	cis-1,2-Dichloroethene						
156-60-5	1,2-trans-Dichloroethene						
15715-94-3	Samarium-151	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
15751-77-6	Zirconium-93	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
15757-87-6	Curium-243	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
15758-45-9	Selenium-79	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
15832-50-5	Tin-126	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
1634-04-4	Methyl tert-butyl ether						
16887-00-6	Chloride						
16984-48-8	Fluoride	7.80E+00	mg/kg BW /d	[4]	7.80E+00	mg/kg BW /d	[3]
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1.00E-02	µg/kg BW /d	[2]	1.00E-02	µg/kg BW /d	[1]
18540-29-9	Chromium(VI)	1.00E+00	mg/kg BW /d	[2]	1.00E+00	mg/kg BW /d	[1]
189-55-9	Dibenzo[a,i]pyrene						
189-64-0	Dibenzo[a,h]pyrene						
191-24-2	Benzo[g,h,i]perylene						
191-30-0	Dibenzo[a,l]pyrene						
192-65-4	Dibenzo[a,e]pyrene						
192-97-2	Benzo[e]pyrene						
193-39-5	Indeno[1,2,3-cd]pyrene	1.00E+00	µg/kg BW /d	[2]	1.00E+00	µg/kg BW /d	[1]
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin						

Table 7-6 Canadian Goose and Spotted Sandpiper Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Canadian Goose	Units for Canadian Goose Ingestion *TRV*	Reference	Ingestion *TRV* of the Spotted Sandpiper	Units for Spotted Sandpiper Ingestion *TRV*	Reference
205-82-3	Benzo[j]fluoranthene						
205-99-2	Benzo[b]fluoranthene	1.40E-01	µg/kg BW /d	[2]	1.40E-01	µg/kg BW /d	[1]
206-44-0	Fluoranthene						
207-08-9	Benzo[k]fluoranthene	1.40E-01	µg/kg BW /d	[2]	1.40E-01	µg/kg BW /d	[1]
208-96-8	Acenaphthylene						
218-01-9	Chrysene	1.00E+00	µg/kg BW /d	[2]	1.00E+00	µg/kg BW /d	[1]
224-42-0	Dibenz[a,j]acridine						
2245-38-7	2,3,5-Trimethylnaphthalene						
226-36-8	Dibenz[a,h]acridine						
22967-92-6	Methyl mercury	6.40E-03	mg/kg BW /d	[2]	6.40E-03	mg/kg BW /d	[1]
23950-58-5	Pronamide						
24959-67-9	Bromide						
27154-33-2	Trichlorofluoroethane						
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)						
319-84-6	alpha-BHC						
319-85-7	beta-BHC						
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)						
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)						
3268-87-9	Octachlorodibenzo(p)dioxin						
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)						
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin						
3697-24-3	5-Methylchrysene						
378253-40-8	Barium-137m	1.00E-01	mg/kg BW /d	[3]	1.00E-01	mg/kg BW /d	[2]
378253-44-2	Cadmium-113m						
378782-82-2	Niobium-93m	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]

Table 7-6 Canadian Goose and Spotted Sandpiper Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Canadian Goose	Units for Canadian Goose Ingestion *TRV*	Reference	Ingestion *TRV* of the Spotted Sandpiper	Units for Spotted Sandpiper Ingestion *TRV*	Reference
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)						
39001-02-0	Octachlorodibenzofuran						
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo (p)dioxin						
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)						
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin						
4170-30-3	Crotonaldehyde (propylene aldehyde)						
41851-50-7	Chlorocyclopentadiene						
460-19-5	Cyanogen (oxalonitrile)						
4786-20-3	2-Butenenitrile						
50-00-0	Formaldehyde						
50-32-8	Benzo[a]pyrene	1.00E+00	µg/kg BW /d	[2]	1.00E+00	µg/kg BW /d	[1]
506-68-3	Cyanogen bromide (bromocyanide)						
506-77-4	Cyanogen chloride						
51-28-5	2,4-Dinitrophenol						
51-79-6	Ethyl carbamate (urethane)						
510-15-6	Chlorobenzilate						
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	1.00E-03	µg/kg BW /d	[4]	1.00E-03	µg/kg BW /d	[3]
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)						
528-29-0	1,2-Dinitrobenzene (o-dinitrobenzene)						
53-70-3	Dibenz[a,h]anthracene	3.90E-01	µg/kg BW /d	[2]	3.90E-01	µg/kg BW /d	[1]
532-27-4	2-Chloroacetophenone						
534-52-1	4,6-Dinitro-o-cresol	1.62E-02	mg/kg BW /d	[1]			
5385-75-1	Dibenzo[a,e]fluoranthene						
540-59-0	1,2-Dichloroethene (total)						

Table 7-6 Canadian Goose and Spotted Sandpiper Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Canadian Goose	Units for Canadian Goose Ingestion *TRV*	Reference	Ingestion *TRV* of the Spotted Sandpiper	Units for Spotted Sandpiper Ingestion *TRV*	Reference
540-73-8	1,2-Dimethylhydrazine						
540-84-1	2,2,4-Trimethylpentane						
541-73-1	1,3-Dichlorobenzene						
542-75-6	1,3-Dichloropropene						
542-88-1	bis(Chloromethyl)ether						
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran						
56-23-5	Carbon tetrachloride						
56-49-5	3-Methylcholanthrene						
56-55-3	Benzo[a]anthracene	7.90E-01	µg/kg BW /d	[2]	7.90E-01	µg/kg BW /d	[1]
57-12-5	Cyanide	4.00E-02	mg/kg BW /d	[2]	4.00E-02	mg/kg BW /d	[1]
57-24-9	Strychnine	1.43E-03	mg/kg BW /d	[1]			
57-74-9	Chlordane	2.14E+03	µg/kg BW /d	[4]	2.14E+03	µg/kg BW /d	[3]
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran						
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran						
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran						
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)						
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin						
58-89-9	gamma-BHC (Lindane)	2.00E+03	µg/kg BW /d	[4]	2.00E+03	µg/kg BW /d	[3]
58-90-2	2,3,4,6-Tetrachlorophenol						
581-42-0	2,6-Dimethylnaphthalene						
584-84-9	2,4-Toluene diisocyanate						
589-38-8	3-Hexanone						
59-50-7	4-Chloro-3-methylphenol						
59-89-2	N-Nitrosomorpholine						
591-50-4	Benzene, iodo-						
591-78-6	2-Hexanone						
593-60-2	Bromoethene (vinyl bromide)						

Table 7-6 Canadian Goose and Spotted Sandpiper Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Canadian Goose	Units for Canadian Goose Ingestion *TRV*	Reference	Ingestion *TRV* of the Spotted Sandpiper	Units for Spotted Sandpiper Ingestion *TRV*	Reference
593-74-8	Dimethyl mercury						
60-11-7	Dimethyl aminoazobenzene						
60-29-7	Ethyl ether						
60-35-5	Acetamide						
602-87-9	5-Nitroacenaphthene						
606-20-2	2,6-Dinitrotoluene						
608-93-5	Pentachlorobenzene						
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran						
61626-71-9	Dichloropentadiene						
62-50-0	Ethyl methanesulfonate						
62-53-3	Aniline						
62-75-9	N-Nitroso-N,N-dimethylamine						
621-64-7	N-Nitroso-di-n-propylamine						
624-83-9	Methyl isocyanate						
628-73-9	Hexanenitrile						
630-08-0	Carbon monoxide						
630-20-6	1,1,1,2-Tetrachloroethane						
64-18-6	Formic acid (methanoic acid)						
65-85-0	Benzoic acid						
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)						
67-56-1	Methyl alcohol						
67-63-0	2-Propyl alcohol						
67-64-1	2-Propanone (acetone)	5.20E+04	µg/kg BW /d	[2]	5.20E+04	µg/kg BW /d	[1]
67-66-3	Chloroform						
67-72-1	Hexachloroethane						
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran						
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)						

Table 7-6 Canadian Goose and Spotted Sandpiper Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Canadian Goose	Units for Canadian Goose Ingestion *TRV*	Reference	Ingestion *TRV* of the Spotted Sandpiper	Units for Spotted Sandpiper Ingestion *TRV*	Reference
70-30-4	Hexachlorophene	5.75E+03	µg/kg BW /d	[2]	5.75E+03	µg/kg BW /d	[1]
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)						
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran						
71-36-3	n-Butyl alcohol						
71-43-2	Benzene						
71-55-6	1,1,1-Trichloroethane						
72-43-5	Methoxychlor	1.43E+00	mg/kg BW /d	[1]			
72-55-9	4,4-DDE	8.45E+02	µg/kg BW /d	[2]	8.45E+02	µg/kg BW /d	[1]
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran						
74-83-9	Bromomethane						
74-87-3	Chloromethane						
74-88-4	Iodomethane						
74-95-3	Methylene bromide						
74-97-5	Bromochloromethane						
7429-90-5	Aluminum	1.00E+02	mg/kg BW /d	[2]	1.00E+02	mg/kg BW /d	[1]
7439-89-6	Iron						
7439-92-1	Lead	2.50E-02	mg/kg BW /d	[2]	2.50E-02	mg/kg BW /d	[1]
7439-93-2	Lithium						
7439-95-4	Magnesium						
7439-96-5	Manganese	9.77E+02	mg/kg BW /d	[4]	9.77E+02	mg/kg BW /d	[3]
7439-97-6	Mercury						
7439-98-7	Molybdenum	3.53E+00	mg/kg BW /d	[4]	3.53E+00	mg/kg BW /d	[3]
7440-02-0	Nickel	6.50E+01	mg/kg BW /d	[2]	6.50E+01	mg/kg BW /d	[1]
7440-16-6	Rhodium						
7440-22-4	Silver	1.78E+02	mg/kg BW /d	[2]	1.78E+02	mg/kg BW /d	[1]
7440-23-5	Sodium						
7440-24-6	Strontium (total)						
7440-25-7	Tantalum						

Table 7-6 Canadian Goose and Spotted Sandpiper Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Canadian Goose	Units for Canadian Goose Ingestion *TRV*	Reference	Ingestion *TRV* of the Spotted Sandpiper	Units for Spotted Sandpiper Ingestion *TRV*	Reference
7440-28-0	Thallium	3.50E-01	mg/kg BW /d	[2]	3.50E-01	mg/kg BW /d	[1]
7440-29-1	Thorium-232	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
7440-31-5	Tin						
7440-33-7	Tungsten						
7440-36-0	Antimony						
7440-38-2	Arsenic	2.46E+00	mg/kg BW /d	[2]	2.46E+00	mg/kg BW /d	[1]
7440-39-3	Barium	2.08E+01	mg/kg BW /d	[2]	2.08E+01	mg/kg BW /d	[1]
7440-41-7	Beryllium						
7440-43-9	Cadmium	1.45E+00	mg/kg BW /d	[2]	1.45E+00	mg/kg BW /d	[1]
7440-47-3	Chromium						
7440-48-4	Cobalt						
7440-50-8	Copper	4.70E+01	mg/kg BW /d	[2]	4.70E+01	mg/kg BW /d	[1]
7440-61-1	Uranium	1.60E+01	mg/kg BW /d	[4]	1.60E+01	mg/kg BW /d	[3]
7440-61-1R	Uranium-238	1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]
7440-62-2	Vanadium	1.14E+01	mg/kg BW /d	[4]	1.14E+01	mg/kg BW /d	[3]
7440-65-5	Yttrium						
7440-66-6	Zinc	1.31E+02	mg/kg BW /d	[2]	1.31E+02	mg/kg BW /d	[1]
7440-67-7	Zirconium						
7446-09-5	Sulfur dioxide						
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)						
7487-94-7	Mercuric chloride ($HgCl_2$)	3.25E+00	mg/kg BW /d	[2]	3.25E+00	mg/kg BW /d	[1]
75-00-3	Chloroethane						
75-01-4	1-Chloroethene						
75-02-5	Fluoroethene (vinyl fluoride)						
75-05-8	Acetonitrile						
75-07-0	Acetaldehyde						
75-09-2	Dichloromethane (methylene chloride)						

Table 7-6 Canadian Goose and Spotted Sandpiper Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Canadian Goose	Units for Canadian Goose Ingestion *TRV*	Reference	Ingestion *TRV* of the Spotted Sandpiper	Units for Spotted Sandpiper Ingestion *TRV*	Reference
75-15-0	Carbon disulfide						
75-21-8	Ethylene oxide (Oxirane)						
75-25-2	Bromoform						
75-27-4	Bromodichloromethane						
75-29-6	2-Chloropropane						
75-34-3	1,1-Dichloroethane						
75-35-4	1,1-Dichloroethene						
75-44-5	Phosgene (hydrogen phosphide)						
75-45-6	Chlorodifluoromethane						
75-50-3	Trimethylamine						
75-69-4	Trichlorofluoromethane						
75-71-8	Dichlorodifluoromethane						
76-01-7	Pentachloroethane						
76-13-1	1,2,2-Trichlorotrifluoroethane						
76-44-8	Heptachlor	6.50E+01	µg/kg BW /d	[2]	6.50E+01	µg/kg BW /d	[1]
764-41-0	1,4-Dichloro-2-butene						
7647-01-0	Hydrogen chloride						
765-34-4	Glycidylaldehyde						
7664-39-3	Hydrogen fluoride	7.80E+00	mg/kg BW /d	[4]	7.80E+00	mg/kg BW /d	[3]
7664-41-7	Ammonia/Ammonium						
77-47-4	Hexachlorocyclopentadiene						
77-78-1	Dimethyl sulfate						
7704-34-9	Total Sulfur (thermodynamically stable)						
7723-14-0	Phosphorus						
7782-41-4	Fluorine gas (F_2)						
7782-49-2	Selenium	5.00E-01	mg/kg BW /d	[2]	5.00E-01	mg/kg BW /d	[1]
7782-50-5	Chlorine						
78-83-1	2-Methylpropyl alcohol						

Table 7-6 Canadian Goose and Spotted Sandpiper Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Canadian Goose	Units for Canadian Goose Ingestion *TRV*	Reference	Ingestion *TRV* of the Spotted Sandpiper	Units for Spotted Sandpiper Ingestion *TRV*	Reference
78-87-5	1,2-Dichloropropane						
78-93-3	2-Butanone						
79-00-5	1,1,2-Trichloroethane						
79-01-6	1,1,2-Trichloroethylene						
79-10-7	2-Propenoic acid						
79-34-5	1,1,2,2-Tetrachloroethane						
79-46-9	2-Nitropropane						
80-62-6	Methyl methacrylate						
82-68-8	Pentachloronitrobenzene (PCNB)	6.88E+04	µg/kg BW /d	[2]	6.88E+04	µg/kg BW /d	[1]
822-06-0	Hexamethylene-1,5-diisocyanate						
823-40-5	Toluene-2,6-diamine						
83-32-9	Acenaphthene						
832-69-9	1-Methylphenanthrene						
84-66-2	Diethyl phthalate						
84-74-2	Di-n-butylphthalate	1.11E+02	µg/kg BW /d	[4]	1.11E+02	µg/kg BW /d	[3]
85-01-8	Phenanthrene						
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)						
85-68-7	Butylbenzylphthalate						
86-73-7	Fluorene						
87-61-6	1,2,3-Trichlorobenzene						
87-68-3	Hexachlorobutadiene	3.19E+03	µg/kg BW /d	[2]	3.19E+03	µg/kg BW /d	[1]
87-86-5	Pentachlorophenol	4.03E+03	µg/kg BW /d	[2]	4.03E+03	µg/kg BW /d	[1]
88-06-2	2,4,6-Trichlorophenol						
88-74-4	o-Nitroaniline (2-nitroaniline)						
88-75-5	2-Nitrophenol						
90-04-0	o-Anisidine						
90-12-0	1-Methylnaphthalene						

Table 7-6 Canadian Goose and Spotted Sandpiper Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Canadian Goose	Units for Canadian Goose Ingestion *TRV*	Reference	Ingestion *TRV* of the Spotted Sandpiper	Units for Spotted Sandpiper Ingestion *TRV*	Reference
91-20-3	Naphthalene						
91-22-5	Quinoline						
91-57-6	2-Methylnaphthalene						
91-58-7	2-Chloronaphthalene						
91-94-1	3,3'-Dichlorobenzidine						
92-52-4	1,1`-Biphenyl						
924-16-3	N-Nitroso-di-n-Buetylamine						
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)						
94-75-7	2,4-D						
95-48-7	o-Cresol						
95-49-8	o-Chlorotoluene						
95-50-1	1,2-Dichlorobenzene						
95-53-4	o-Toluidine						
95-57-8	2-Chlorophenol						
95-63-6	1,2,4-Trimethyl benzene						
95-94-3	1,2,4,5-Tetrachlorobenzene						
95-95-4	2,4,5-Trichlorophenol						
96-12-8	1,2-Dibromo-3-chloropropane						
96-18-4	1,2,3-Trichloropropane						
96-45-7	Ethylene thiourea						
97-63-2	Ethyl methacrylate						
98-01-1	Furfural						
98-06-6	tert-Butyl benzene						
98-07-7	Benzotrichloride						
98-82-8	Cumene						
98-83-9	Methyl styrene (mixed isomers)						
98-86-2	Acetophenone						
98-95-3	Nitrobenzene						

Table 7-6 Canadian Goose and Spotted Sandpiper Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Canadian Goose	Units for Canadian Goose Ingestion *TRV*	Reference	Ingestion *TRV* of the Spotted Sandpiper	Units for Spotted Sandpiper Ingestion *TRV*	Reference
99-35-4	1,3,5-Trinitrobenzene						
99-65-0	1,3-Dinitrobenzene	4.22E-01	µg/kg BW /d	[2]	4.22E-01	µg/kg BW /d	[1]
99-87-6	p-Cymene						
All radionuclides combined		1.00E-01	rad/d	[3]	1.00E-01	rad/d	[2]

Reference **Reference (source) for Ingestion Toxicity Reference Values of the Canadian Goose**

[1] 1984. Hudson,R.H., R.K. Tucker, and M.A. Haegele. "Handbook of Toxicity of Pesticides to Wildlife", Resource Publication 153, Fish and Wildlife Service, U.S. Department of the Interior:90 p. (Mallard Duck LD50, ECOTOX Ref. #50386, accessed February 2013).

[2] EPA. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Peer Review Draft*, EPA 530-D-99-001. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC, USA. (http://www.epa.gov/epaoswer/hazwaste/combust/ecorisk.htm)

[3] IAEA. 1992. "Effects of Ionizing Radiation on Plants and Animals at Levels Implied by Current Radiation Protection Standards," IAEA Technical Report Series 332, International Commission on Radiological Protection, Vienna, Austria.

[4] Sample BE, Opresko DM, and Suter II GW. 1996. *Toxicological Benchmarks for Wildlife: 1996 Revision*, ES/ER/TM-86/R3, Lockheed Martin Energy Systems, Inc., Oak Ridge National Laboratory, Oak Ridge, TN

Reference **Reference (source) for Ingestion Toxicity Reference Values of the Spotted Sandpiper**

[1] EPA. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Peer Review Draft*, EPA 530-D-99-001. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC, USA. (http://www.epa.gov/epaoswer/hazwaste/combust/ecorisk.htm)

[2] IAEA. 1992. "Effects of Ionizing Radiation on Plants and Animals at Levels Implied by Current Radiation Protection Standards," IAEA Technical Report Series 332, International Commission on Radiological Protection, Vienna, Austria.

[3] Sample BE, Opresko DM, and Suter II GW. 1996. *Toxicological Benchmarks for Wildlife: 1996 Revision*, ES/ER/TM-86/R3, Lockheed Martin Energy Systems, Inc., Oak Ridge National Laboratory, Oak Ridge, TN

Table 7-7 provides ingestion TRVs for the bald eagle and the great blue heron. Note that units vary, with units of mass of contaminant per body weight (BW) of the receptor, per day for chemical consistuents, and units of rad per day for radioisotopes. Blank entries in the table indicate where data are not available.

Table 7-7 Bald Eagle and Great Blue Heron Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Bald Eagle	Units for Bald Eagle Ingestion *TRV*	Reference	Ingestion *TRV* of the Great Blue Heron	Units for Great Blue Heron Ingestion *TRV*	Reference
100-02-7	p-Nitrophenol						
100-21-0	Phthalic acid						
100-25-4	1,4-Dinitrobenzene						
100-40-3	4-Ethenylcyclohexene						
100-41-4	Ethyl benzene						
100-42-5	Styrene						
100-44-7	Benzyl chloride						
100-47-0	Benzonitrile						
100-51-6	Benzyl alcohol						
100-52-7	Benzaldehyde						
10028-15-6	Ozone						
10028-17-8	Tritium	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
10045-97-3	Cesium-137	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
10061-01-5	cis-1,3-Dichloropropene						
10061-02-6	trans-1,3-Dichloropropene						
10098-91-6	Yttrium-90	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
10098-97-2	Strontium-90	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
101-55-3	4-Bromophenylphenyl ether						
101-77-9	4,4-Methylenedianiline						
10102-44-0	Nitrogen dioxide						
10198-40-0	Cobalt-60	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
103-33-3	Azobenzene						
103-65-1	n-Propyl benzene (isocumene)						
104-51-8	n-Butylbenzene						
104-76-7	2-Ethyl-1-hexanol						
105-67-9	2,4-Dimethylphenol						
10595-95-6	n-Nitrosomethylethylamine						

Table 7-7 Bald Eagle and Great Blue Heron Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Bald Eagle	Units for Bald Eagle Ingestion *TRV*	Reference	Ingestion *TRV* of the Great Blue Heron	Units for Great Blue Heron Ingestion *TRV*	Reference
106-43-4	4-Chlorotoluene (p-tolyl chloride)						
106-44-5	p-Cresol (4-methyl phenol)						
106-46-7	1,4-Dichlorobenzene						
106-47-8	p-Chloroaniline						
106-49-0	p-Toluidine						
106-51-4	Quinone						
106-88-7	1,2-Epoxybutane						
106-89-8	Epichlorohydrin (1-chloro-2,3-epoxypropane)						
106-93-4	Ethylene dibromide						
106-99-0	1,3-Butadiene						
107-02-8	Acrolein						
107-05-1	3-Chloropropene						
107-06-2	1,2-Dichloroethane	1.72E+04	µg/kg BW /d	[3]	1.72E+04	µg/kg BW /d	[3]
107-12-0	Propionitrile						
107-13-1	Acrylonitrile						
107-19-7	Propargyl alcohol						
107-21-1	Ethylene glycol (1,2-ethanediol)						
107-98-2	Propylene glycol monomethyl ether						
108-05-4	Acetic acid vinyl ester						
108-10-1	4-Methyl-2-pentanone						
108-39-4	m-Cresol						
108-60-1	bis(2-Chloroisopropyl) ether						
108-67-8	1,3,5-Trimethylbenzene						
108-86-1	Bromobenzene (phenyl bromide)						
108-87-2	Methylcyclohexane						
108-88-3	Toluene						
108-90-7	Chlorobenzene						
108-94-1	Cyclohexanone						
108-95-2	Phenol						
109-74-0	n-Butanenitrile						

Table 7-7 Bald Eagle and Great Blue Heron Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Bald Eagle	Units for Bald Eagle Ingestion *TRV*	Reference	Ingestion *TRV* of the Great Blue Heron	Units for Great Blue Heron Ingestion *TRV*	Reference
109-75-1	3-Butenenitrile						
109-77-3	Malononitrile						
109-86-4	2-Methoxyethanol						
109-99-9	Tetrahydrofuran						
110-00-9	Furan						
110-54-3	n-Hexane						
110-59-8	Pentanenitrile						
110-80-5	2-Ethoxyethanol						
110-82-7	Cyclohexane						
110-83-8	Cyclohexene						
110-86-1	Pyridine						
111-15-9	Ethylene glycol monoethyl ether acetate						
111-44-4	bis(2-Chloroethyl)ether						
111-65-9	n-Octane						
111-76-2	2-Butoxyethanol						
111-84-2	n-Nonane						
111-91-1	bis(2-Chloroethoxy)methane						
112-30-1	1-Decanol						
112-31-2	Decanal						
112-40-3	Dodecane						
1120-21-4	Undecane						
1120-71-4	1,3-Propane sultone						
117-81-7	bis(2-Ethylhexyl)phthalate	1.11E+02	µg/kg BW /d	[1]	1.11E+02	µg/kg BW /d	[1]
117-84-0	Di-n-octylphthalate						
118-74-1	Hexachlorobenzene	2.25E+02	µg/kg BW /d	[1]	2.25E+02	µg/kg BW /d	[1]
119-90-4	3,3'-Dimethoxybenzidine						
120-12-7	Anthracene						
120-82-1	1,2,4-Trichlorobenzene						
120-83-2	2,4-Dichlorophenol						
121-14-2	2,4-Dinitrotoluene						

Table 7-7 Bald Eagle and Great Blue Heron Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Bald Eagle	Units for Bald Eagle Ingestion *TRV*	Reference	Ingestion *TRV* of the Great Blue Heron	Units for Great Blue Heron Ingestion *TRV*	Reference
122-39-4	N,N-Diphenylamine						
122-66-7	1,2-Diphenylhydrazine						
123-33-1	Maleic hydrazide						
123-38-6	Propionaldehyde						
123-72-8	Butanal						
123-91-1	1,4-Dioxan						
124-18-5	Decane						
124-38-9	Carbon dioxide						
124-48-1	Chlorodibromomethane						
126-73-8	Tributyl phosphate						
126-98-7	2-Methyl-2-propenenitrile						
127-18-4	1,1,2,2-Tetrachloroethene						
128-37-0	2,6-bis(tert-butyl)-4-Methylphenol						
129-00-0	Pyrene						
131-11-3	Dimethyl Phthalate						
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol						
132-64-9	Dibenzofuran						
133-06-2	Captan						
1330-20-7	Xylenes (mixed isomers)						
1336-36-3	Polychlorinated biphenyls	7.20E+01	µg/kg BW /d	[1]	7.20E+01	µg/kg BW /d	[1]
134-32-7	alpha-Naphthylamine						
135-98-8	sec-Butylbenzene						
13966-29-5	Uranium-234	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
13967-48-1	Ruthenium-106	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
13967-70-9	Cesium-134	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
13968-55-3	Uranium-233	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
13981-15-2	Curium-244	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
13981-16-3	Plutonium-238	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
13981-37-8	Nickel-63	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
13982-10-0	Plutonium-242	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
13982-63-3	Radium-226	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]

Table 7-7 Bald Eagle and Great Blue Heron Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Bald Eagle	Units for Bald Eagle Ingestion *TRV*	Reference	Ingestion *TRV* of the Great Blue Heron	Units for Great Blue Heron Ingestion *TRV*	Reference
13982-70-2	Uranium-236	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
13994-20-2	Neptunium-237	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
141-78-6	Acetic acid ethyl ester						
14119-32-5	Plutonium-241	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
14119-33-6	Plutonium-240	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
14133-76-7	Technetium-99	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
14158-29-3	Uranium-232	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
14234-35-6	Antimony-125	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
14265-44-2	Phosphate						
14331-85-2	Protactinium-231	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
14336-70-0	Nickel-59	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
14391-16-3	Europium-155	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
145-73-3	Endothall						
14596-10-2	Americium-241	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
14683-23-9	Europium-152	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
14762-75-5	Carbon-14	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
14797-55-8	Nitrate						
14797-65-0	Nitrite						
14808-79-8	Sulfate						
14952-40-0	Actinium-227	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
14993-75-0	Americium-243	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
15046-84-1	Iodine-129	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
15117-48-3	Plutonium-239	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
15117-96-1	Uranium-235	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
15262-20-1	Radium-228	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
15510-73-3	Curium-242	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
15585-10-1	Europium-154	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
15594-54-4	Thorium-229	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
156-59-2	cis-1,2-Dichloroethene						
156-60-5	1,2-trans-Dichloroethene						
15715-94-3	Samarium-151	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]

Table 7-7 Bald Eagle and Great Blue Heron Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Bald Eagle	Units for Bald Eagle Ingestion *TRV*	Reference	Ingestion *TRV* of the Great Blue Heron	Units for Great Blue Heron Ingestion *TRV*	Reference
15751-77-6	Zirconium-93	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
15757-87-6	Curium-243	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
15758-45-9	Selenium-79	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
15832-50-5	Tin-126	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
1634-04-4	Methyl tert-butyl ether						
16887-00-6	Chloride						
16984-48-8	Fluoride	7.80E+00	mg/kg BW /d	[3]	7.80E+00	mg/kg BW /d	[3]
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1.00E-02	µg/kg BW /d	[1]	1.00E-02	µg/kg BW /d	[1]
18540-29-9	Chromium(VI)	1.00E+00	mg/kg BW /d	[1]	1.00E+00	mg/kg BW /d	[1]
189-55-9	Dibenzo[a,i]pyrene						
189-64-0	Dibenzo[a,h]pyrene						
191-24-2	Benzo[g,h,i]perylene						
191-30-0	Dibenzo[a,l]pyrene						
192-65-4	Dibenzo[a,e]pyrene						
192-97-2	Benzo[e]pyrene						
193-39-5	Indeno[1,2,3-cd]pyrene	1.00E+00	µg/kg BW /d	[1]	1.00E+00	µg/kg BW /d	[1]
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin						
205-82-3	Benzo[j]fluoranthene						
205-99-2	Benzo[b]fluoranthene	1.40E-01	µg/kg BW /d	[1]	1.40E-01	µg/kg BW /d	[1]
206-44-0	Fluoranthene						
207-08-9	Benzo[k]fluoranthene	1.40E-01	µg/kg BW /d	[1]	1.40E-01	µg/kg BW /d	[1]
208-96-8	Acenaphthylene						
218-01-9	Chrysene	1.00E+00	µg/kg BW /d	[1]	1.00E+00	µg/kg BW /d	[1]
224-42-0	Dibenz[a,j]acridine						
2245-38-7	2,3,5-Trimethylnaphthalene						
226-36-8	Dibenz[a,h]acridine						
22967-92-6	Methyl mercury	6.40E-03	mg/kg BW /d	[1]	6.40E-03	mg/kg BW /d	[1]
23950-58-5	Pronamide						
24959-67-9	Bromide						
27154-33-2	Trichlorofluoroethane						

Table 7-7 Bald Eagle and Great Blue Heron Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Bald Eagle	Units for Bald Eagle Ingestion *TRV*	Reference	Ingestion *TRV* of the Great Blue Heron	Units for Great Blue Heron Ingestion *TRV*	Reference
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)						
319-84-6	alpha-BHC						
319-85-7	beta-BHC						
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)						
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)						
3268-87-9	Octachlorodibenzo(p)dioxin						
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)						
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin						
3697-24-3	5-Methylchrysene						
378253-40-8	Barium-137m	1.00E-01	mg/kg BW /d	[2]	1.00E-01	mg/kg BW /d	[2]
378253-44-2	Cadmium-113m						
378782-82-2	Niobium-93m	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)						
39001-02-0	Octachlorodibenzofuran						
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo (p)dioxin						
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)						
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin						
4170-30-3	Crotonaldehyde (propylene aldehyde)						
41851-50-7	Chlorocyclopentadiene						
460-19-5	Cyanogen (oxalonitrile)						
4786-20-3	2-Butenenitrile						
50-00-0	Formaldehyde						
50-32-8	Benzo[a]pyrene	1.00E+00	µg/kg BW /d	[1]	1.00E+00	µg/kg BW /d	[1]
506-68-3	Cyanogen bromide (bromocyanide)						

Table 7-7 Bald Eagle and Great Blue Heron Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Bald Eagle	Units for Bald Eagle Ingestion *TRV*	Reference	Ingestion *TRV* of the Great Blue Heron	Units for Great Blue Heron Ingestion *TRV*	Reference
506-77-4	Cyanogen chloride						
51-28-5	2,4-Dinitrophenol						
51-79-6	Ethyl carbamate (urethane)						
510-15-6	Chlorobenzilate						
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	1.00E-03	µg/kg BW /d	[3]	1.00E-03	µg/kg BW /d	[3]
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)						
528-29-0	1,2-Dinitrobenzene (o-dinitrobenzene)						
53-70-3	Dibenz[a,h]anthracene	3.90E-01	µg/kg BW /d	[1]	3.90E-01	µg/kg BW /d	[1]
532-27-4	2-Chloroacetophenone						
534-52-1	4,6-Dinitro-o-cresol						
5385-75-1	Dibenzo[a,e]fluoranthene						
540-59-0	1,2-Dichloroethene (total)						
540-73-8	1,2-Dimethylhydrazine						
540-84-1	2,2,4-Trimethylpentane						
541-73-1	1,3-Dichlorobenzene						
542-75-6	1,3-Dichloropropene						
542-88-1	bis(Chloromethyl)ether						
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran						
56-23-5	Carbon tetrachloride						
56-49-5	3-Methylcholanthrene						
56-55-3	Benzo[a]anthracene	7.90E-01	µg/kg BW /d	[1]	7.90E-01	µg/kg BW /d	[1]
57-12-5	Cyanide	4.00E-02	mg/kg BW /d	[1]	4.00E-02	mg/kg BW /d	[1]
57-24-9	Strychnine						
57-74-9	Chlordane	2.14E+03	µg/kg BW /d	[3]	2.14E+03	µg/kg BW /d	[3]
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran						
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran						
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran						
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)						

Table 7-7 Bald Eagle and Great Blue Heron Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Bald Eagle	Units for Bald Eagle Ingestion *TRV*	Reference	Ingestion *TRV* of the Great Blue Heron	Units for Great Blue Heron Ingestion *TRV*	Reference
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin						
58-89-9	gamma-BHC (Lindane)	2.00E+03	µg/kg BW /d	[3]	2.00E+03	µg/kg BW /d	[3]
58-90-2	2,3,4,6-Tetrachlorophenol						
581-42-0	2,6-Dimethylnaphthalene						
584-84-9	2,4-Toluene diisocyanate						
589-38-8	3-Hexanone						
59-50-7	4-Chloro-3-methylphenol						
59-89-2	N-Nitrosomorpholine						
591-50-4	Benzene, iodo-						
591-78-6	2-Hexanone						
593-60-2	Bromoethene (vinyl bromide)						
593-74-8	Dimethyl mercury						
60-11-7	Dimethyl aminoazobenzene						
60-29-7	Ethyl ether						
60-35-5	Acetamide						
602-87-9	5-Nitroacenaphthene						
606-20-2	2,6-Dinitrotoluene						
608-93-5	Pentachlorobenzene						
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran						
61626-71-9	Dichloropentadiene						
62-50-0	Ethyl methanesulfonate						
62-53-3	Aniline						
62-75-9	N-Nitroso-N,N-dimethylamine						
621-64-7	N-Nitroso-di-n-propylamine						
624-83-9	Methyl isocyanate						
628-73-9	Hexanenitrile						
630-08-0	Carbon monoxide						
630-20-6	1,1,1,2-Tetrachloroethane						
64-18-6	Formic acid (methanoic acid)						
65-85-0	Benzoic acid						

Table 7-7 Bald Eagle and Great Blue Heron Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Bald Eagle	Units for Bald Eagle Ingestion *TRV*	Reference	Ingestion *TRV* of the Great Blue Heron	Units for Great Blue Heron Ingestion *TRV*	Reference
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)						
67-56-1	Methyl alcohol						
67-63-0	2-Propyl alcohol						
67-64-1	2-Propanone (acetone)	5.20E+04	µg/kg BW /d	[1]	5.20E+04	µg/kg BW /d	[1]
67-66-3	Chloroform						
67-72-1	Hexachloroethane						
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran						
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)						
70-30-4	Hexachlorophene	5.75E+03	µg/kg BW /d	[1]	5.75E+03	µg/kg BW /d	[1]
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)						
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran						
71-36-3	n-Butyl alcohol						
71-43-2	Benzene						
71-55-6	1,1,1-Trichloroethane						
72-43-5	Methoxychlor						
72-55-9	4,4-DDE	8.45E+02	µg/kg BW /d	[1]	8.45E+02	µg/kg BW /d	[1]
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran						
74-83-9	Bromomethane						
74-87-3	Chloromethane						
74-88-4	Iodomethane						
74-95-3	Methylene bromide						
74-97-5	Bromochloromethane						
7429-90-5	Aluminum	1.00E+02	mg/kg BW /d	[1]	1.00E+02	mg/kg BW /d	[1]
7439-89-6	Iron						
7439-92-1	Lead	2.50E-02	mg/kg BW /d	[1]	2.50E-02	mg/kg BW /d	[1]
7439-93-2	Lithium						
7439-95-4	Magnesium						
7439-96-5	Manganese	9.77E+02	mg/kg BW /d	[3]	9.77E+02	mg/kg BW /d	[3]

Table 7-7 Bald Eagle and Great Blue Heron Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Bald Eagle	Units for Bald Eagle Ingestion *TRV*	Reference	Ingestion *TRV* of the Great Blue Heron	Units for Great Blue Heron Ingestion *TRV*	Reference
7439-97-6	Mercury						
7439-98-7	Molybdenum	3.53E+00	mg/kg BW /d	[3]	3.53E+00	mg/kg BW /d	[3]
7440-02-0	Nickel	6.50E+01	mg/kg BW /d	[1]	6.50E+01	mg/kg BW /d	[1]
7440-16-6	Rhodium						
7440-22-4	Silver	1.78E+02	mg/kg BW /d	[1]	1.78E+02	mg/kg BW /d	[1]
7440-23-5	Sodium						
7440-24-6	Strontium (total)						
7440-25-7	Tantalum						
7440-28-0	Thallium	3.50E-01	mg/kg BW /d	[1]	3.50E-01	mg/kg BW /d	[1]
7440-29-1	Thorium-232	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
7440-31-5	Tin						
7440-33-7	Tungsten						
7440-36-0	Antimony						
7440-38-2	Arsenic	2.46E+00	mg/kg BW /d	[1]	2.46E+00	mg/kg BW /d	[1]
7440-39-3	Barium	2.08E+01	mg/kg BW /d	[1]	2.08E+01	mg/kg BW /d	[1]
7440-41-7	Beryllium						
7440-43-9	Cadmium	1.45E+00	mg/kg BW /d	[1]	1.45E+00	mg/kg BW /d	[1]
7440-47-3	Chromium						
7440-48-4	Cobalt						
7440-50-8	Copper	4.70E+01	mg/kg BW /d	[1]	4.70E+01	mg/kg BW /d	[1]
7440-61-1	Uranium	1.60E+01	mg/kg BW /d	[3]	1.60E+01	mg/kg BW /d	[3]
7440-61-1R	Uranium-238	1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]
7440-62-2	Vanadium	1.14E+01	mg/kg BW /d	[3]	1.14E+01	mg/kg BW /d	[3]
7440-65-5	Yttrium						
7440-66-6	Zinc	1.31E+02	mg/kg BW /d	[1]	1.31E+02	mg/kg BW /d	[1]
7440-67-7	Zirconium						
7446-09-5	Sulfur dioxide						
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)						
7487-94-7	Mercuric chloride ($HgCl_2$)	3.25E+00	mg/kg BW /d	[1]	3.25E+00	mg/kg BW /d	[1]
75-00-3	Chloroethane						

Table 7-7 Bald Eagle and Great Blue Heron Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Bald Eagle	Units for Bald Eagle Ingestion *TRV*	Reference	Ingestion *TRV* of the Great Blue Heron	Units for Great Blue Heron Ingestion *TRV*	Reference
75-01-4	1-Chloroethene						
75-02-5	Fluoroethene (vinyl fluoride)						
75-05-8	Acetonitrile						
75-07-0	Acetaldehyde						
75-09-2	Dichloromethane (methylene chloride)						
75-15-0	Carbon disulfide						
75-21-8	Ethylene oxide (Oxirane)						
75-25-2	Bromoform						
75-27-4	Bromodichloromethane						
75-29-6	2-Chloropropane						
75-34-3	1,1-Dichloroethane						
75-35-4	1,1-Dichloroethene						
75-44-5	Phosgene (hydrogen phosphide)						
75-45-6	Chlorodifluoromethane						
75-50-3	Trimethylamine						
75-69-4	Trichlorofluoromethane						
75-71-8	Dichlorodifluoromethane						
76-01-7	Pentachloroethane						
76-13-1	1,2,2-Trichlorotrifluoroethane						
76-44-8	Heptachlor	6.50E+01	µg/kg BW /d	[1]	6.50E+01	µg/kg BW /d	[1]
764-41-0	1,4-Dichloro-2-butene						
7647-01-0	Hydrogen chloride						
765-34-4	Glycidylaldehyde						
7664-39-3	Hydrogen fluoride	7.80E+00	mg/kg BW /d	[3]	7.80E+00	mg/kg BW /d	[3]
7664-41-7	Ammonia/Ammonium						
77-47-4	Hexachlorocyclopentadiene						
77-78-1	Dimethyl sulfate						
7704-34-9	Total Sulfur (thermodynamically stable)						
7723-14-0	Phosphorus						
7782-41-4	Fluorine gas (F_2)						

Table 7-7 Bald Eagle and Great Blue Heron Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Bald Eagle	Units for Bald Eagle Ingestion *TRV*	Reference	Ingestion *TRV* of the Great Blue Heron	Units for Great Blue Heron Ingestion *TRV*	Reference
7782-49-2	Selenium	5.00E-01	mg/kg BW /d	[1]	5.00E-01	mg/kg BW /d	[1]
7782-50-5	Chlorine						
78-83-1	2-Methylpropyl alcohol						
78-87-5	1,2-Dichloropropane						
78-93-3	2-Butanone						
79-00-5	1,1,2-Trichloroethane						
79-01-6	1,1,2-Trichloroethylene						
79-10-7	2-Propenoic acid						
79-34-5	1,1,2,2-Tetrachloroethane						
79-46-9	2-Nitropropane						
80-62-6	Methyl methacrylate						
82-68-8	Pentachloronitrobenzene (PCNB)	6.88E+04	µg/kg BW /d	[1]	6.88E+04	µg/kg BW /d	[1]
822-06-0	Hexamethylene-1,5-diisocyanate						
823-40-5	Toluene-2,6-diamine						
83-32-9	Acenaphthene						
832-69-9	1-Methylphenanthrene						
84-66-2	Diethyl phthalate						
84-74-2	Di-n-butylphthalate	1.11E+02	µg/kg BW /d	[3]	1.11E+02	µg/kg BW /d	[3]
85-01-8	Phenanthrene						
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)						
85-68-7	Butylbenzylphthalate						
86-73-7	Fluorene						
87-61-6	1,2,3-Trichlorobenzene						
87-68-3	Hexachlorobutadiene	3.19E+03	µg/kg BW /d	[1]	3.19E+03	µg/kg BW /d	[1]
87-86-5	Pentachlorophenol	4.03E+03	µg/kg BW /d	[1]	4.03E+03	µg/kg BW /d	[1]
88-06-2	2,4,6-Trichlorophenol						
88-74-4	o-Nitroaniline (2-nitroaniline)						
88-75-5	2-Nitrophenol						
90-04-0	o-Anisidine						
90-12-0	1-Methylnaphthalene						

Table 7-7 Bald Eagle and Great Blue Heron Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Bald Eagle	Units for Bald Eagle Ingestion *TRV*	Reference	Ingestion *TRV* of the Great Blue Heron	Units for Great Blue Heron Ingestion *TRV*	Reference
91-20-3	Naphthalene						
91-22-5	Quinoline						
91-57-6	2-Methylnaphthalene						
91-58-7	2-Chloronaphthalene						
91-94-1	3,3'-Dichlorobenzidine						
92-52-4	1,1`-Biphenyl						
924-16-3	N-Nitroso-di-n-Buetylamine						
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)						
94-75-7	2,4-D						
95-48-7	o-Cresol						
95-49-8	o-Chlorotoluene						
95-50-1	1,2-Dichlorobenzene						
95-53-4	o-Toluidine						
95-57-8	2-Chlorophenol						
95-63-6	1,2,4-Trimethyl benzene						
95-94-3	1,2,4,5-Tetrachlorobenzene						
95-95-4	2,4,5-Trichlorophenol						
96-12-8	1,2-Dibromo-3-chloropropane						
96-18-4	1,2,3-Trichloropropane						
96-45-7	Ethylene thiourea						
97-63-2	Ethyl methacrylate						
98-01-1	Furfural						
98-06-6	tert-Butyl benzene						
98-07-7	Benzotrichloride						
98-82-8	Cumene						
98-83-9	Methyl styrene (mixed isomers)						
98-86-2	Acetophenone						
98-95-3	Nitrobenzene						
99-35-4	1,3,5-Trinitrobenzene						
99-65-0	1,3-Dinitrobenzene	4.22E-01	µg/kg BW /d	[1]	4.22E-01	µg/kg BW /d	[1]

Table 7-7 Bald Eagle and Great Blue Heron Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Bald Eagle	Units for Bald Eagle Ingestion *TRV*	Reference	Ingestion *TRV* of the Great Blue Heron	Units for Great Blue Heron Ingestion *TRV*	Reference
99-87-6	p-Cymene						
All radionuclides combined		1.00E-01	rad/d	[2]	1.00E-01	rad/d	[2]

Reference	Reference (source) for Ingestion Toxicity Reference Values of the Bald Eagle
[1]	EPA. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Peer Review Draft*, EPA 530-D-99-001. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC, USA. (http://www.epa.gov/epaoswer/hazwaste/combust/ecorisk.htm)
[2]	IAEA. 1992. "Effects of Ionizing Radiation on Plants and Animals at Levels Implied by Current Radiation Protection Standards," IAEA Technical Report Series 332, International Commission on Radiological Protection, Vienna, Austria.
[3]	Sample BE, Opresko DM, and Suter II GW. 1996. *Toxicological Benchmarks for Wildlife: 1996 Revision*, ES/ER/TM-86/R3, Lockheed Martin Energy Systems, Inc., Oak Ridge National Laboratory, Oak Ridge, TN

Reference	Reference (source) for Ingestion Toxicity Reference Values of the Great Blue Heron
[1]	EPA. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Peer Review Draft*, EPA 530-D-99-001. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC, USA. (http://www.epa.gov/epaoswer/hazwaste/combust/ecorisk.htm)
[2]	IAEA. 1992. "Effects of Ionizing Radiation on Plants and Animals at Levels Implied by Current Radiation Protection Standards," IAEA Technical Report Series 332, International Commission on Radiological Protection, Vienna, Austria.
[3]	Sample BE, Opresko DM, and Suter II GW. 1996. *Toxicological Benchmarks for Wildlife: 1996 Revision*, ES/ER/TM-86/R3, Lockheed Martin Energy Systems, Inc., Oak Ridge National Laboratory, Oak Ridge, TN

Table 7-8 provides ingestion TRVs for the mink and fish (chinook salmon and other salmonids). Note that units vary, with units of mass of contaminant per body weight (BW) of the mink, per day for chemical consistuents, and units of rad per day for radioisotopes. Units for fish (an aquatic biota) TRVs are concentration units for chemical consistuents, and units of rad per day for radioisotopes. Blank entries in the table indicate where data are not available.

Table 7-8 Mink, Chinook Salmon, and Other Salmonids Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Mink	Units for Mink Ingestion *TRV*	Reference	Direct Exposure *TRV* of the Chinook Salmon and Other Salmonids	Units for Salmon Direct Exposure *TRV*	Reference
100-02-7	p-Nitrophenol				6.31E+00	µg/L	[42]
100-21-0	Phthalic acid						
100-25-4	1,4-Dinitrobenzene						
100-40-3	4-Ethenylcyclohexene						
100-41-4	Ethyl benzene	9.71E+03	µg/kg BW /d	[3]	7.30E+00	µg/L	[33]
100-42-5	Styrene	2.00E+04	µg/kg BW /d	[3]			
100-44-7	Benzyl chloride						
100-47-0	Benzonitrile						
100-51-6	Benzyl alcohol				8.60E+00	µg/L	[36]
100-52-7	Benzaldehyde	1.43E+04	µg/kg BW /d	[3]			
10028-15-6	Ozone						
10028-17-8	Tritium	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
10045-97-3	Cesium-137	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
10061-01-5	cis-1,3-Dichloropropene						
10061-02-6	trans-1,3-Dichloropropene						
10098-91-6	Yttrium-90	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
10098-97-2	Strontium-90	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
101-55-3	4-Bromophenylphenyl ether				1.50E+00	µg/L	[33]
101-77-9	4,4-Methylenedianiline						
10102-44-0	Nitrogen dioxide						
10198-40-0	Cobalt-60	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
103-33-3	Azobenzene						
103-65-1	n-Propyl benzene (isocumene)						
104-51-8	n-Butylbenzene						
104-76-7	2-Ethyl-1-hexanol						
105-67-9	2,4-Dimethylphenol	5.00E+03	µg/kg BW /d	[3]	2.12E+01	µg/L	[30]
10595-95-6	n-Nitrosomethylethylamine						

Table 7-8 Mink, Chinook Salmon, and Other Salmonids Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Mink	Units for Mink Ingestion *TRV*	Reference	Direct Exposure *TRV* of the Chinook Salmon and Other Salmonids	Units for Salmon Direct Exposure *TRV*	Reference
106-43-4	4-Chlorotoluene (p-tolyl chloride)						
106-44-5	p-Cresol (4-methyl phenol)						
106-46-7	1,4-Dichlorobenzene				1.50E+01	µg/L	[33]
106-47-8	p-Chloroaniline	1.25E+03	µg/kg BW /d	[3]			
106-49-0	p-Toluidine						
106-51-4	Quinone						
106-88-7	1,2-Epoxybutane						
106-89-8	Epichlorohydrin (1-chloro-2,3-epoxypropane)						
106-93-4	Ethylene dibromide						
106-99-0	1,3-Butadiene						
107-02-8	Acrolein				2.10E+00	µg/L	[30]
107-05-1	3-Chloropropene						
107-06-2	1,2-Dichloroethane	5.00E+04	µg/kg BW /d	[5]	9.10E+02	µg/L	[36]
107-12-0	Propionitrile						
107-13-1	Acrylonitrile	4.60E+02	µg/kg BW /d	[2]	2.60E+02	µg/L	[31]
107-19-7	Propargyl alcohol	5.00E+02	µg/kg BW /d	[3]			
107-21-1	Ethylene glycol (1,2-ethanediol)	2.00E+04	µg/kg BW /d	[3]			
107-98-2	Propylene glycol monomethyl ether						
108-05-4	Acetic acid vinyl ester				1.60E+01	µg/L	[36]
108-10-1	4-Methyl-2-pentanone	2.50E+04	µg/kg BW /d	[5]	1.70E+02	µg/L	[36]
108-39-4	m-Cresol	5.00E+03	µg/kg BW /d	[3]			
108-60-1	bis(2-Chloroisopropyl) ether						
108-67-8	1,3,5-Trimethylbenzene						
108-86-1	Bromobenzene (phenyl bromide)				5.60E+01	µg/L	[21]
108-87-2	Methylcyclohexane						
108-88-3	Toluene	2.60E+04	µg/kg BW /d	[5]	9.80E+00	µg/L	[33]
108-90-7	Chlorobenzene	1.90E+04	µg/kg BW /d	[3]	6.40E+01	µg/L	[33]
108-94-1	Cyclohexanone				5.27E+03	µg/L	[11]
108-95-2	Phenol	6.00E+04	µg/kg BW /d	[3]	1.10E+02	µg/L	[37]
109-74-0	n-Butanenitrile						
109-75-1	3-Butenenitrile						

Table 7-8 Mink, Chinook Salmon, and Other Salmonids Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Mink	Units for Mink Ingestion *TRV*	Reference	Direct Exposure *TRV* of the Chinook Salmon and Other Salmonids	Units for Salmon Direct Exposure *TRV*	Reference
109-77-3	Malononitrile						
109-86-4	2-Methoxyethanol						
109-99-9	Tetrahydrofuran						
110-00-9	Furan				3.63E+04	µg/L	[20]
110-54-3	n-Hexane				5.80E-01	µg/L	[36]
110-59-8	Pentanenitrile						
110-80-5	2-Ethoxyethanol						
110-82-7	Cyclohexane						
110-83-8	Cyclohexene						
110-86-1	Pyridine	1.00E+02	µg/kg BW /d	[3]	2.60E+02	µg/L	[4]
111-15-9	Ethylene glycol monoethyl ether acetate						
111-44-4	bis(2-Chloroethyl)ether						
111-65-9	n-Octane						
111-76-2	2-Butoxyethanol	5.10E+02	µg/kg BW /d	[3]			
111-84-2	n-Nonane						
111-91-1	bis(2-Chloroethoxy)methane						
112-30-1	1-Decanol						
112-31-2	Decanal						
112-40-3	Dodecane						
1120-21-4	Undecane						
1120-71-4	1,3-Propane sultone						
117-81-7	bis(2-Ethylhexyl)phthalate	6.00E+04	µg/kg BW /d	[2]	3.00E+00	µg/L	[31]
117-84-0	Di-n-octylphthalate	7.50E+06	µg/kg BW /d	[2]	3.20E+02	µg/L	[31]
118-74-1	Hexachlorobenzene	1.60E+03	µg/kg BW /d	[2]	3.68E+00	µg/L	[31]
119-90-4	3,3'-Dimethoxybenzidine						
120-12-7	Anthracene	1.00E+05	µg/kg BW /d	[3]	2.07E+01	µg/L	[32]
120-82-1	1,2,4-Trichlorobenzene				1.10E+02	µg/L	[33]
120-83-2	2,4-Dichlorophenol	3.00E+01	µg/kg BW /d	[3]	3.65E+01	µg/L	[30]
121-14-2	2,4-Dinitrotoluene	3.50E+04	µg/kg BW /d	[2]	2.30E+01	µg/L	[31]
122-39-4	N,N-Diphenylamine	2.50E+02	µg/kg BW /d	[3]			
122-66-7	1,2-Diphenylhydrazine				2.70E+00	µg/L	[30]

Table 7-8 Mink, Chinook Salmon, and Other Salmonids Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Mink	Units for Mink Ingestion *TRV*	Reference	Direct Exposure *TRV* of the Chinook Salmon and Other Salmonids	Units for Salmon Direct Exposure *TRV*	Reference
123-33-1	Maleic hydrazide	5.00E+04	µg/kg BW /d	[3]	2.60E+02	µg/L	[2]
123-38-6	Propionaldehyde						
123-72-8	Butanal						
123-91-1	1,4-Dioxan	1.06E+05	µg/kg BW /d	[2]	6.21E+04	µg/L	[31]
124-18-5	Decane				5.00E+04	µg/L	[8]
124-38-9	Carbon dioxide						
124-48-1	Chlorodibromomethane	2.14E+03	µg/kg BW /d	[3]			
126-73-8	Tributyl phosphate				4.20E+01	µg/L	[6]
126-98-7	2-Methyl-2-propenenitrile	3.40E+01	µg/kg BW /d	[3]			
127-18-4	1,1,2,2-Tetrachloroethene	1.40E+03	µg/kg BW /d	[3]	9.80E+01	µg/L	[33]
128-37-0	2,6-bis(tert-butyl)-4-Methylphenol						
129-00-0	Pyrene	7.50E+03	µg/kg BW /d	[3]	1.01E+01	µg/L	[32]
131-11-3	Dimethyl Phthalate				4.00E-03	µg/L	[42]
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	2.00E+01	µg/kg BW /d	[3]			
132-64-9	Dibenzofuran				3.70E+00	µg/L	[33]
133-06-2	Captan				5.60E-01	µg/L	[26]
1330-20-7	Xylenes (mixed isomers)				6.70E+01	µg/L	[34]
1336-36-3	Polychlorinated biphenyls	2.06E-01	µg/kg BW /d	[2]	1.40E-01	µg/L	[36]
134-32-7	alpha-Naphthylamine						
135-98-8	sec-Butylbenzene						
13966-29-5	Uranium-234	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
13967-48-1	Ruthenium-106	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
13967-70-9	Cesium-134	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
13968-55-3	Uranium-233	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
13981-15-2	Curium-244	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
13981-16-3	Plutonium-238	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
13981-37-8	Nickel-63	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
13982-10-0	Plutonium-242	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
13982-63-3	Radium-226	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
13982-70-2	Uranium-236	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
13994-20-2	Neptunium-237	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
141-78-6	Acetic acid ethyl ester	9.00E+04	µg/kg BW /d	[3]	2.60E+03	µg/L	[10]

Table 7-8 Mink, Chinook Salmon, and Other Salmonids Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Mink	Units for Mink Ingestion *TRV*	Reference	Direct Exposure *TRV* of the Chinook Salmon and Other Salmonids	Units for Salmon Direct Exposure *TRV*	Reference
14119-32-5	Plutonium-241	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
14119-33-6	Plutonium-240	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
14133-76-7	Technetium-99	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
14158-29-3	Uranium-232	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
14234-35-6	Antimony-125	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
14265-44-2	Phosphate						
14331-85-2	Protactinium-231	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
14336-70-0	Nickel-59	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
14391-16-3	Europium-155	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
145-73-3	Endothall	2.00E+03	µg/kg BW /d	[3]	1.00E+03	µg/L	[14]
14596-10-2	Americium-241	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
14683-23-9	Europium-152	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
14762-75-5	Carbon-14	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
14797-55-8	Nitrate						
14797-65-0	Nitrite						
14808-79-8	Sulfate						
14952-40-0	Actinium-227	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
14993-75-0	Americium-243	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
15046-84-1	Iodine-129	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
15117-48-3	Plutonium-239	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
15117-96-1	Uranium-235	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
15262-20-1	Radium-228	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
15510-73-3	Curium-242	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
15585-10-1	Europium-154	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
15594-54-4	Thorium-229	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
156-59-2	cis-1,2-Dichloroethene						
156-60-5	1,2-trans-Dichloroethene	1.70E+03	µg/kg BW /d	[3]			
15715-94-3	Samarium-151	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
15751-77-6	Zirconium-93	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
15757-87-6	Curium-243	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
15758-45-9	Selenium-79	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
15832-50-5	Tin-126	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]

Table 7-8 Mink, Chinook Salmon, and Other Salmonids Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Mink	Units for Mink Ingestion *TRV*	Reference	Direct Exposure *TRV* of the Chinook Salmon and Other Salmonids	Units for Salmon Direct Exposure *TRV*	Reference
1634-04-4	Methyl tert-butyl ether						
16887-00-6	Chloride				2.30E+02	mg/L	[41]
16984-48-8	Fluoride	3.14E+01	mg/kg BW /d	[5]			
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1.00E-03	µg/kg BW /d	[5]	3.80E-06	µg/L	[31]
18540-29-9	Chromium(VI)	3.50E+00	mg/kg BW /d	[2]	2.66E-04	mg/L	[39]
189-55-9	Dibenzo[a,i]pyrene						
189-64-0	Dibenzo[a,h]pyrene						
191-24-2	Benzo[g,h,i]perylene				4.39E-01	µg/L	[32]
191-30-0	Dibenzo[a,l]pyrene						
192-65-4	Dibenzo[a,e]pyrene						
192-97-2	Benzo[e]pyrene				9.01E-01	µg/L	[32]
193-39-5	Indeno[1,2,3-cd]pyrene				2.75E-01	µg/L	[32]
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin						
205-82-3	Benzo[j]fluoranthene				6.42E-01	µg/L	[32]
205-99-2	Benzo[b]fluoranthene				6.77E-01	µg/L	[32]
206-44-0	Fluoranthene	1.25E+04	µg/kg BW /d	[3]	7.11E+00	µg/L	[32]
207-08-9	Benzo[k]fluoranthene				6.42E-01	µg/L	[32]
208-96-8	Acenaphthylene				3.07E+02	µg/L	[32]
218-01-9	Chrysene				2.04E+00	µg/L	[32]
224-42-0	Dibenz[a,j]acridine						
2245-38-7	2,3,5-Trimethylnaphthalene				9.79E+00	µg/L	[32]
226-36-8	Dibenz[a,h]acridine						
22967-92-6	Methyl mercury	3.20E-02	mg/kg BW /d	[2]	2.80E-06	mg/L	[31]
23950-58-5	Pronamide	7.50E+02	µg/kg BW /d	[3]	7.20E+02	µg/L	[27]
24959-67-9	Bromide						
27154-33-2	Trichlorofluoroethane						
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)						
319-84-6	alpha-BHC				2.20E+00	µg/L	[36]
319-85-7	beta-BHC	4.00E-01	µg/kg BW /d	[5]	2.20E+00	µg/L	[36]

Table 7-8 Mink, Chinook Salmon, and Other Salmonids Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Mink	Units for Mink Ingestion *TRV*	Reference	Direct Exposure *TRV* of the Chinook Salmon and Other Salmonids	Units for Salmon Direct Exposure *TRV*	Reference
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)						
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)						
3268-87-9	Octachlorodibenzo(p)dioxin						
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)						
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin						
3697-24-3	5-Methylchrysene				8.56E-01	µg/L	[32]
378253-40-8	Barium-137m	1.00E-01	mg/kg BW /d	[4]	1.00E+00	mg/L	[35]
378253-44-2	Cadmium-113m						
378782-82-2	Niobium-93m	1.00E-01	rad/d	[4]	1.00E+00	mg/L	[35]
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)						
39001-02-0	Octachlorodibenzofuran						
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo (p)dioxin						
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)						
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin						
4170-30-3	Crotonaldehyde (propylene aldehyde)	8.00E+01	µg/kg BW /d	[2]	3.50E+01	µg/L	[31]
41851-50-7	Chlorocyclopentadiene						
460-19-5	Cyanogen (oxalonitrile)						
4786-20-3	2-Butenenitrile						
50-00-0	Formaldehyde	2.30E+03	µg/kg BW /d	[2]	4.96E+01	µg/L	[31]
50-32-8	Benzo[a]pyrene	1.00E+02	µg/kg BW /d	[2]	9.57E-01	µg/L	[32]
506-68-3	Cyanogen bromide (bromocyanide)	4.40E+03	µg/kg BW /d	[3]			
506-77-4	Cyanogen chloride	2.53E+03	µg/kg BW /d	[3]			
51-28-5	2,4-Dinitrophenol	2.00E+02	µg/kg BW /d	[3]			
51-79-6	Ethyl carbamate (urethane)				1.00E+04	µg/L	[9]
510-15-6	Chlorobenzilate						

Table 7-8 Mink, Chinook Salmon, and Other Salmonids Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Mink	Units for Mink Ingestion *TRV*	Reference	Direct Exposure *TRV* of the Chinook Salmon and Other Salmonids	Units for Salmon Direct Exposure *TRV*	Reference
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran						
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)						
528-29-0	1,2-Dinitrobenzene (o-dinitrobenzene)						
53-70-3	Dibenz[a,h]anthracene	2.00E+00	µg/kg BW /d	[2]	2.83E-01	µg/L	[32]
532-27-4	2-Chloroacetophenone						
534-52-1	4,6-Dinitro-o-cresol				2.50E+02	µg/L	[23]
5385-75-1	Dibenzo[a,e]fluoranthene						
540-59-0	1,2-Dichloroethene (total)	4.52E+04	µg/kg BW /d	[5]	5.90E+02	µg/L	[36]
540-73-8	1,2-Dimethylhydrazine						
540-84-1	2,2,4-Trimethylpentane						
541-73-1	1,3-Dichlorobenzene				7.10E+01	µg/L	[33]
542-75-6	1,3-Dichloropropene	2.50E+03	µg/kg BW /d	[3]	5.50E-02	µg/L	[36]
542-88-1	bis(Chloromethyl)ether						
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran						
56-23-5	Carbon tetrachloride	7.10E+01	µg/kg BW /d	[3]	2.40E+02	µg/L	[33]
56-49-5	3-Methylcholanthrene				2.00E+02	µg/L	[25]
56-55-3	Benzo[a]anthracene	1.67E+02	µg/kg BW /d	[2]	2.23E+00	µg/L	[32]
57-12-5	Cyanide	2.40E+01	mg/kg BW /d	[2]	1.17E-03	mg/L	[39]
57-24-9	Strychnine	2.50E+01	µg/kg BW /d	[3]	2.30E+01	µg/L	[27]
57-74-9	Chlordane	4.58E+03	µg/kg BW /d	[5]	1.70E-01	µg/L	[37]
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	1.60E-02	µg/kg BW /d	[5]			
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	1.60E-01	µg/kg BW /d	[5]			
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	1.60E-01	µg/kg BW /d	[5]			
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)						
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin						
58-89-9	gamma-BHC (Lindane)	8.00E+03	µg/kg BW /d	[5]	8.00E-02	µg/L	[33]
58-90-2	2,3,4,6-Tetrachlorophenol	2.50E+03	µg/kg BW /d	[3]			
581-42-0	2,6-Dimethylnaphthalene				2.58E+01	µg/L	[32]

Table 7-8 Mink, Chinook Salmon, and Other Salmonids Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Mink	Units for Mink Ingestion *TRV*	Reference	Direct Exposure *TRV* of the Chinook Salmon and Other Salmonids	Units for Salmon Direct Exposure *TRV*	Reference
584-84-9	2,4-Toluene diisocyanate						
589-38-8	3-Hexanone						
59-50-7	4-Chloro-3-methylphenol				3.00E-01	µg/L	[30]
59-89-2	N-Nitrosomorpholine						
591-50-4	Benzene, iodo-						
591-78-6	2-Hexanone				9.90E+01	µg/L	[36]
593-60-2	Bromoethene (vinyl bromide)						
593-74-8	Dimethyl mercury						
60-11-7	Dimethyl aminoazobenzene						
60-29-7	Ethyl ether	5.00E+04	µg/kg BW /d	[3]			
60-35-5	Acetamide						
602-87-9	5-Nitroacenaphthene						
606-20-2	2,6-Dinitrotoluene	4.00E+01	µg/kg BW /d	[2]	6.00E+01	µg/L	[31]
608-93-5	Pentachlorobenzene	7.25E+03	µg/kg BW /d	[2]	4.70E-01	µg/L	[33]
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran						
61626-71-9	Dichloropentadiene						
62-50-0	Ethyl methanesulfonate				2.50E+04	µg/L	[24]
62-53-3	Aniline				2.00E+03	µg/L	[17]
62-75-9	N-Nitroso-N,N-dimethylamine				9.40E+03	µg/L	[7]
621-64-7	N-Nitroso-di-n-propylamine						
624-83-9	Methyl isocyanate						
628-73-9	Hexanenitrile						
630-08-0	Carbon monoxide						
630-20-6	1,1,1,2-Tetrachloroethane	8.93E+03	µg/kg BW /d	[3]			
64-18-6	Formic acid (methanoic acid)				1.75E+03	µg/L	[1]
65-85-0	Benzoic acid	4.00E+03	µg/kg BW /d	[3]	4.20E+01	µg/L	[36]
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)						
67-56-1	Methyl alcohol	5.00E+04	µg/kg BW /d	[3]	1.00E-01	µg/L	[28]
67-63-0	2-Propyl alcohol				7.50E+00	µg/L	[36]
67-64-1	2-Propanone (acetone)	1.00E+04	µg/kg BW /d	[2]	1.26E+03	µg/L	[42]
67-66-3	Chloroform	6.00E+04	µg/kg BW /d	[2]	2.80E+01	µg/L	[31]

Table 7-8 Mink, Chinook Salmon, and Other Salmonids Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Mink	Units for Mink Ingestion *TRV*	Reference	Direct Exposure *TRV* of the Chinook Salmon and Other Salmonids	Units for Salmon Direct Exposure *TRV*	Reference
67-72-1	Hexachloroethane	1.00E+02	µg/kg BW /d	[3]	1.20E+01	µg/L	[33]
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran						
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)						
70-30-4	Hexachlorophene	5.60E+03	µg/kg BW /d	[2]	8.80E-01	µg/L	[31]
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)						
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran						
71-36-3	n-Butyl alcohol	1.25E+04	µg/kg BW /d	[3]	1.00E+03	µg/L	[13]
71-43-2	Benzene	2.64E+04	µg/kg BW /d	[5]	1.30E+02	µg/L	[33]
71-55-6	1,1,1-Trichloroethane	1.00E+06	µg/kg BW /d	[5]	1.10E+01	µg/L	[33]
72-43-5	Methoxychlor	5.01E+03	µg/kg BW /d	[3]	1.90E-02	µg/L	[33]
72-55-9	4,4-DDE	1.00E+03	µg/kg BW /d	[2]	1.05E+01	µg/L	[31]
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran						
74-83-9	Bromomethane	1.40E+02	µg/kg BW /d	[3]	3.20E+02	µg/L	[19]
74-87-3	Chloromethane						
74-88-4	Iodomethane						
74-95-3	Methylene bromide						
74-97-5	Bromochloromethane						
7429-90-5	Aluminum	1.93E+00	mg/kg BW /d	[2]	7.50E-02	mg/L	[39]
7439-89-6	Iron				1.00E+00	mg/L	[36]
7439-92-1	Lead	3.75E-02	mg/kg BW /d	[2]	3.50E-04	mg/L	[39]
7439-93-2	Lithium	9.39E+00	mg/kg BW /d	[5]	1.40E-02	mg/L	[36]
7439-95-4	Magnesium						
7439-96-5	Manganese	8.80E+01	mg/kg BW /d	[5]	1.20E-01	mg/L	[36]
7439-97-6	Mercury						
7439-98-7	Molybdenum	2.58E-01	mg/kg BW /d	[5]	3.70E-01	mg/L	[36]
7440-02-0	Nickel	5.00E+01	mg/kg BW /d	[2]	1.10E-02	mg/L	[39]
7440-16-6	Rhodium						
7440-22-4	Silver	3.75E-01	mg/kg BW /d	[2]	1.20E-04	mg/L	[31]
7440-23-5	Sodium						
7440-24-6	Strontium (total)	2.63E+02	mg/kg BW /d	[5]	1.50E+00	mg/L	[36]

Table 7-8 Mink, Chinook Salmon, and Other Salmonids Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Mink	Units for Mink Ingestion *TRV*	Reference	Direct Exposure *TRV* of the Chinook Salmon and Other Salmonids	Units for Salmon Direct Exposure *TRV*	Reference
7440-25-7	Tantalum						
7440-28-0	Thallium	1.31E-02	mg/kg BW /d	[2]	4.00E-03	mg/L	[31]
7440-29-1	Thorium-232	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
7440-31-5	Tin				7.30E-02	mg/L	[36]
7440-33-7	Tungsten						
7440-36-0	Antimony	6.60E-02	mg/kg BW /d	[2]	3.00E-02	mg/L	[31]
7440-38-2	Arsenic	1.25E+00	mg/kg BW /d	[2]	5.50E-02	mg/L	[39]
7440-39-3	Barium	5.10E-01	mg/kg BW /d	[2]	4.00E-03	mg/L	[36]
7440-41-7	Beryllium	6.60E-01	mg/kg BW /d	[2]	6.60E-04	mg/L	[31]
7440-43-9	Cadmium	2.52E-02	mg/kg BW /d	[2]	1.30E-05	mg/L	[39]
7440-47-3	Chromium						
7440-48-4	Cobalt	2.86E-01	mg/kg BW /d	[1]	2.30E-02	mg/L	[36]
7440-50-8	Copper	1.20E+01	mg/kg BW /d	[2]	2.60E-04	mg/L	[39]
7440-61-1	Uranium	3.07E+00	mg/kg BW /d	[5]	2.60E-03	mg/L	[36]
7440-61-1R	Uranium-238	1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]
7440-62-2	Vanadium	2.10E-01	mg/kg BW /d	[5]	2.00E-02	mg/L	[36]
7440-65-5	Yttrium						
7440-66-6	Zinc	1.04E+01	mg/kg BW /d	[2]	2.10E-02	mg/L	[39]
7440-67-7	Zirconium	1.74E+00	mg/kg BW /d	[5]	1.70E-02	mg/L	[36]
7446-09-5	Sulfur dioxide						
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)						
7487-94-7	Mercuric chloride ($HgCl_2$)	1.01E+00	mg/kg BW /d	[2]	1.80E-04	mg/L	[39]
75-00-3	Chloroethane						
75-01-4	1-Chloroethene	1.70E+02	µg/kg BW /d	[2]	3.88E+03	µg/L	[31]
75-02-5	Fluoroethene (vinyl fluoride)						
75-05-8	Acetonitrile				1.00E+03	µg/L	[12]
75-07-0	Acetaldehyde						
75-09-2	Dichloromethane (methylene chloride)	6.16E+03	µg/kg BW /d	[3]	2.20E+03	µg/L	[36]
75-15-0	Carbon disulfide	1.10E+04	µg/kg BW /d	[3]	9.20E-01	µg/L	[36]
75-21-8	Ethylene oxide (Oxirane)						
75-25-2	Bromoform	1.79E+03	µg/kg BW /d	[3]	3.20E+02	µg/L	[33]

Table 7-8 Mink, Chinook Salmon, and Other Salmonids Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Mink	Units for Mink Ingestion *TRV*	Reference	Direct Exposure *TRV* of the Chinook Salmon and Other Salmonids	Units for Salmon Direct Exposure *TRV*	Reference
75-27-4	Bromodichloromethane	1.79E+03	µg/kg BW /d	[3]			
75-29-6	2-Chloropropane						
75-34-3	1,1-Dichloroethane				4.70E+01	µg/L	[36]
75-35-4	1,1-Dichloroethene	3.00E+04	µg/kg BW /d	[5]	2.50E+01	µg/L	[36]
75-44-5	Phosgene (hydrogen phosphide)						
75-45-6	Chlorodifluoromethane						
75-50-3	Trimethylamine						
75-69-4	Trichlorofluoromethane	3.49E+04	µg/kg BW /d	[3]			
75-71-8	Dichlorodifluoromethane	1.50E+04	µg/kg BW /d	[3]			
76-01-7	Pentachloroethane				3.90E+01	µg/L	[30]
76-13-1	1,2,2-Trichlorotrifluoroethane						
76-44-8	Heptachlor	2.50E+00	µg/kg BW /d	[2]	3.80E-03	µg/L	[31]
764-41-0	1,4-Dichloro-2-butene						
7647-01-0	Hydrogen chloride	1.44E+01	mg/kg BW /d	[3]	2.30E+02	mg/L	[40]
765-34-4	Glycidylaldehyde	1.09E+02	µg/kg BW /d	[3]			
7664-39-3	Hydrogen fluoride	3.14E+01	mg/kg BW /d	[5]			
7664-41-7	Ammonia/Ammonium				1.70E-03	mg/L	[38]
77-47-4	Hexachlorocyclopentadiene	3.80E+03	µg/kg BW /d	[2]	5.20E-01	µg/L	[31]
77-78-1	Dimethyl sulfate						
7704-34-9	Total Sulfur (thermodynamically stable)						
7723-14-0	Phosphorus						
7782-41-4	Fluorine gas (F_2)						
7782-49-2	Selenium	7.60E-02	mg/kg BW /d	[2]	2.60E-03	mg/L	[39]
7782-50-5	Chlorine	1.44E+01	mg/kg BW /d	[3]	1.10E-02	mg/L	[41]
78-83-1	2-Methylpropyl alcohol	3.16E+04	µg/kg BW /d	[3]	1.79E-01	µg/L	[18]
78-87-5	1,2-Dichloropropane				6.10E+02	µg/L	[3]
78-93-3	2-Butanone	1.77E+06	µg/kg BW /d	[3]	1.40E+04	µg/L	[36]
79-00-5	1,1,2-Trichloroethane				1.20E+03	µg/L	[36]
79-01-6	1,1,2-Trichloroethylene	7.00E+02	µg/kg BW /d	[3]	4.70E+01	µg/L	[33]
79-10-7	2-Propenoic acid	5.30E+03	µg/kg BW /d	[3]	3.15E+03	µg/L	[5]
79-34-5	1,1,2,2-Tetrachloroethane				6.10E+02	µg/L	[33]

Table 7-8 Mink, Chinook Salmon, and Other Salmonids Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Mink	Units for Mink Ingestion *TRV*	Reference	Direct Exposure *TRV* of the Chinook Salmon and Other Salmonids	Units for Salmon Direct Exposure *TRV*	Reference
79-46-9	2-Nitropropane						
80-62-6	Methyl methacrylate	1.36E+05	µg/kg BW /d	[3]			
82-68-8	Pentachloronitrobenzene (PCNB)	4.58E+05	µg/kg BW /d	[2]	1.00E+01	µg/L	[31]
822-06-0	Hexamethylene-1,5-diisocyanate						
823-40-5	Toluene-2,6-diamine						
83-32-9	Acenaphthene	1.75E+04	µg/kg BW /d	[3]	5.59E+01	µg/L	[32]
832-69-9	1-Methylphenanthrene				7.49E+00	µg/L	[32]
84-66-2	Diethyl phthalate	4.58E+06	µg/kg BW /d	[5]	2.70E+02	µg/L	[33]
84-74-2	Di-n-butylphthalate	5.50E+05	µg/kg BW /d	[5]	3.50E+01	µg/L	[33]
85-01-8	Phenanthrene				1.91E+01	µg/L	[32]
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	1.56E+05	µg/kg BW /d	[3]			
85-68-7	Butylbenzylphthalate				1.90E+01	µg/L	[33]
86-73-7	Fluorene	1.25E+04	µg/kg BW /d	[3]	3.93E+01	µg/L	[32]
87-61-6	1,2,3-Trichlorobenzene				5.00E-01	µg/L	[22]
87-68-3	Hexachlorobutadiene	2.00E+02	µg/kg BW /d	[2]	9.30E-01	µg/L	[31]
87-86-5	Pentachlorophenol	3.00E+02	µg/kg BW /d	[2]	1.58E+00	µg/L	[42]
88-06-2	2,4,6-Trichlorophenol				9.70E+00	µg/L	[30]
88-74-4	o-Nitroaniline (2-nitroaniline)						
88-75-5	2-Nitrophenol				1.60E+01	µg/L	[16]
90-04-0	o-Anisidine						
90-12-0	1-Methylnaphthalene				7.54E+01	µg/L	[32]
91-20-3	Naphthalene	7.10E+03	µg/kg BW /d	[3]	1.94E+02	µg/L	[32]
91-22-5	Quinoline						
91-57-6	2-Methylnaphthalene				7.22E+01	µg/L	[32]
91-58-7	2-Chloronaphthalene	2.50E+05	µg/kg BW /d	[3]			
91-94-1	3,3'-Dichlorobenzidine						
92-52-4	1,1`-Biphenyl	5.00E+04	µg/kg BW /d	[3]	1.40E+01	µg/L	[33]
924-16-3	N-Nitroso-di-n-Buetylamine						
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)						
94-75-7	2,4-D				1.00E+02	µg/L	[29]

Table 7-8 Mink, Chinook Salmon, and Other Salmonids Ingestion Toxicity Reference Values

CAS Registry Number	Constituent	Ingestion *TRV* of the Mink	Units for Mink Ingestion *TRV*	Reference	Direct Exposure *TRV* of the Chinook Salmon and Other Salmonids	Units for Salmon Direct Exposure *TRV*	Reference
95-48-7	o-Cresol	5.00E+03	µg/kg BW /d	[3]	6.31E+00	µg/L	[42]
95-49-8	o-Chlorotoluene	2.00E+04	µg/kg BW /d	[3]			
95-50-1	1,2-Dichlorobenzene	8.57E+04	µg/kg BW /d	[3]	1.40E+01	µg/L	[33]
95-53-4	o-Toluidine						
95-57-8	2-Chlorophenol						
95-63-6	1,2,4-Trimethyl benzene						
95-94-3	1,2,4,5-Tetrachlorobenzene	3.40E+01	µg/kg BW /d	[3]			
95-95-4	2,4,5-Trichlorophenol	1.00E+04	µg/kg BW /d	[3]			
96-12-8	1,2-Dibromo-3-chloropropane						
96-18-4	1,2,3-Trichloropropane	5.71E+02	µg/kg BW /d	[3]			
96-45-7	Ethylene thiourea	2.50E+01	µg/kg BW /d	[3]	1.00E+04	µg/L	[15]
97-63-2	Ethyl methacrylate						
98-01-1	Furfural	7.90E+01	µg/kg BW /d	[3]	4.26E+02	µg/L	[20]
98-06-6	tert-Butyl benzene						
98-07-7	Benzotrichloride						
98-82-8	Cumene	1.10E+05	µg/kg BW /d	[3]			
98-83-9	Methyl styrene (mixed isomers)						
98-86-2	Acetophenone	4.23E+04	µg/kg BW /d	[3]			
98-95-3	Nitrobenzene	4.60E+01	µg/kg BW /d	[3]	2.70E+02	µg/L	[31]
99-35-4	1,3,5-Trinitrobenzene	2.68E+03	µg/kg BW /d	[3]	1.30E+01	µg/L	[42]
99-65-0	1,3-Dinitrobenzene	1.05E+03	µg/kg BW /d	[2]	2.60E+01	µg/L	[31]
99-87-6	p-Cymene						
All radionuclides combined		1.00E-01	rad/d	[4]	1.00E+00	rad/d	[35]

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[27]	2000. Office of Pesticide Programs. "Pesticide Ecotoxicity Database (Formerly: Environmental Effects Database (EEDB))", Environmental Fate and Effects Division, U.S.EPA, Washington, D.C.: (Rainbow Trout LC50, ECOTOX Ref. #344, accessed February 2013).

Reference	Reference (source) for Ingestion Toxicity Reference Values of Chinook Salmon and Other Salmonids
[28]	2003. Thomas-Jones,E., K. Thorpe, N. Harrison, G. Thomas, C. Morris, T. Hutchinson, S. Woodhead, and C. Tyler. "Dynamics of Estrogen Biomarker Responses in Rainbow Trout Exposed to 17beta-Estradiol and 17alpha-Ethinylestradiol", Environ. Toxicol. Chem.22(12): 3001-3008 (Rainbow Trout NOEC, ECOTOX Ref. #73292, accessed February 2013).
[29]	2006. Tierney,K.B., P.S. Ross, H.E. Jarrard, K.R. Delaney, and C.J. Kennedy. "Changes in Juvenile Coho Salmon Electro-Olfactogram During and After Short-Term Exposure to Current-Use Pesticides", Environ. Toxicol. Chem.25(10): 2809-2817 (Coho Salmon,Silver Salmon NOEL, ECOTOX Ref. #89637, accessed February 2013).
[30]	EPA. 1987. *Quality criteria for water 1986 and update No. 1 and update No. 2 (May 1, 1987)*, EPA-440/5-86-001. US Environmental Protection Agency, Washington, DC, USA.
[31]	EPA. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Peer Review Draft*, EPA 530-D-99-001A. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC (Table E-1).
[32]	EPA. 2003. *Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures*, EPA/600/R-02/013, U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC.
[33]	EPA. 2008. *Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Compendium of Tier 2 Values for Nonionic Organics*, EPA/600/R-02/016, U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC.
[34]	EPA. 2008. *Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Compendium of Tier 2 Values for Nonionic Organics*, EPA/600/R-02/016, U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC. (benchmark value for m-Xylene)
[35]	NCRP. 1991. "Effects of Ionizing Radiation on Aquatic Organisms," NCRP Report No. 109. National Council on Radiation Protection and Measurements, Bethesda, Maryland, USA.
[36]	Suter II GW and Tsao CL. 1996. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision*, ES/ER/TM 96/R2. Lockheed Martin Energy Systems, Inc., Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA.
[37]	Suter II GW and Tsao CL. 1996. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision*, ES/ER/TM 96/R2. Lockheed Martin Energy Systems, Inc., Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA. (Table 1, NAWQ chronic value)
[38]	Suter II GW and Tsao CL. 1996. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision*, ES/ER/TM 96/R2. Lockheed Martin Energy Systems, Inc., Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA. (Table 1, lowest chronic value for Ammonia)
[39]	Suter II GW and Tsao CL. 1996. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision*, ES/ER/TM 96/R2. Lockheed Martin Energy Systems, Inc., Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA. (Table 2, Sensitive Species EC20)
[40]	Suter II GW and Tsao CL. 1996. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision*, ES/ER/TM 96/R2. Lockheed Martin Energy Systems, Inc., Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA. (Table 3, Region IV chronic value for chloride used as surrogate)
[41]	Suter II GW and Tsao CL. 1996. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision*, ES/ER/TM 96/R2. Lockheed Martin Energy Systems, Inc., Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA. (Table 3, Region IV chronic value)

Reference	Reference (source) for Ingestion Toxicity Reference Values of Chinook Salmon and Other Salmonids
[42]	Suter II GW and Tsao CL. 1996. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision*, ES/ER/TM 96/R2. Lockheed Martin Energy Systems, Inc., Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA. (Table C-1, rainbow trout, 95% LCL)

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8 Radionuclide-Specific Parameters for Ecological Risk Assessment

This section defines the various radionuclide-specific parameters used in the estimation of receptor dose (and corresponding risk) as described in the RAWP.

Table 8-1 provides a listing of radioisotopes with associated daughter products, the serial transformations (decay chain), and the yield of the daughter product from the decay of the parent isotope (see footnote 1). Ecological internal exposure and sediment immersion dose factors include the contribution of daughter products. For Table 8-1 and subsequent tables, refer to RAWP Sections 8.2.3.4 and 8.2.4.4 for additional details on radioactive dose related to external and internal exposure.

Table 8-1 Radionuclide Daughter Products Used for Dose Assessment

Parent Radionuclide CAS Registry Number	Parent Isotope	Daughter Product CAS Registry Number	Daughter Product (and yield)[1]
14952-40-0	Actinium-227	15756-98-6	Francium-223 (1.38 %)
		15623-47-9	Thorium-227 (98.62 %)
		15623-45-7	Radium-223
		14835-02-0	Radon-219
		15706-52-2	Polonium-215
		15816-77-0	Lead-211
		15229-37-5	Bismuth-211
		7440-08-6	Polonium-211 (0.27 %)
		14133-67-6	Thallium-207 (99.72 %)
14993-75-0	Americium-243	13968-59-7	Neptunium-239
		15117-48-3	Plutonium-239
		15117-96-1	Uranium-235
		14932-40-2	Thorium-231
		14331-85-2	Protactinium-231
		14952-40-0	Actinium-227
		15756-98-6	Francium-223 (1.38 %)
		15623-47-9	Thorium-227 (98.62 %)
		15623-45-7	Radium-223
		14835-02-0	Radon-219
		15706-52-2	Polonium-215
		15816-77-0	Lead-211
		15229-37-5	Bismuth-211
		7440-08-6	Polonium-211 (0.27 %)
		14133-67-6	Thallium-207 (99.72 %)

Table 8-1 Radionuclide Daughter Products Used for Dose Assessment

Parent Radionuclide CAS Registry Number	Parent Isotope	Daughter Product CAS Registry Number	Daughter Product (and yield)[1]
14234-35-6	Antimony-125	14390-73-9	Tellurium-125m (22.8 %)
14683-23-9	Europium-152	7440-54-2	Gadolinium-152 (27.92 %)
13994-20-2	Neptunium-237	13981-14-1	Protactinium-233
13982-63-3	Radium-226	14859-67-7	Radon-222
		15422-74-9	Polonium-218
		15067-28-4	Lead-214 (99.98 %)
		15755-40-5	Astatine-218 (0.02 %)
		14733-03-0	Bismuth-214
		15735-68-8	Polonium-214
		14255-04-0	Lead-210
		14331-79-4	Bismuth-210
		13981-52-7	Polonium-210
15262-20-1	Radium-228	14331-83-0	Actinium-228
		14274-82-9	Thorium-228
		13233-32-4	Radium-224
		22481-48-7	Radon-220
		15756-58-8	Polonium-216
		15092-94-1	Lead-212
		14913-49-6	Bismuth-212
		15389-34-1	Polonium-212 (62.07%)
		14913-50-9	Thalium-208 (35.93%)
13967-48-1	Ruthenium-106	14234-34-5	Rhodium-106
15594-54-4	Thorium-229	13981-53-8	Radium-225
		14265-85-1	Actinium-225
		15756-41-9	Francium-221
		17239-90-6	Astatine-217
		15776-20-2	Bismuth-213
		15756-57-7	Polonium-213 (97.84 %)
		15690-73-0	Thallium-209 (2.16 %)
		14119-30-3	Lead-209
15832-50-5	Tin-126	15756-32-8m	Antimony-126m
		15756-32-8	Antimony-126 (14.0 %)
14158-29-3	Uranium-232	14274-82-9	Thorium-228
		13233-32-4	Radium-224
		22481-48-7	Radon-220

Table 8-1 Radionuclide Daughter Products Used for Dose Assessment

Parent Radionuclide CAS Registry Number	Parent Isotope	Daughter Product CAS Registry Number	Daughter Product (and yield)[1]
cont.	cont.	15756-58-8	Polonium-216
		15092-94-1	Lead-212
		14913-49-6	Bismuth-212
		15389-34-1	Polonium-212 (62.07%)
		14913-50-9	Thalium-208 (35.93%)
13966-29-5	Uranium-234	14269-63-7	Thorium-230
		14859-67-7	Radium-226
		14859-67-7	Radon-222
		15422-74-9	Polonium-218
		15067-28-4	Lead-214 (99.98 %)
		15755-40-5	Astatine-218 (0.02 %)
		14733-03-0	Bismuth-214
		15735-68-8	Polonium-214
		14255-04-0	Lead-210
		14331-79-4	Bismuth-210
		13981-52-7	Polonium-210
15117-96-1	Uranium-235	14932-40-2	Thorium-231
		14331-85-2	Protactinium-231
		14952-40-0	Actinium-227
		15756-98-6	Francium-223 (1.38 %)
		15623-47-9	Thorium-227 (98.62 %)
		15623-45-7	Radium-223
		14835-02-0	Radon-219
		15706-52-2	Polonium-215
		15816-77-0	Lead-211
		15229-37-5	Bismuth-211
		7440-08-6	Polonium-211 (0.27 %)
		14133-67-6	Thallium-207 (99.72 %)
7440-61-1	Uranium-238	15605-10-8	Thorium-234
		15100-28-4	Protactinium-234
		15100-28-4m	Protactinium-234m
		13966-29-5	Uranium-234
		14859-67-7	Radium-226
		14859-67-7	Radon-222
		15422-74-9	Polonium-218

Table 8-1 Radionuclide Daughter Products Used for Dose Assessment

Parent Radionuclide CAS Registry Number	Parent Isotope	Daughter Product CAS Registry Number	Daughter Product (and yield)[1]
cont.	cont.	15067-28-4	Lead-214 (99.98 %)
		15755-40-5	Astatine-218 (0.02 %)
		14733-03-0	Bismuth-214
		15735-68-8	Polonium-214
		14255-04-0	Lead-210
		14331-79-4	Bismuth-210
		13981-52-7	Polonium-210
15751-77-6	Zirconium-93	378782-82-2	Niobium-93m

[1] Percentage shown is the yield of the daughter product from the decay of the parent isotope. If no percentage is shown, an isotope is considered equal in activity to that of its parent.

Reference for Daughter Products and Yield:

Table A.1 from Eckerman KF and Ryman JC. 1993. *External Exposure to Radionuclides in Air, Water, and Soil*, EPA 402-R-93-081, Federal Guidance Report No. 12. Office of Radiation and Indoor Air, US Environmental Protection Agency, Washington, DC, USA.

Table 8-2 provides the dose conversion factors used for computing external dose due to soil and air. The dose conversion factor for external radiation from soil is used in the assessment of external dose to terrestrial receptors. The air immersion external radiation dose conversion factor is used in the assessment of external dose to both terrestrial and aquatic receptors.

Table 8-2 Radionuclide Dose Conversion Factors

CAS Registry Number	Constituent	Dose Conversion Factor for External Radiation from Soil	Units for Dose Conversion Factor for External Radiation from Soil	Air Immersion External Radiation Dose Conversion Factor	Units for Air Immersion External Radiation Dose Conversion Factor
10028-17-8	Tritium	0.00E+00	(Sv/s)/(Bq/m^3)	3.31E-19	(Sv/s)/(Bq/m^3)
10045-97-3	Cesium-137	1.34E-21	(Sv/s)/(Bq/m^3)	7.74E-18	(Sv/s)/(Bq/m^3)
10098-91-6	Yttrium-90	3.10E-20	(Sv/s)/(Bq/m^3)	1.90E-16	(Sv/s)/(Bq/m^3)
10098-97-2	Strontium-90	1.31E-21	(Sv/s)/(Bq/m^3)	7.53E-18	(Sv/s)/(Bq/m^3)
10198-40-0	Cobalt-60	1.52E-17	(Sv/s)/(Bq/m^3)	1.26E-13	(Sv/s)/(Bq/m^3)
13966-29-5	Uranium-234	1.01E-21	(Sv/s)/(Bq/m^3)	7.63E-18	(Sv/s)/(Bq/m^3)
13967-48-1	Ruthenium-106	0.00E+00	(Sv/s)/(Bq/m^3)	0.00E+00	(Sv/s)/(Bq/m^3)
13967-70-9	Cesium-134	9.78E-18	(Sv/s)/(Bq/m^3)	7.57E-14	(Sv/s)/(Bq/m^3)
13968-55-3	Uranium-233	2.16E-21	(Sv/s)/(Bq/m^3)	1.63E-17	(Sv/s)/(Bq/m^3)
13981-15-2	Curium-244	6.54E-22	(Sv/s)/(Bq/m^3)	4.91E-18	(Sv/s)/(Bq/m^3)
13981-16-3	Plutonium-238	6.34E-22	(Sv/s)/(Bq/m^3)	4.88E-18	(Sv/s)/(Bq/m^3)
13981-37-8	Nickel-63	0.00E+00	(Sv/s)/(Bq/m^3)	0.00E+00	(Sv/s)/(Bq/m^3)
13982-10-0	Plutonium-242	5.23E-22	(Sv/s)/(Bq/m^3)	4.01E-18	(Sv/s)/(Bq/m^3)
13982-63-3	Radium-226	4.15E-20	(Sv/s)/(Bq/m^3)	3.15E-16	(Sv/s)/(Bq/m^3)
13982-70-2	Uranium-236	6.53E-22	(Sv/s)/(Bq/m^3)	5.01E-18	(Sv/s)/(Bq/m^3)
13994-20-2	Neptunium-237	1.38E-19	(Sv/s)/(Bq/m^3)	1.03E-15	(Sv/s)/(Bq/m^3)
14119-32-5	Plutonium-241	9.60E-24	(Sv/s)/(Bq/m^3)	7.25E-20	(Sv/s)/(Bq/m^3)
14119-33-6	Plutonium-240	6.20E-22	(Sv/s)/(Bq/m^3)	4.75E-18	(Sv/s)/(Bq/m^3)
14133-76-7	Technetium-99	2.92E-22	(Sv/s)/(Bq/m^3)	1.62E-18	(Sv/s)/(Bq/m^3)
14158-29-3	Uranium-232	1.88E-21	(Sv/s)/(Bq/m^3)	1.42E-17	(Sv/s)/(Bq/m^3)
14234-35-6	Antimony-125	2.67E-18	(Sv/s)/(Bq/m^3)	2.02E-14	(Sv/s)/(Bq/m^3)
14331-85-2	Protactinium-231	2.30E-19	(Sv/s)/(Bq/m^3)	1.72E-15	(Sv/s)/(Bq/m^3)
14336-70-0	Nickel-59	0.00E+00	(Sv/s)/(Bq/m^3)	0.00E+00	(Sv/s)/(Bq/m^3)
14391-16-3	Europium-155	3.37E-19	(Sv/s)/(Bq/m^3)	2.49E-15	(Sv/s)/(Bq/m^3)
14596-10-2	Americium-241	1.15E-19	(Sv/s)/(Bq/m^3)	8.18E-16	(Sv/s)/(Bq/m^3)
14683-23-9	Europium-152	7.03E-18	(Sv/s)/(Bq/m^3)	5.65E-14	(Sv/s)/(Bq/m^3)
14762-75-5	Carbon-14	4.30E-23	(Sv/s)/(Bq/m^3)	2.24E-19	(Sv/s)/(Bq/m^3)
14952-40-0	Actinium-227	7.70E-22	(Sv/s)/(Bq/m^3)	5.82E-18	(Sv/s)/(Bq/m^3)
14993-75-0	Americium-243	2.96E-19	(Sv/s)/(Bq/m^3)	2.18E-15	(Sv/s)/(Bq/m^3)

Table 8-2 Radionuclide Dose Conversion Factors

CAS Registry Number	Constituent	Dose Conversion Factor for External Radiation from Soil	Units for Dose Conversion Factor for External Radiation from Soil	Air Immersion External Radiation Dose Conversion Factor	Units for Air Immersion External Radiation Dose Conversion Factor
15046-84-1	Iodine-129	5.95E-20	(Sv/s)/(Bq/m^3)	3.80E-16	(Sv/s)/(Bq/m^3)
15117-48-3	Plutonium-239	5.61E-22	(Sv/s)/(Bq/m^3)	4.24E-18	(Sv/s)/(Bq/m^3)
15117-96-1	Uranium-235	9.49E-19	(Sv/s)/(Bq/m^3)	7.20E-15	(Sv/s)/(Bq/m^3)
15262-20-1	Radium-228	0.00E+00	(Sv/s)/(Bq/m^3)	0.00E+00	(Sv/s)/(Bq/m^3)
15510-73-3	Curium-242	7.59E-22	(Sv/s)/(Bq/m^3)	5.69E-18	(Sv/s)/(Bq/m^3)
15585-10-1	Europium-154	7.62E-18	(Sv/s)/(Bq/m^3)	6.14E-14	(Sv/s)/(Bq/m^3)
15594-54-4	Thorium-229	5.09E-19	(Sv/s)/(Bq/m^3)	3.83E-15	(Sv/s)/(Bq/m^3)
15715-94-3	Samarium-151	5.22E-24	(Sv/s)/(Bq/m^3)	3.61E-20	(Sv/s)/(Bq/m^3)
15751-77-6	Zirconium-93	0.00E+00	(Sv/s)/(Bq/m^3)	0.00E+00	(Sv/s)/(Bq/m^3)
15757-87-6	Curium-243	7.79E-19	(Sv/s)/(Bq/m^3)	5.88E-15	(Sv/s)/(Bq/m^3)
15758-45-9	Selenium-79	5.77E-23	(Sv/s)/(Bq/m^3)	3.03E-19	(Sv/s)/(Bq/m^3)
15832-50-5	Tin-126	2.85E-19	(Sv/s)/(Bq/m^3)	2.11E-15	(Sv/s)/(Bq/m^3)
378253-40-8	Barium-137m	3.76E-18	(Sv/s)/(Bq/m^3)	2.88E-14	(Sv/s)/(Bq/m^3)
378253-44-2	Cadmium-113m	0.00E+00	(Sv/s)/(Bq/m^3)	0.00E+00	(Sv/s)/(Bq/m^3)
378782-82-2	Niobium-93m	5.59E-22	(Sv/s)/(Bq/m^3)	4.44E-18	(Sv/s)/(Bq/m^3)
7440-29-1	Thorium-232	1.16E-21	(Sv/s)/(Bq/m^3)	8.72E-18	(Sv/s)/(Bq/m^3)
7440-61-1R	Uranium-238	4.42E-22	(Sv/s)/(Bq/m^3)	3.41E-18	(Sv/s)/(Bq/m^3)

Reference for Dose Conversion Factor for External Radiation from Soil

Eckerman KF and Ryman JC. 1993. *External Exposure to Radionuclides in Air, Water, and Soil*, EPA 402-R-93-081, Federal Guidance Report No. 12. Office of Radiation and Indoor Air, US Environmental Protection Agency, Washington, DC, USA (Table III.4 for soil, Table III.1 for air).

Table 8-3 provides the internal alpha, beta, and gamma energy and alpha and beta adsorption factors. The energies shown are emitted during transition from a higher to a lower energy state, proportioned by the number of disintegrations producing radiation. The adsorption factors are simply the fraction of energy adsorbed (in most cases, all the energy is assumed to be adsorbed) and are the same for alpha and beta energy regardless of the receptor. Gamma adsorption fractions vary by receptor and are presented in subsequent tables. The symbol "[d]" indicates radionuclide is also daughter product of a radionuclide of potential concern. All energies shown below are in units of MeV per disintegration.

Table 8-3 Radiation Energy and Alpha/Beta Absorption Fractions

CAS Registry Number	Constituent	Internal Alpha Energy	Internal Alpha Absorbed Fraction	Internal Beta Energy	Internal Beta Absorbed Fraction	Internal Gamma Energy
10028-17-8	Tritium	0.00E+00	1	6.00E-03	1	0.00E+00
10045-97-3	Cesium-137	0.00E+00	1	1.87E-01	1	0.00E+00
10098-91-6	Yttrium-90	0.00E+00	1	9.35E-01	1	0.00E+00
10098-97-2	Strontium-90	0.00E+00	1	1.96E-01	1	0.00E+00
10198-40-0	Cobalt-60	0.00E+00	1	9.70E-02	1	2.50E+00
13233-32-4	Radium-224 [d]	5.67E+00	1	2.00E-03	1	1.00E-02
13966-29-5	Uranium-234	4.76E+00	1	1.30E-02	1	2.00E-03
13967-48-1	Ruthenium-106	0.00E+00	1	1.00E-02	1	0.00E+00
13967-70-9	Cesium-134	0.00E+00	1	1.64E-01	1	1.56E+00
13968-55-3	Uranium-233	4.82E+00	1	6.00E-03	1	1.00E-03
13968-59-7	Neptunium-239 [d]	4.77E+00	1	7.00E-02	1	3.50E-02
13981-14-1	Protactinium-233 [d]	0.00E+00	1	1.96E-01	1	2.04E-01
13981-15-2	Curium-244	5.80E+00	1	9.00E-03	1	2.00E-03
13981-16-3	Plutonium-238	5.49E+00	1	1.10E-02	1	2.00E-03
13981-37-8	Nickel-63	0.00E+00	1	1.70E-02	1	0.00E+00
13981-52-7	Polonium-210 [d]	5.30E+00	1	0.00E+00	1	0.00E+00
13981-53-8	Radium-225 [d]	0.00E+00	1	1.07E-01	1	1.40E-02
13982-10-0	Plutonium-242	4.89E+00	1	9.00E-03	1	1.00E-03
13982-63-3	Radium-226	4.77E+00	1	4.00E-03	1	7.00E-03
13982-70-2	Uranium-236	4.51E+00	1	1.10E-02	1	2.00E-03
13994-20-2	Neptunium-237	4.77E+00	1	7.00E-02	1	3.50E-02
14119-30-3	Lead-209 [d]	0.00E+00	1	1.98E-01	1	0.00E+00
14119-32-5	Plutonium-241	0.00E+00	1	5.00E-03	1	0.00E+00
14119-33-6	Plutonium-240	5.16E+00	1	1.10E-02	1	2.00E-03
14133-67-6	Thallium-207 [d]	0.00E+00	1	4.93E-01	1	2.00E-03
14133-76-7	Technetium-99	0.00E+00	1	1.01E-01	1	0.00E+00
14158-29-3	Uranium-232	5.30E+00	1	1.70E-02	1	2.00E-03

Table 8-3 Radiation Energy and Alpha/Beta Absorption Fractions

CAS Registry Number	Constituent	Internal Alpha Energy	Internal Alpha Absorbed Fraction	Internal Beta Energy	Internal Beta Absorbed Fraction	Internal Gamma Energy
14234-34-5	Rhodium-106 [d]	0.00E+00	1	1.41E+00	0.96	2.05E-01
14234-35-6	Antimony-125	0.00E+00	1	1.00E-01	1	4.31E-01
14255-04-0	Lead-210 (d)	0.00E+00	1	3.80E-02	1	5.00E-03
14265-85-1	Actinium-225 [d]	5.79E+00	1	2.20E-02	1	1.80E-02
14269-63-7	Thorium-230 [d]	4.67E+00	1	1.50E-02	1	2.00E-03
14274-82-9	Thorium-228 [d]	5.40E+00	1	2.10E-02	1	3.00E-03
14331-79-4	Bismuth-210 [d]	0.00E+00	1	3.89E-01	1	0.00E+00
14331-83-0	Actinium-228 [d]	0.00E+00	1	4.75E-01	1	9.71E-01
14331-85-2	Protactinium-231	4.97E+00	1	6.50E-02	1	4.80E-02
14336-70-0	Nickel-59	0.00E+00	1	5.00E-03	1	2.00E-03
14390-73-9	Tellurium-125m [d]	0.00E+00	1	1.09E-01	1	3.60E-02
14391-16-3	Europium-155	0.00E+00	1	6.30E-02	1	6.10E-02
14596-10-2	Americium-241	5.48E+00	1	5.20E-02	1	3.30E-02
14683-23-9	Europium-152	0.00E+00	1	1.39E-01	1	1.16E+00
14733-03-0	Bismuth-214 [d]	0.00E+00	1	6.59E-01	1	1.51E+00
14762-75-5	Carbon-14	0.00E+00	1	4.90E-02	1	0.00E+00
14835-02-0	Radon-219 [d]	6.76E+00	1	6.00E-03	1	5.60E-02
14859-67-7	Radon-222 [d]	5.49E+00	1	0.00E+00	1	0.00E+00
14913-49-6	Bismuth-212 [d]	2.17E+00	1	4.72E-01	1	1.86E-01
14913-50-9	Thalium-208 [d]	0.00E+00	1	5.98E-01	1	3.38E+00
14932-40-2	Thorium-231 [d]	0.00E+00	1	1.65E-01	1	2.60E-02
14952-40-0	Actinium-227	6.80E-02	1	1.60E-02	1	0.00E+00
14993-75-0	Americium-243	5.27E+00	1	2.20E-02	1	5.60E-02
15046-84-1	Iodine-129	0.00E+00	1	6.40E-02	1	2.50E-02
15067-28-4	Lead-214 [d]	0.00E+00	1	2.93E-01	1	2.50E-01
15092-94-1	Lead-212 [d]	0.00E+00	1	1.76E-01	1	1.48E-01
15100-28-4m	Protactinium-234m [d]	0.00E+00	1	8.22E-01	1	1.20E-02
15100-28-4	Protactinium-234 [d]	0.00E+00	1	4.94E-01	1	1.92E+00
15117-48-3	Plutonium-239 [d]	5.15E+00	1	7.00E-03	1	2.00E-03
15117-96-1	Uranium-235	4.40E+00	1	4.90E-02	1	1.56E-01
15229-37-5	Bismuth-211 [d]	6.55E+00	1	1.00E-02	1	4.70E-02
15262-20-1	Radium-228	0.00E+00	1	1.70E-02	1	0.00E+00
15389-34-1	Polonium-212 [d]	8.79E+00	1	0.00E+00	1	0.00E+00
15422-74-9	Polonium-218 [d]	6.00E+00	1	0.00E+00	1	0.00E+00

Table 8-3 Radiation Energy and Alpha/Beta Absorption Fractions

CAS Registry Number	Constituent	Internal Alpha Energy	Internal Alpha Absorbed Fraction	Internal Beta Energy	Internal Beta Absorbed Fraction	Internal Gamma Energy
15510-73-3	Curium-242	6.10E+00	1	1.00E-02	1	2.00E-03
15585-10-1	Europium-154	0.00E+00	1	2.92E-01	1	1.24E+00
15594-54-4	Thorium-229	4.87E+00	1	1.16E-01	1	9.60E-02
15605-10-8	Thorium-234 [d]	0.00E+00	1	6.00E-02	1	9.00E-03
15623-45-7	Radium-223 [d]	5.67E+00	1	7.60E-02	1	1.34E-01
15623-47-9	Thorium-227 [d]	5.88E+00	1	5.30E-02	1	1.10E-01
15690-73-0	Thallium-209 [d]	0.00E+00	1	6.88E-01	1	2.03E+00
15706-52-2	Polonium-215 [d]	7.39E+00	1	0.00E+00	1	0.00E+00
15715-94-3	Samarium-151	0.00E+00	1	2.00E-02	1	0.00E+00
15735-68-8	Polonium-214 [d]	7.69E+00	1	0.00E+00	1	0.00E+00
15751-77-6	Zirconium-93	0.00E+00	1	2.00E-02	1	0.00E+00
15755-40-5	Astatine-218 [d]	6.70E+00	1	4.00E-02	1	7.00E-03
15756-32-8	Antimony-126 [d]	0.00E+00	1	2.83E-01	1	2.83E+00
15756-32-8m	Antimony-126m [d]	0.00E+00	1	5.91E-01	1	1.55E+00
15756-41-9	Francium-221 [d]	6.30E+00	1	1.00E-02	1	3.10E-02
15756-57-7	Polonium-213 [d]	8.38E+00	1	0.00E+00	1	0.00E+00
15756-58-8	Polonium-216 [d]	6.78E+00	1	0.00E+00	1	0.00E+00
15756-98-6	Francium-223 [d]	0.00E+00	1	4.00E-01	1	5.90E-02
15757-87-6	Curium-243	5.80E+00	1	1.38E-01	1	1.34E-01
15758-45-9	Selenium-79	0.00E+00	1	5.60E-02	1	0.00E+00
15776-20-2	Bismuth-213 [d]	1.26E-01	1	4.42E-01	1	1.33E-01
15816-77-0	Lead-211 [d]	0.00E+00	1	4.56E-01	1	5.10E-02
15832-50-5	Tin-126	0.00E+00	1	1.72E-01	1	5.70E-02
17239-90-6	Astatine-217 [d]	7.07E+00	1	0.00E+00	1	0.00E+00
22481-48-7	Radon-220 [d]	6.29E+00	1	0.00E+00	1	0.00E+00
378253-40-8	Barium-137m	0.00E+00	1	6.50E-02	1	5.97E-01
378253-44-2	Cadmium-113m	0.00E+00	1	1.85E-01	1	0.00E+00
378782-82-2	Niobium-93m [d]	0.00E+00	1	2.80E-02	1	2.00E-03
7440-08-6R	Polonium-211 [d]	7.44E+00	1	0.00E+00	1	8.00E-03
7440-29-1	Thorium-232	4.00E+00	1	1.20E-02	1	1.00E-03
7440-54-2R	Gadolinium-152 [d]	2.15E+00	1	0.00E+00	1	0.00E+00
7440-61-1R	Uranium-238	4.19E+00	1	1.00E-02	1	1.00E-03

Table 8-3 Radiation Energy and Alpha/Beta Absorption Fractions

CAS Registry Number	Constituent	Internal Alpha Energy	Internal Alpha Absorbed Fraction	Internal Beta Energy	Internal Beta Absorbed Fraction	Internal Gamma Energy

Notes:

Internal alpha absorbed fraction assumed to be 1.0 for alpha radiation, internal beta absorbed fraction is from the reference(s) cited below. "[d]" indicates radionuclide is a daughter product of a radionuclide of potential concern. All energy units are in MeV/disintegration.

Reference for Internal Alpha, Beta, and Gamma Energy

Table A.1 from Eckerman KF and Ryman JC. 1993. *External Exposure to Radionuclides in Air, Water, and Soil*, EPA 402-R-93-081, Federal Guidance Report No. 12. Office of Radiation and Indoor Air, US Environmental Protection Agency, Washington, DC, USA.

Reference for Internal Beta Absorbed Fraction

Blaylock BG, Frank ML, and O'Neal BR. 1993. *Methodology for Estimating Radiation Dose Rates to Freshwater Biota Exposed to Radionuclides in the Environment*, ES/ER/TM-78. Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA.

Because gamma rays, like X-rays, may pass through the tissues without depositing their energy, gamma energies are adjusted to account for greater absorption by larger organisms at a given energy level and for greater absorption by all receptors at lower energy levels. Tables 8-3 through 8-9 provide receptor-specific gamma absorption factors that are used in dose computations for ecological receptors (see RAWP Sections 8.2.3.4 and 8.2.4.4). Only gamma emitting ROPCs and daughter products are shown. Some ROPCs are also daughter products. The symbol "[d]" indicates radionuclide is also daughter product of a radionuclide of potential concern. The RAWP should be consulted for an explicit list of ROPCs.

The majority of absorption factors were from Table 2 of *Methods and Tools for Estimation of the Exposure of Terrestrial Wildlife to Contaminants* (Sample, et. al., 1997) as indicated at the footer of the following tables. However, not all ROPCs and daughter products are indicated in Table 2 of that reference. Gamma energy absorption factors for radioisotopes not listed in Table 2 of the reference were derived by assigning an absorption factor from a surrogate radioisotope of equivalent gamma decay energy (refer to the tabulation of Table 2 data in Appendix A).

Table 8-4 provides gamma absorption factors for plants and invertebrates. Plants and invertebrates are presumed to be exposed to gamma emitters present in soils and air (external exposure), and from accumulation in tissue (internal exposure).

Table 8-4 Plant and Invertebrate Gamma Radiation Absorption Fractions

CAS Registry Number	Constituent	Plant Gamma Absorption Factor	Units for Plant Gamma Absorption Factor	Invertebrate Gamma Absorption Factor	Units for Invertebrate Gamma Absorption Factor
10198-40-0	Cobalt-60	1.00E-02	unitless	1.00E-02	unitless
13233-32-4	Radium-224 [d]	6.30E-01	unitless	6.30E-01	unitless
13966-29-5	Uranium-234	6.30E-01	unitless	6.30E-01	unitless
13966-29-5	Uranium-234 [d]	6.30E-01	unitless	6.30E-01	unitless
13967-70-9	Cesium-134	8.50E-02	unitless	8.50E-02	unitless
13968-55-3	Uranium-233	6.30E-01	unitless	6.30E-01	unitless
13968-59-7	Neptunium-239 [d]	1.00E-02	unitless	1.00E-02	unitless
13981-14-1	Protactinium-233 [d]	1.00E-02	unitless	1.00E-02	unitless
13981-15-2	Curium-244	6.30E-01	unitless	6.30E-01	unitless
13981-16-3	Plutonium-238	6.30E-01	unitless	6.30E-01	unitless
13981-53-8	Radium-225 [d]	5.50E-01	unitless	5.50E-01	unitless
13982-10-0	Plutonium-242	6.30E-01	unitless	6.30E-01	unitless
13982-63-3	Radium-226 [d]	6.30E-01	unitless	6.30E-01	unitless
13982-70-2	Uranium-236	1.00E-02	unitless	1.00E-02	unitless
13994-20-2	Neptunium-237	2.70E-02	unitless	2.70E-02	unitless
14119-33-6	Plutonium-240	6.30E-01	unitless	6.30E-01	unitless
14133-67-6	Thallium-207 [d]	6.30E-01	unitless	6.30E-01	unitless

Table 8-4 Plant and Invertebrate Gamma Radiation Absorption Fractions

CAS Registry Number	Constituent	Plant Gamma Absorption Factor	Units for Plant Gamma Absorption Factor	Invertebrate Gamma Absorption Factor	Units for Invertebrate Gamma Absorption Factor
14158-29-3	Uranium-232	6.30E-01	unitless	6.30E-01	unitless
14234-34-5	Rhodium-106 [d]	1.00E-02	unitless	1.00E-02	unitless
14234-35-6	Antimony-125	1.10E-02	unitless	1.10E-02	unitless
14255-04-0	Lead-210 [d]	6.30E-01	unitless	6.30E-01	unitless
14265-85-1	Actinium-225 [d]	9.00E-02	unitless	9.00E-02	unitless
14269-63-7	Thorium-230 [d]	6.30E-01	unitless	6.30E-01	unitless
14274-82-9_r	Thorium-228 [d]	6.30E-01	unitless	6.30E-01	unitless
14331-83-0	Actinium-228 [d]	1.00E-02	unitless	1.00E-02	unitless
14331-85-2	Protactinium-231 [d]	2.70E-02	unitless	2.70E-02	unitless
14336-70-0	Nickel-59	6.30E-01	unitless	6.30E-01	unitless
14390-73-9	Tellurium-125m [d]	2.70E-02	unitless	2.70E-02	unitless
14391-16-3	Europium-155	1.20E-02	unitless	1.20E-02	unitless
14596-10-2	Americium-241	4.00E-02	unitless	4.00E-02	unitless
14683-23-9	Europium-152	8.50E-02	unitless	8.50E-02	unitless
14733-03-0	Bismuth-214 [d]	8.50E-02	unitless	8.50E-02	unitless
14835-02-0	Radon-219 [d]	1.20E-02	unitless	1.20E-02	unitless
14913-49-6	Bismuth-212 [d]	1.00E-02	unitless	1.00E-02	unitless
14913-50-9	Thalium-208 [d]	1.00E-02	unitless	1.00E-02	unitless
14932-40-2	Thorium-231 [d]	9.00E-02	unitless	9.00E-02	unitless
14993-75-0	Americium-243	1.20E-02	unitless	1.20E-02	unitless
15046-84-1	Iodine-129	9.00E-02	unitless	9.00E-02	unitless
15067-28-4	Lead-214 [d]	1.00E-02	unitless	1.00E-02	unitless
15092-94-1	Lead-212 [d]	1.00E-02	unitless	1.00E-02	unitless
1510-28-4m	Protactinium-234m [d]	5.50E-01	unitless	5.50E-01	unitless
15100-28-4	Protactinium-234 [d]	8.50E-02	unitless	8.50E-02	unitless
15117-48-3	Plutonium-239 [d]	6.30E-01	unitless	6.30E-01	unitless
15117-96-1	Uranium-235 [d]	1.00E-02	unitless	1.00E-02	unitless
15229-37-5	Bismuth-211 [d]	2.70E-02	unitless	2.70E-02	unitless
15510-73-3	Curium-242	6.30E-01	unitless	6.30E-01	unitless
15585-10-1	Europium-154	8.50E-02	unitless	8.50E-02	unitless
15594-54-4	Thorium-229	1.00E-02	unitless	1.00E-02	unitless
15605-10-8	Thorium-234 [d]	6.30E-01	unitless	6.30E-01	unitless
15623-45-7	Radium-223 [d]	1.00E-02	unitless	1.00E-02	unitless

Table 8-4 Plant and Invertebrate Gamma Radiation Absorption Fractions

CAS Registry Number	Constituent	Plant Gamma Absorption Factor	Units for Plant Gamma Absorption Factor	Invertebrate Gamma Absorption Factor	Units for Invertebrate Gamma Absorption Factor
15623-47-9	Thorium-227 [d]	1.00E-02	unitless	1.00E-02	unitless
15690-73-0	Thallium-209 [d]	8.50E-02	unitless	8.50E-02	unitless
15755-40-5	Astatine-218 [d]	6.30E-01	unitless	6.30E-01	unitless
15756-32-8	Antimony-126 [d]	1.00E-02	unitless	1.00E-02	unitless
15756-32-8m	Antimony-126m [d]	8.50E-02	unitless	8.50E-02	unitless
15756-41-9	Francium-221 [d]	6.30E-01	unitless	6.30E-01	unitless
15756-98-6_r	Francium-223 [d]	6.30E-01	unitless	6.30E-01	unitless
15757-87-6	Curium-243	1.00E-02	unitless	1.00E-02	unitless
15776-20-2	Bismuth-213 [d]	1.00E-02	unitless	1.00E-02	unitless
15816-77-0	Lead-211 [d]	6.30E-01	unitless	6.30E-01	unitless
15832-50-5	Tin-126	1.20E-02	unitless	1.20E-02	unitless
378253-40-8	Barium-137m	1.10E-02	unitless	1.10E-02	unitless
378782-82-2	Niobium-93m [d]	6.30E-01	unitless	6.30E-01	unitless
7440-08-6	Polonium-211 [d]	6.30E-01	unitless	6.30E-01	unitless
7440-29-1	Thorium-232	6.30E-01	unitless	6.30E-01	unitless
7440-61-1	Uranium-238	6.30E-01	unitless	6.30E-01	unitless

Reference for Plant Gamma Absorption Factor

Sample BE, Aplin MS, Efroymson RA, Suter II GW, and Welsh CJE. 1997. *Methods and Tools for Estimation of the Exposure of Terrestrial Wildlife to Contaminants*, ORNL/TM-13391. Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN (Table 2, fraction A).

Table 8-5 provides gamma absorption factors for the mule deer and mourning dove. Mule deer and mourning dove are presumed to be exposed to external radiation from soil and air, and exposed to internal to radiation from the accumulation of ROPCs (and their daughter products) in their tissue.

Table 8-5 Mule Deer and Mourning Dove Gamma Radiation Absorption Fractions

CAS Registry Number	Constituent	Mule Deer Gamma Absorption Factor	Units for Mule Deer Gamma Absorption Factor	Mourning Dove Gamma Absorption Factor	Units for Mourning Dove Gamma Absorption Factor
10198-40-0	Cobalt-60	1.10E-01	unitless	1.00E-02	unitless
13233-32-4	Radium-224 [d]	5.20E-01	unitless	7.90E-01	unitless
13966-29-5	Uranium-234	9.40E-01	unitless	7.90E-01	unitless
13966-29-5	Uranium-234 [d]	9.40E-01	unitless	7.90E-01	unitless
13967-70-9	Cesium-134	1.20E-01	unitless	1.23E-02	unitless
13968-55-3	Uranium-233	9.40E-01	unitless	7.90E-01	unitless
13968-59-7	Neptunium-239 [d]	1.40E-01	unitless	1.10E-02	unitless
13981-14-1	Protactinium-233 [d]	1.40E-01	unitless	1.00E-02	unitless
13981-15-2	Curium-244	9.40E-01	unitless	7.90E-01	unitless
13981-16-3	Plutonium-238	9.40E-01	unitless	7.90E-01	unitless
13981-53-8	Radium-225 [d]	9.30E-01	unitless	6.30E-01	unitless
13982-10-0	Plutonium-242	9.40E-01	unitless	7.90E-01	unitless
13982-63-3	Radium-226	9.40E-01	unitless	7.90E-01	unitless
13982-63-3	Radium-226 [d]	9.40E-01	unitless	7.90E-01	unitless
13982-70-2	Uranium-236	1.40E-01	unitless	1.15E-02	unitless
13994-20-2	Neptunium-237	2.90E-01	unitless	4.00E-02	unitless
14119-33-6	Plutonium-240	9.40E-01	unitless	7.90E-01	unitless
14133-67-6	Thallium-207 [d]	9.40E-01	unitless	7.90E-01	unitless
14158-29-3	Uranium-232	9.40E-01	unitless	7.90E-01	unitless
14234-34-5	Rhodium-106 [d]	1.40E-01	unitless	7.90E-01	unitless
14234-35-6	Antimony-125	1.50E-01	unitless	1.50E-02	unitless
14255-04-0	Lead-210 [d]	9.40E-01	unitless	7.90E-01	unitless
14265-85-1	Actinium-225 [d]	9.40E-01	unitless	7.90E-01	unitless
14269-63-7	Thorium-230 [d]	9.40E-01	unitless	7.90E-01	unitless
14274-82-9	Thorium-228 [d]	9.40E-01	unitless	7.90E-01	unitless
14331-83-0	Actinium-228 [d]	1.40E-01	unitless	1.27E-02	unitless
14331-85-2	Protactinium-231	2.90E-01	unitless	4.00E-02	unitless
14331-85-2	Protactinium-231 [d]	2.90E-01	unitless	4.00E-02	unitless
14336-70-0	Nickel-59	9.40E-01	unitless	7.90E-01	unitless
14390-73-9	Tellurium-125m [d]	2.90E-01	unitless	7.90E-01	unitless

Table 8-5 Mule Deer and Mourning Dove Gamma Radiation Absorption Fractions

CAS Registry Number	Constituent	Mule Deer Gamma Absorption Factor	Units for Mule Deer Gamma Absorption Factor	Mourning Dove Gamma Absorption Factor	Units for Mourning Dove Gamma Absorption Factor
14391-16-3	Europium-155	2.00E-01	unitless	1.70E-02	unitless
14596-10-2	Americium-241	3.00E-01	unitless	5.00E-02	unitless
14683-23-9	Europium-152	1.20E-01	unitless	1.23E-02	unitless
14733-03-0	Bismuth-214 [d]	1.20E-01	unitless	1.23E-02	unitless
14835-02-0	Radon-219 [d]	2.00E-01	unitless	1.70E-02	unitless
14913-49-6	Bismuth-212 [d]	1.40E-01	unitless	1.10E-02	unitless
14913-50-9	Thalium-208 [d]	1.10E-01	unitless	1.00E-02	unitless
14932-40-2	Thorium-231 [d]	3.60E-01	unitless	1.26E-01	unitless
14993-75-0	Americium-243	2.00E-01	unitless	1.70E-02	unitless
15046-84-1	Iodine-129	3.60E-01	unitless	1.26E-01	unitless
15067-28-4	Lead-214 [d]	1.40E-01	unitless	1.00E-02	unitless
15092-94-1	Lead-212 [d]	1.50E-01	unitless	1.10E-02	unitless
1510-28-4m	Protactinium-234m [d]	9.30E-01	unitless	6.30E-01	unitless
15100-28-4	Protactinium-234 [d]	1.20E-01	unitless	1.23E-02	unitless
15117-48-3	Plutonium-239 [d]	9.40E-01	unitless	7.90E-01	unitless
15117-96-1	Uranium-235 [d]	1.40E-01	unitless	1.15E-02	unitless
15229-37-5	Bismuth-211 [d]	2.90E-01	unitless	4.00E-02	unitless
15510-73-3	Curium-242	9.40E-01	unitless	7.90E-01	unitless
15585-10-1	Europium-154	1.20E-01	unitless	1.23E-02	unitless
15594-54-4	Thorium-229	1.50E-01	unitless	1.20E-02	unitless
15605-10-8	Thorium-234 [d]	9.40E-01	unitless	7.90E-01	unitless
15623-45-7	Radium-223 [d]	1.50E-01	unitless	1.05E-02	unitless
15623-47-9	Thorium-227 [d]	1.50E-01	unitless	1.20E-02	unitless
15690-73-0	Thallium-209 [d]	1.20E-01	unitless	1.23E-02	unitless
15755-40-5	Astatine-218 [d]	9.40E-01	unitless	7.90E-01	unitless
15755-40-5	Astatine-218 [d]	9.40E-01	unitless	7.90E-01	unitless
15756-32-8	Antimony-126 [d]	1.10E-01	unitless	1.00E-02	unitless
15756-32-8m	Antimony-126m [d]	1.20E-01	unitless	1.23E-02	unitless
15756-41-9	Francium-221 [d]	3.00E-01	unitless	5.00E-02	unitless
15756-98-6	Francium-223 [d]	2.00E-01	unitless	1.70E-02	unitless
15757-87-6	Curium-243	1.50E-01	unitless	1.05E-02	unitless
15776-20-2	Bismuth-213 [d]	1.50E-01	unitless	1.05E-02	unitless
15816-77-0	Lead-211 [d]	2.00E-01	unitless	1.70E-02	unitless

Table 8-5 Mule Deer and Mourning Dove Gamma Radiation Absorption Fractions

CAS Registry Number	Constituent	Mule Deer Gamma Absorption Factor	Units for Mule Deer Gamma Absorption Factor	Mourning Dove Gamma Absorption Factor	Units for Mourning Dove Gamma Absorption Factor
15832-50-5	Tin-126	2.00E-01	unitless	1.70E-02	unitless
378253-40-8	Barium-137m	1.50E-01	unitless	1.50E-02	unitless
378782-82-2	Niobium-93m [d]	9.40E-01	unitless	7.90E-01	unitless
7440-08-6	Polonium-211 [d]	9.40E-01	unitless	7.90E-01	unitless
7440-29-1	Thorium-232	9.40E-01	unitless	7.90E-01	unitless
7440-61-1	Uranium-238	9.40E-01	unitless	7.90E-01	unitless

Reference (source) for Mule Deer and Mourning Dove Gamma Absorption Factor

Sample BE, Aplin MS, Efroymson RA, Suter II GW, and Welsh CJE. 1997. *Methods and Tools for Estimation of the Exposure of Terrestrial Wildlife to Contaminants*, ORNL/TM-13391. Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN (Table 2, fraction E for the mule deer, fraction B for the mourning dove).

Table 8-6 provides gamma absorption factors for the great basin pocket mouse and western meadowlark. The great basin pocket mouse and western meadowlark are presumed to be exposed to external radiation from soil and air, and exposed to internal to radiation from the accumulation of ROPCs (and their daughter products) in their tissue.

Table 8-6 Great Basin Pocket Mouse and Western Meadowlark Gamma Radiation Absorption Fractions

CAS Registry Number	Constituent	Great Basin Pocket Mouse Gamma Absorption Factor	Units for Great Basin Pocket Mouse Gamma Absorption Factor	Meadowlark Gamma Absorption Factor	Units for Meadowlark Gamma Absorption Factor
10198-40-0	Cobalt-60	1.00E-02	unitless	1.00E-02	unitless
13233-32-4	Radium-224 [d]	7.90E-01	unitless	7.90E-01	unitless
13966-29-5	Uranium-234 [d]	7.90E-01	unitless	7.90E-01	unitless
13967-70-9	Cesium-134	1.23E-02	unitless	1.23E-02	unitless
13968-55-3	Uranium-233	7.90E-01	unitless	7.90E-01	unitless
13968-59-7	Neptunium-239 [d]	1.10E-02	unitless	1.10E-02	unitless
13981-14-1	Protactinium-233 [d]	1.00E-02	unitless	1.00E-02	unitless
13981-15-2	Curium-244	7.90E-01	unitless	7.90E-01	unitless
13981-16-3	Plutonium-238	7.90E-01	unitless	7.90E-01	unitless
13981-53-8	Radium-225 [d]	6.30E-01	unitless	6.30E-01	unitless
13982-10-0	Plutonium-242	7.90E-01	unitless	7.90E-01	unitless
13982-63-3	Radium-226 [d]	7.90E-01	unitless	7.90E-01	unitless
13982-70-2	Uranium-236	1.15E-02	unitless	1.15E-02	unitless
13994-20-2	Neptunium-237	4.00E-02	unitless	4.00E-02	unitless
14119-33-6	Plutonium-240	7.90E-01	unitless	7.90E-01	unitless
14133-67-6	Thallium-207 [d]	7.90E-01	unitless	7.90E-01	unitless
14158-29-3	Uranium-232	7.90E-01	unitless	7.90E-01	unitless
14234-34-5	Rhodium-106 [d]	7.90E-01	unitless	7.90E-01	unitless
14234-35-6	Antimony-125	1.50E-02	unitless	1.50E-02	unitless
14255-04-0	Lead-210 [d]	7.90E-01	unitless	7.90E-01	unitless
14265-85-1	Actinium-225 [d]	7.90E-01	unitless	7.90E-01	unitless
14269-63-7	Thorium-230 [d]	7.90E-01	unitless	7.90E-01	unitless
14274-82-9	Thorium-228 [d]	7.90E-01	unitless	7.90E-01	unitless
14331-83-0	Actinium-228 [d]	1.27E-02	unitless	1.27E-02	unitless
14331-85-2	Protactinium-231 [d]	4.00E-02	unitless	4.00E-02	unitless
14336-70-0	Nickel-59	7.90E-01	unitless	7.90E-01	unitless
14390-73-9	Tellurium-125m [d]	7.90E-01	unitless	7.90E-01	unitless
14391-16-3	Europium-155	1.70E-02	unitless	1.70E-02	unitless

Table 8-6 Great Basin Pocket Mouse and Western Meadowlark Gamma Radiation Absorption Fractions

CAS Registry Number	Constituent	Great Basin Pocket Mouse Gamma Absorption Factor	Units for Great Basin Pocket Mouse Gamma Absorption Factor	Meadowlark Gamma Absorption Factor	Units for Meadowlark Gamma Absorption Factor
14596-10-2	Americium-241	5.00E-02	unitless	5.00E-02	unitless
14683-23-9	Europium-152	1.23E-02	unitless	1.23E-02	unitless
14733-03-0	Bismuth-214 [d]	1.23E-02	unitless	1.23E-02	unitless
14835-02-0	Radon-219 [d]	1.70E-02	unitless	1.70E-02	unitless
14913-49-6	Bismuth-212 [d]	1.10E-02	unitless	1.10E-02	unitless
14913-50-9	Thalium-208 [d]	1.00E-02	unitless	1.00E-02	unitless
14932-40-2	Thorium-231 [d]	1.26E-01	unitless	1.26E-01	unitless
14993-75-0	Americium-243	1.70E-02	unitless	1.70E-02	unitless
15046-84-1	Iodine-129	1.26E-01	unitless	1.26E-01	unitless
15067-28-4	Lead-214 [d]	1.00E-02	unitless	1.00E-02	unitless
15092-94-1	Lead-212 [d]	1.10E-02	unitless	1.10E-02	unitless
1510-28-4m	Protactinium-234m [d]	6.30E-01	unitless	6.30E-01	unitless
15100-28-4	Protactinium-234 [d]	1.23E-02	unitless	1.23E-02	unitless
15117-48-3	Plutonium-239 [d]	7.90E-01	unitless	7.90E-01	unitless
15117-96-1	Uranium-235 [d]	1.15E-02	unitless	1.15E-02	unitless
15229-37-5	Bismuth-211 [d]	4.00E-02	unitless	4.00E-02	unitless
15510-73-3	Curium-242	7.90E-01	unitless	7.90E-01	unitless
15585-10-1	Europium-154	1.23E-02	unitless	1.23E-02	unitless
15594-54-4	Thorium-229	1.20E-02	unitless	1.20E-02	unitless
15605-10-8	Thorium-234 [d]	7.90E-01	unitless	7.90E-01	unitless
15623-45-7	Radium-223 [d]	1.05E-02	unitless	1.05E-02	unitless
15623-47-9	Thorium-227 [d]	1.20E-02	unitless	1.20E-02	unitless
15690-73-0	Thallium-209 [d]	1.23E-02	unitless	1.23E-02	unitless
15755-40-5	Astatine-218 [d]	7.90E-01	unitless	7.90E-01	unitless
15756-32-8	Antimony-126 [d]	1.00E-02	unitless	1.00E-02	unitless
15756-32-8m	Antimony-126m [d]	1.23E-02	unitless	1.23E-02	unitless
15756-41-9	Francium-221 [d]	5.00E-02	unitless	5.00E-02	unitless
15756-98-6	Francium-223 [d]	1.70E-02	unitless	1.70E-02	unitless
15757-87-6	Curium-243	1.05E-02	unitless	1.05E-02	unitless
15776-20-2	Bismuth-213 [d]	1.05E-02	unitless	1.05E-02	unitless
15816-77-0	Lead-211 [d]	1.70E-02	unitless	1.70E-02	unitless
15832-50-5	Tin-126	1.70E-02	unitless	1.70E-02	unitless

Table 8-6 Great Basin Pocket Mouse and Western Meadowlark Gamma Radiation Absorption Fractions

CAS Registry Number	Constituent	Great Basin Pocket Mouse Gamma Absorption Factor	Units for Great Basin Pocket Mouse Gamma Absorption Factor	Meadowlark Gamma Absorption Factor	Units for Meadowlark Gamma Absorption Factor
378253-40-8	Barium-137m	1.50E-02	unitless	1.50E-02	unitless
378782-82-2	Niobium-93m [d]	7.90E-01	unitless	7.90E-01	unitless
7440-08-6	Polonium-211 [d]	7.90E-01	unitless	7.90E-01	unitless
7440-29-1	Thorium-232	7.90E-01	unitless	7.90E-01	unitless
7440-61-1	Uranium-238	7.90E-01	unitless	7.90E-01	unitless

Reference (source) for Great Basin Pocket Mouse and Western Meadowlark Gamma Absorption Factor

Sample BE, Aplin MS, Efroymson RA, Suter II GW, and Welsh CJE. 1997. *Methods and Tools for Estimation of the Exposure of Terrestrial Wildlife to Contaminants*, ORNL/TM-13391. Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN (Table 2, fraction B).

Table 8-7 provides gamma absorption factors for the coyote, red-tailed hawk, and burrowing owl. The coyote, red-tailed hawk, and burrowing owl are presumed to be exposed to external radiation from soil and air, and exposed to internal to radiation from the accumulation of ROPCs (and their daughter products) in their tissue.

Table 8-7 Coyote, Red-Tailed Hawk, and Burrowing Owl Gamma Radiation Absorption Fractions

CAS Registry Number	Constituent	Coyote Absorption Factor	Units for Coyote Absorption Factor	Red-tailed Hawk Absorption Factor	Units for Red-tailed Hawk Absorption Factor	Burrowing Owl Absorption Factor	Units for Burrowing Owl Absorption Factor
10198-40-0	Cobalt-60	4.00E-02	unitless	4.00E-02	unitless	1.00E-02	unitless
13233-32-4	Radium-224 [d]	3.50E-01	unitless	3.50E-01	unitless	7.90E-01	unitless
13966-29-5	Uranium-234 [d]	9.40E-01	unitless	9.40E-01	unitless	7.90E-01	unitless
13967-70-9	Cesium-134	5.00E-02	unitless	5.00E-02	unitless	1.23E-02	unitless
13968-55-3	Uranium-233	9.40E-01	unitless	9.40E-01	unitless	7.90E-01	unitless
13968-59-7	Neptunium-239 [d]	6.00E-02	unitless	6.00E-02	unitless	1.10E-02	unitless
13981-14-1	Protactinium-233 [d]	6.00E-02	unitless	6.00E-02	unitless	1.00E-02	unitless
13981-15-2	Curium-244	9.40E-01	unitless	9.40E-01	unitless	7.90E-01	unitless
13981-16-3	Plutonium-238	9.40E-01	unitless	9.40E-01	unitless	7.90E-01	unitless
13981-53-8	Radium-225 [d]	9.30E-01	unitless	9.30E-01	unitless	6.30E-01	unitless
13982-10-0	Plutonium-242	9.40E-01	unitless	9.40E-01	unitless	7.90E-01	unitless
13982-63-3	Radium-226 [d]	9.40E-01	unitless	9.40E-01	unitless	7.90E-01	unitless
13982-70-2	Uranium-236	6.00E-02	unitless	6.00E-02	unitless	1.15E-02	unitless
13994-20-2	Neptunium-237	1.50E-01	unitless	1.50E-01	unitless	4.00E-02	unitless
14119-33-6	Plutonium-240	9.40E-01	unitless	9.40E-01	unitless	7.90E-01	unitless
14133-67-6	Thallium-207 [d]	9.40E-01	unitless	9.40E-01	unitless	7.90E-01	unitless
14158-29-3	Uranium-232	9.40E-01	unitless	9.40E-01	unitless	7.90E-01	unitless
14234-34-5	Rhodium-106 [d]	6.00E-02	unitless	6.00E-02	unitless	7.90E-01	unitless
14234-35-6	Antimony-125	6.00E-02	unitless	6.00E-02	unitless	1.50E-02	unitless
14255-04-0	Lead-210 [d]	9.40E-01	unitless	9.40E-01	unitless	7.90E-01	unitless
14265-85-1	Actinium-225 [d]	9.30E-01	unitless	9.30E-01	unitless	7.90E-01	unitless
14269-63-7	Thorium-230 [d]	9.40E-01	unitless	9.40E-01	unitless	7.90E-01	unitless
14274-82-9	Thorium-228 [d]	9.40E-01	unitless	9.40E-01	unitless	7.90E-01	unitless
14331-83-0	Actinium-228 [d]	6.00E-02	unitless	6.00E-02	unitless	1.27E-02	unitless
14331-85-2	Protactinium-231 [d]	1.50E-01	unitless	1.50E-01	unitless	4.00E-02	unitless
14336-70-0	Nickel-59	9.40E-01	unitless	9.40E-01	unitless	7.90E-01	unitless
14390-73-9	Tellurium-125m [d]	1.50E-01	unitless	1.50E-01	unitless	7.90E-01	unitless
14391-16-3	Europium-155	9.00E-02	unitless	9.00E-02	unitless	1.70E-02	unitless
14596-10-2	Americium-241	1.60E-01	unitless	1.60E-01	unitless	5.00E-02	unitless

Table 8-7 Coyote, Red-Tailed Hawk, and Burrowing Owl Gamma Radiation Absorption Fractions

CAS Registry Number	Constituent	Coyote Absorption Factor	Units for Coyote Absorption Factor	Red-tailed Hawk Absorption Factor	Units for Red-tailed Hawk Absorption Factor	Burrowing Owl Absorption Factor	Units for Burrowing Owl Absorption Factor
14683-23-9	Europium-152	5.00E-02	unitless	5.00E-02	unitless	1.23E-02	unitless
14733-03-0	Bismuth-214 [d]	5.00E-02	unitless	5.00E-02	unitless	1.23E-02	unitless
14835-02-0	Radon-219 [d]	9.00E-02	unitless	9.00E-02	unitless	1.70E-02	unitless
14913-49-6	Bismuth-212 [d]	6.00E-02	unitless	6.00E-02	unitless	1.10E-02	unitless
14913-50-9	Thalium-208 [d]	4.00E-02	unitless	4.00E-02	unitless	1.00E-02	unitless
14932-40-2	Thorium-231 [d]	2.10E-01	unitless	2.10E-01	unitless	1.26E-01	unitless
14993-75-0	Americium-243	9.00E-02	unitless	9.00E-02	unitless	1.70E-02	unitless
15046-84-1	Iodine-129	2.10E-01	unitless	2.10E-01	unitless	1.26E-01	unitless
15067-28-4	Lead-214 [d]	6.00E-02	unitless	6.00E-02	unitless	1.00E-02	unitless
15092-94-1	Lead-212 [d]	6.00E-02	unitless	6.00E-02	unitless	1.10E-02	unitless
1510-28-4m	Protactinium-234m [d]	9.30E-01	unitless	9.30E-01	unitless	6.30E-01	unitless
15100-28-4	Protactinium-234 [d]	5.00E-02	unitless	5.00E-02	unitless	1.23E-02	unitless
15117-48-3	Plutonium-239 [d]	9.40E-01	unitless	9.40E-01	unitless	7.90E-01	unitless
15117-96-1	Uranium-235 [d]	6.00E-02	unitless	6.00E-02	unitless	1.15E-02	unitless
15229-37-5	Bismuth-211 [d]	1.50E-01	unitless	1.50E-01	unitless	4.00E-02	unitless
15510-73-3	Curium-242	9.40E-01	unitless	9.40E-01	unitless	7.90E-01	unitless
15585-10-1	Europium-154	5.00E-02	unitless	5.00E-02	unitless	1.23E-02	unitless
15594-54-4	Thorium-229	6.00E-02	unitless	6.00E-02	unitless	1.20E-02	unitless
15605-10-8	Thorium-234 [d]	9.40E-01	unitless	9.40E-01	unitless	7.90E-01	unitless
15623-45-7	Radium-223 [d]	6.00E-02	unitless	6.00E-02	unitless	1.05E-02	unitless
15623-47-9	Thorium-227 [d]	6.00E-02	unitless	6.00E-02	unitless	1.20E-02	unitless
15690-73-0	Thallium-209 [d]	5.00E-02	unitless	5.00E-02	unitless	1.23E-02	unitless
15755-40-5	Astatine-218 [d]	9.40E-01	unitless	9.40E-01	unitless	7.90E-01	unitless
15756-32-8	Antimony-126 [d]	4.00E-02	unitless	4.00E-02	unitless	1.00E-02	unitless
15756-32-8m	Antimony-126m [d]	5.00E-02	unitless	5.00E-02	unitless	1.23E-02	unitless
15756-41-9	Francium-221 [d]	9.40E-01	unitless	9.40E-01	unitless	5.00E-02	unitless
15756-98-6	Francium-223 [d]	9.40E-01	unitless	9.40E-01	unitless	1.70E-02	unitless
15757-87-6	Curium-243	6.00E-02	unitless	6.00E-02	unitless	1.05E-02	unitless
15776-20-2	Bismuth-213 [d]	6.00E-02	unitless	6.00E-02	unitless	1.05E-02	unitless
15816-77-0	Lead-211 [d]	9.00E-02	unitless	9.00E-02	unitless	1.70E-02	unitless
15832-50-5	Tin-126	9.00E-02	unitless	9.00E-02	unitless	1.70E-02	unitless
378253-40-8	Barium-137m	6.00E-02	unitless	6.00E-02	unitless	1.50E-02	unitless
378782-82-2	Niobium-93m [d]	9.40E-01	unitless	9.40E-01	unitless	7.90E-01	unitless

Table 8-7 Coyote, Red-Tailed Hawk, and Burrowing Owl Gamma Radiation Absorption Fractions

CAS Registry Number	Constituent	Coyote Absorption Factor	Units for Coyote Absorption Factor	Red-tailed Hawk Absorption Factor	Units for Red-tailed Hawk Absorption Factor	Burrowing Owl Absorption Factor	Units for Burrowing Owl Absorption Factor
7440-08-6	Polonium-211 [d]	9.40E-01	unitless	9.40E-01	unitless	7.90E-01	unitless
7440-29-1	Thorium-232	9.40E-01	unitless	9.40E-01	unitless	7.90E-01	unitless
7440-61-1	Uranium-238	9.40E-01	unitless	9.40E-01	unitless	7.90E-01	unitless

Reference (source) for Coyote, Red-Tailed Hawk, and Burrowing Owl Gamma Absorption Factor

Sample BE, Aplin MS, Efroymson RA, Suter II GW, and Welsh CJE. 1997. *Methods and Tools for Estimation of the Exposure of Terrestrial Wildlife to Contaminants*, ORNL/TM-13391. Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN (Table 2, fraction D for the coyote and hawk, fraction B for the owl).

Table 8-8 provides gamma absorption factors for aquatic plants, benthic invertebrates, and Chinook salmon (and other salmonids). Aquatic plants are presumed to be exposed to external radiation from sediment, water, and air. Benthic invertebrates are presumed to be exposed to external radiation from sediment, water (including exposures near or on water), and air. Chinook salmon (and other salmonids) are presumed to be exposed to external radiation from sediment and water (including exposures near or on water). All three receptors, quatic plants, benthic invertebrates, and Chinook salmon (and other salmonids) are considered exposed to internal to radiation from the accumulation of ROPCs (and their daughter products) in their tissue.

Table 8-8 Aquatic Plants, Benthic Invertebrate and Chinook Salmon and Other Salmonids Gamma Radiation Absorption Fractions

CAS Registry Number	Constituent	Plant Gamma Absorption Factor	Units for Plant Gamma Absorption Factor	Benthic Invertebrates Absorption Factor	Units for Benthic Invertebrates Absorption Factor	Chinook Salmon and Other Salmonids Absorption Factor	Units for Chinook Salmon and Other Salmonids Absorption Factor
10198-40-0	Cobalt-60	1.00E-02	unitless	6.00E-03	unitless	9.00E-03	unitless
13233-32-4	Radium-224 [d]	6.30E-01	unitless	6.30E-01	unitless	7.90E-01	unitless
13966-29-5	Uranium-234 [d]	6.30E-01	unitless	6.30E-01	unitless	8.00E-01	unitless
13967-70-9	Cesium-134	8.50E-02	unitless	1.00E-02	unitless	1.00E-02	unitless
13968-55-3	Uranium-233	6.30E-01	unitless	6.30E-01	unitless	8.00E-01	unitless
13968-59-7	Neptunium-239 [d]	1.00E-02	unitless	1.00E-02	unitless	1.10E-02	unitless
13981-14-1	Protactinium-233 [d]	1.00E-02	unitless	1.00E-02	unitless	1.00E-02	unitless
13981-15-2	Curium-244	6.30E-01	unitless	6.30E-01	unitless	8.00E-01	unitless
13981-16-3	Plutonium-238	6.30E-01	unitless	6.30E-01	unitless	8.00E-01	unitless
13981-53-8	Radium-225 [d]	5.50E-01	unitless	6.30E-01	unitless	4.00E-01	unitless
13982-10-0	Plutonium-242	6.30E-01	unitless	6.30E-01	unitless	8.00E-01	unitless
13982-63-3	Radium-226 [d]	6.30E-01	unitless	6.30E-01	unitless	8.00E-01	unitless
13982-70-2	Uranium-236	1.00E-02	unitless	9.00E-03	unitless	1.00E-02	unitless
13994-20-2	Neptunium-237	2.70E-02	unitless	3.00E-02	unitless	4.00E-02	unitless
14119-33-6	Plutonium-240	6.30E-01	unitless	6.30E-01	unitless	8.00E-01	unitless
14133-67-6	Thallium-207 [d]	6.30E-01	unitless	6.30E-01	unitless	7.90E-01	unitless
14158-29-3	Uranium-232	6.30E-01	unitless	6.30E-01	unitless	8.00E-01	unitless
14234-34-5	Rhodium-106 [d]	1.00E-02	unitless	1.00E-02	unitless	1.00E-02	unitless
14234-35-6	Antimony-125	1.10E-02	unitless	9.00E-03	unitless	1.50E-02	unitless
14255-04-0	Lead-210 [d]	6.30E-01	unitless	6.30E-01	unitless	7.90E-01	unitless
14265-85-1	Actinium-225 [d]	9.00E-02	unitless	5.50E-01	unitless	6.30E-01	unitless
14269-63-7	Thorium-230 [d]	6.30E-01	unitless	6.30E-01	unitless	7.90E-01	unitless
14274-82-9	Thorium-228 [d]	6.30E-01	unitless	6.30E-01	unitless	7.90E-01	unitless
14331-83-0	Actinium-228 [d]	1.00E-02	unitless	1.00E-02	unitless	1.27E-02	unitless

Table 8-8 Aquatic Plants, Benthic Invertebrate and Chinook Salmon and Other Salmonids Gamma Radiation Absorption Fractions

CAS Registry Number	Constituent	Plant Gamma Absorption Factor	Units for Plant Gamma Absorption Factor	Benthic Invertebrates Absorption Factor	Units for Benthic Invertebrates Absorption Factor	Chinook Salmon and Other Salmonids Absorption Factor	Units for Chinook Salmon and Other Salmonids Absorption Factor
14331-85-2	Protactinium-231 [d]	2.70E-02	unitless	2.70E-02	unitless	4.00E-02	unitless
14336-70-0	Nickel-59	6.30E-01	unitless	6.30E-01	unitless	7.90E-01	unitless
14390-73-9	Tellurium-125m [d]	2.70E-02	unitless	2.70E-02	unitless	4.00E-02	unitless
14391-16-3	Europium-155	1.20E-02	unitless	7.50E-03	unitless	1.20E-02	unitless
14596-10-2	Americium-241	4.00E-02	unitless	4.00E-02	unitless	1.20E-02	unitless
14683-23-9	Europium-152	8.50E-02	unitless	9.00E-03	unitless	1.10E-02	unitless
14733-03-0	Bismuth-214 [d]	8.50E-02	unitless	8.50E-02	unitless	1.00E-02	unitless
14835-02-0	Radon-219 [d]	1.20E-02	unitless	7.50E-03	unitless	1.50E-02	unitless
14913-49-6	Bismuth-212 [d]	1.00E-02	unitless	1.00E-02	unitless	1.10E-02	unitless
14913-50-9	Thalium-208 [d]	1.00E-02	unitless	1.00E-02	unitless	1.00E-02	unitless
14932-40-2	Thorium-231 [d]	9.00E-02	unitless	9.00E-02	unitless	1.26E-01	unitless
14993-75-0	Americium-243	1.20E-02	unitless	9.00E-03	unitless	1.10E-02	unitless
15046-84-1	Iodine-129	9.00E-02	unitless	9.00E-02	unitless	2.00E-01	unitless
15067-28-4	Lead-214 [d]	1.00E-02	unitless	1.00E-02	unitless	1.00E-02	unitless
15092-94-1	Lead-212 [d]	1.00E-02	unitless	1.00E-02	unitless	1.10E-02	unitless
15100-28-4	Protactinium-234 [d]	8.50E-02	unitless	8.50E-02	unitless	1.23E-02	unitless
15100-28-4m	Protactinium-234m [d]	5.50E-01	unitless	5.50E-01	unitless	6.30E-01	unitless
15117-48-3	Plutonium-239 [d]	6.30E-01	unitless	6.30E-01	unitless	8.00E-01	unitless
15117-96-1	Uranium-235 [d]	1.00E-02	unitless	9.00E-03	unitless	1.00E-02	unitless
15229-37-5	Bismuth-211 [d]	2.70E-02	unitless	2.70E-02	unitless	4.00E-02	unitless
15510-73-3	Curium-242	6.30E-01	unitless	6.30E-01	unitless	8.00E-01	unitless
15585-10-1	Europium-154	8.50E-02	unitless	7.00E-03	unitless	1.10E-02	unitless
15594-54-4	Thorium-229	1.00E-02	unitless	8.50E-03	unitless	1.00E-02	unitless
15605-10-8	Thorium-234 [d]	6.30E-01	unitless	6.30E-01	unitless	7.90E-01	unitless
15623-45-7	Radium-223 [d]	1.00E-02	unitless	8.00E-03	unitless	1.00E-02	unitless
15623-47-9	Thorium-227 [d]	1.00E-02	unitless	8.50E-03	unitless	1.00E-02	unitless
15690-73-0	Thallium-209 [d]	8.50E-02	unitless	8.50E-02	unitless	1.23E-02	unitless
15755-40-5	Astatine-218 [d]	6.30E-01	unitless	6.30E-01	unitless	8.00E-01	unitless
15756-32-8	Antimony-126 [d]	1.00E-02	unitless	1.00E-02	unitless	1.00E-02	unitless
15756-32-8m	Antimony-126m [d]	8.50E-02	unitless	8.50E-02	unitless	1.23E-02	unitless
15756-41-9	Francium-221 [d]	6.30E-01	unitless	4.00E-02	unitless	5.00E-02	unitless

Table 8-8 Aquatic Plants, Benthic Invertebrate and Chinook Salmon and Other Salmonids Gamma Radiation Absorption Fractions

CAS Registry Number	Constituent	Plant Gamma Absorption Factor	Units for Plant Gamma Absorption Factor	Benthic Invertebrates Absorption Factor	Units for Benthic Invertebrates Absorption Factor	Chinook Salmon and Other Salmonids Absorption Factor	Units for Chinook Salmon and Other Salmonids Absorption Factor
15756-98-6	Francium-223 [d]	6.30E-01	unitless	1.20E-02	unitless	1.70E-02	unitless
15757-87-6	Curium-243	1.00E-02	unitless	8.00E-03	unitless	1.00E-02	unitless
15776-20-2	Bismuth-213 [d]	1.00E-02	unitless	1.00E-02	unitless	1.05E-02	unitless
15816-77-0	Lead-211 [d]	6.30E-01	unitless	1.20E-02	unitless	1.70E-02	unitless
15832-50-5	Tin-126	1.20E-02	unitless	9.00E-03	unitless	1.10E-02	unitless
378253-40-8	Barium-137m	1.10E-02	unitless	9.00E-03	unitless	1.20E-02	unitless
378782-82-2	Niobium-93m [d]	6.30E-01	unitless	6.30E-01	unitless	7.90E-01	unitless
7440-08-6	Polonium-211 [d]	6.30E-01	unitless	6.30E-01	unitless	7.90E-01	unitless
7440-29-1	Thorium-232	6.30E-01	unitless	6.30E-01	unitless	8.00E-01	unitless
7440-61-1	Uranium-238	6.30E-01	unitless	6.30E-01	unitless	8.00E-01	unitless

Reference for Aquatic Plant Gamma Absorption Factor

Sample BE, Aplin MS, Efroymson RA, Suter II GW, and Welsh CJE. 1997. *Methods and Tools for Estimation of the Exposure of Terrestrial Wildlife to Contaminants*, ORNL/TM-13391. Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN (Table 2, fraction A).

Reference (source) for Benthic Invertebrate and Chinook Salmon (and Other Salmonids) Gamma Absorption Factor

Blaylock BG, Frank ML, and O'Neal BR. 1993. *Methodology for Estimating Radiation Dose Rates to Freshwater Biota Exposed to Radionuclides in the Environment*, ES/ER/TM-78, Oak Ridge National Laboratory, Oak Ridge, TN (Figure A.1, large insects & molluscs used for benthic invertebrates, small fish used for salmon and salmonids).

Table 8-9 provides gamma absorption factors for the Canadian goose and spotted sandpiper. The Canadian goose and spotted sandpiper are presumed to be exposed to external radiation from water (including exposures near or on water), and air, and exposed to internal to radiation from the accumulation of ROPCs (and their daughter products) in their tissue.

Table 8-9 Canadian Goose and Spotted Sandpiper Gamma Radiation Absorption Fractions

CAS Registry Number	Constituent	Canada Goose Absorption Factor	Canada Goose Absorption Factor	Spotted Sandpiper Absorption Factor	Spotted Sandpiper Absorption Factor
10198-40-0	Cobalt-60	4.00E-02	unitless	1.00E-02	unitless
13233-32-4	Radium-224 [d]	3.50E-01	unitless	7.90E-01	unitless
13966-29-5	Uranium-234 [d]	9.40E-01	unitless	7.90E-01	unitless
13967-70-9	Cesium-134	5.00E-02	unitless	1.23E-02	unitless
13968-55-3	Uranium-233	9.40E-01	unitless	7.90E-01	unitless
13968-59-7	Neptunium-239 [d]	6.00E-02	unitless	1.10E-02	unitless
13981-14-1	Protactinium-233 [d]	6.00E-02	unitless	1.00E-02	unitless
13981-15-2	Curium-244	9.40E-01	unitless	7.90E-01	unitless
13981-16-3	Plutonium-238	9.40E-01	unitless	7.90E-01	unitless
13981-53-8	Radium-225 [d]	9.30E-01	unitless	6.30E-01	unitless
13982-10-0	Plutonium-242	9.40E-01	unitless	7.90E-01	unitless
13982-63-3	Radium-226 [d]	9.40E-01	unitless	7.90E-01	unitless
13982-70-2	Uranium-236	6.00E-02	unitless	1.15E-02	unitless
13994-20-2	Neptunium-237	1.50E-01	unitless	4.00E-02	unitless
14119-33-6	Plutonium-240	9.40E-01	unitless	7.90E-01	unitless
14133-67-6	Thallium-207 [d]	9.40E-01	unitless	7.90E-01	unitless
14158-29-3	Uranium-232	9.40E-01	unitless	7.90E-01	unitless
14234-34-5	Rhodium-106 [d]	6.00E-02	unitless	7.90E-01	unitless
14234-35-6	Antimony-125	6.00E-02	unitless	1.50E-02	unitless
14255-04-0	Lead-210 [d]	9.40E-01	unitless	7.90E-01	unitless
14265-85-1	Actinium-225 [d]	9.30E-01	unitless	7.90E-01	unitless
14269-63-7	Thorium-230 [d]	9.40E-01	unitless	7.90E-01	unitless
14274-82-9	Thorium-228 [d]	9.40E-01	unitless	7.90E-01	unitless
14331-83-0	Actinium-228 [d]	6.00E-02	unitless	1.27E-02	unitless
14331-85-2	Protactinium-231 [d]	1.50E-01	unitless	4.00E-02	unitless
14336-70-0	Nickel-59	9.40E-01	unitless	7.90E-01	unitless
14390-73-9	Tellurium-125m [d]	1.50E-01	unitless	7.90E-01	unitless
14391-16-3	Europium-155	9.00E-02	unitless	1.70E-02	unitless
14596-10-2	Americium-241	1.60E-01	unitless	5.00E-02	unitless
14683-23-9	Europium-152	5.00E-02	unitless	1.23E-02	unitless

Table 8-9 Canadian Goose and Spotted Sandpiper Gamma Radiation Absorption Fractions

CAS Registry Number	Constituent	Canada Goose Absorption Factor	Canada Goose Absorption Factor	Spotted Sandpiper Absorption Factor	Spotted Sandpiper Absorption Factor
14733-03-0	Bismuth-214 [d]	5.00E-02	unitless	1.23E-02	unitless
14835-02-0	Radon-219 [d]	9.00E-02	unitless	1.70E-02	unitless
14913-49-6	Bismuth-212 [d]	6.00E-02	unitless	1.10E-02	unitless
14913-50-9	Thalium-208 [d]	4.00E-02	unitless	1.00E-02	unitless
14932-40-2	Thorium-231 [d]	2.10E-01	unitless	1.26E-01	unitless
14993-75-0	Americium-243	9.00E-02	unitless	1.70E-02	unitless
15046-84-1	Iodine-129	2.10E-01	unitless	1.26E-01	unitless
15067-28-4	Lead-214 [d]	6.00E-02	unitless	1.00E-02	unitless
15092-94-1	Lead-212 [d]	6.00E-02	unitless	1.10E-02	unitless
15100-28-4	Protactinium-234 [d]	5.00E-02	unitless	1.23E-02	unitless
15100-28-4m	Protactinium-234m [d]	9.30E-01	unitless	6.30E-01	unitless
15117-48-3	Plutonium-239 [d]	9.40E-01	unitless	7.90E-01	unitless
15117-96-1	Uranium-235 [d]	6.00E-02	unitless	1.15E-02	unitless
15229-37-5	Bismuth-211 [d]	1.50E-01	unitless	4.00E-02	unitless
15510-73-3	Curium-242	9.40E-01	unitless	7.90E-01	unitless
15585-10-1	Europium-154	5.00E-02	unitless	1.23E-02	unitless
15594-54-4	Thorium-229	6.00E-02	unitless	1.20E-02	unitless
15605-10-8	Thorium-234 [d]	9.40E-01	unitless	7.90E-01	unitless
15623-45-7	Radium-223 [d]	6.00E-02	unitless	1.05E-02	unitless
15623-47-9	Thorium-227 [d]	6.00E-02	unitless	1.20E-02	unitless
15690-73-0	Thallium-209 (2.16 %) [d]	5.00E-02	unitless	1.23E-02	unitless
15755-40-5	Astatine-218 [d]	9.40E-01	unitless	7.90E-01	unitless
15756-32-8	Antimony-126 [d]	4.00E-02	unitless	1.00E-02	unitless
15756-32-8m	Antimony-126m [d]	5.00E-02	unitless	1.23E-02	unitless
15756-41-9	Francium-221 [d]	9.40E-01	unitless	5.00E-02	unitless
15756-98-6	Francium-223 [d]	9.40E-01	unitless	1.70E-02	unitless
15757-87-6	Curium-243	6.00E-02	unitless	1.05E-02	unitless
15776-20-2	Bismuth-213 [d]	6.00E-02	unitless	1.05E-02	unitless
15816-77-0	Lead-211 [d]	9.00E-02	unitless	1.70E-02	unitless
15832-50-5	Tin-126	9.00E-02	unitless	1.70E-02	unitless
378253-40-8	Barium-137m	6.00E-02	unitless	1.50E-02	unitless
378782-82-2	Niobium-93m [d]	9.40E-01	unitless	7.90E-01	unitless
7440-08-6	Polonium-211 [d]	9.40E-01	unitless	7.90E-01	unitless

Table 8-9 Canadian Goose and Spotted Sandpiper Gamma Radiation Absorption Fractions

CAS Registry Number	Constituent	Canada Goose Absorption Factor	Canada Goose Absorption Factor	Spotted Sandpiper Absorption Factor	Spotted Sandpiper Absorption Factor
7440-29-1	Thorium-232	9.40E-01	unitless	7.90E-01	unitless
7440-61-1	Uranium-238	9.40E-01	unitless	7.90E-01	unitless

Reference (source) for Canadian Goose and Spotted Sandpiper Gamma Absorption Factor

Sample BE, Aplin MS, Efroymson RA, Suter II GW, and Welsh CJE. 1997. *Methods and Tools for Estimation of the Exposure of Terrestrial Wildlife to Contaminants*, ORNL/TM-13391. Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN (Table 2, fraction D for the goose, fraction B for the sandpiper).

Table 8-10 provides gamma absorption factors for the bald eagle, great blue heron, and mink. The bald eagle, great blue heron, and mink are presumed to be exposed to external radiation from water (including exposures near or on water), and air, and exposed to internal to radiation from the accumulation of ROPCs (and their daughter products) in their tissue.

Table 8-10 Bald Eagle, Great Blue Heron, and Mink Gamma Radiation Absorption Fractions

CAS Registry Number	Constituent	Bald Eagle Absorption Factor	Bald Eagle Absorption Factor	Great Blue Heron Absorption Factor	Great Blue Heron Absorption Factor	Mink Absorption Factor	Mink Absorption Factor
10198-40-0	Cobalt-60	4.00E-02	unitless	4.00E-02	unitless	3.00E-02	unitless
13233-32-4	Radium-224 [d]	3.50E-01	unitless	3.50E-01	unitless	2.90E-01	unitless
13966-29-5	Uranium-234 [d]	9.40E-01	unitless	9.40E-01	unitless	9.40E-01	unitless
13967-70-9	Cesium-134	5.00E-02	unitless	5.00E-02	unitless	3.00E-02	unitless
13968-55-3	Uranium-233	9.40E-01	unitless	9.40E-01	unitless	9.40E-01	unitless
13968-59-7	Neptunium-239 [d]	6.00E-02	unitless	6.00E-02	unitless	4.00E-02	unitless
13981-14-1	Protactinium-233 [d]	6.00E-02	unitless	6.00E-02	unitless	4.00E-02	unitless
13981-15-2	Curium-244	9.40E-01	unitless	9.40E-01	unitless	9.40E-01	unitless
13981-16-3	Plutonium-238	9.40E-01	unitless	9.40E-01	unitless	9.40E-01	unitless
13981-53-8	Radium-225 [d]	9.30E-01	unitless	9.30E-01	unitless	9.30E-01	unitless
13982-10-0	Plutonium-242	9.40E-01	unitless	9.40E-01	unitless	9.40E-01	unitless
13982-63-3	Radium-226 [d]	9.40E-01	unitless	9.40E-01	unitless	9.40E-01	unitless
13982-70-2	Uranium-236	6.00E-02	unitless	6.00E-02	unitless	4.00E-02	unitless
13994-20-2	Neptunium-237	1.50E-01	unitless	1.50E-01	unitless	1.10E-01	unitless
14119-33-6	Plutonium-240	9.40E-01	unitless	9.40E-01	unitless	9.40E-01	unitless
14133-67-6	Thallium-207 [d]	9.40E-01	unitless	9.40E-01	unitless	9.40E-01	unitless
14158-29-3	Uranium-232	9.40E-01	unitless	9.40E-01	unitless	9.40E-01	unitless
14234-34-5	Rhodium-106 [d]	6.00E-02	unitless	6.00E-02	unitless	4.00E-02	unitless
14234-35-6	Antimony-125	6.00E-02	unitless	6.00E-02	unitless	4.00E-02	unitless
14255-04-0	Lead-210 [d]	9.40E-01	unitless	9.40E-01	unitless	9.40E-01	unitless
14265-85-1	Actinium-225 [d]	9.30E-01	unitless	9.30E-01	unitless	9.30E-01	unitless
14269-63-7	Thorium-230 [d]	9.40E-01	unitless	9.40E-01	unitless	9.40E-01	unitless
14274-82-9	Thorium-228 [d]	9.40E-01	unitless	9.40E-01	unitless	9.40E-01	unitless
14331-83-0	Actinium-228 [d]	6.00E-02	unitless	6.00E-02	unitless	4.00E-02	unitless
14331-85-2	Protactinium-231 [d]	1.50E-01	unitless	1.50E-01	unitless	1.10E-01	unitless
14336-70-0	Nickel-59	9.40E-01	unitless	9.40E-01	unitless	9.40E-01	unitless
14390-73-9	Tellurium-125m [d]	1.50E-01	unitless	1.50E-01	unitless	1.10E-01	unitless
14391-16-3	Europium-155	9.00E-02	unitless	9.00E-02	unitless	6.00E-02	unitless
14596-10-2	Americium-241	1.60E-01	unitless	1.60E-01	unitless	1.20E-01	unitless
14683-23-9	Europium-152	5.00E-02	unitless	5.00E-02	unitless	3.00E-02	unitless

Table 8-10 Bald Eagle, Great Blue Heron, and Mink Gamma Radiation Absorption Fractions

CAS Registry Number	Constituent	Bald Eagle Absorption Factor	Bald Eagle Absorption Factor	Great Blue Heron Absorption Factor	Great Blue Heron Absorption Factor	Mink Absorption Factor	Mink Absorption Factor
14733-03-0	Bismuth-214 [d]	5.00E-02	unitless	5.00E-02	unitless	3.00E-02	unitless
14835-02-0	Radon-219 [d]	9.00E-02	unitless	9.00E-02	unitless	6.00E-02	unitless
14913-49-6	Bismuth-212 [d]	6.00E-02	unitless	6.00E-02	unitless	4.00E-02	unitless
14913-50-9	Thalium-208 [d]	4.00E-02	unitless	4.00E-02	unitless	3.00E-02	unitless
14932-40-2	Thorium-231 [d]	2.10E-01	unitless	2.10E-01	unitless	1.60E-01	unitless
14993-75-0	Americium-243	9.00E-02	unitless	9.00E-02	unitless	4.00E-02	unitless
15046-84-1	Iodine-129	2.10E-01	unitless	2.10E-01	unitless	1.60E-01	unitless
15067-28-4	Lead-214 [d]	6.00E-02	unitless	6.00E-02	unitless	4.00E-02	unitless
15092-94-1	Lead-212 [d]	6.00E-02	unitless	6.00E-02	unitless	4.00E-02	unitless
15100-28-4	Protactinium-234 [d]	5.00E-02	unitless	5.00E-02	unitless	3.00E-02	unitless
15100-28-4m	Protactinium-234m [d]	9.30E-01	unitless	9.30E-01	unitless	9.30E-01	unitless
15117-48-3	Plutonium-239 [d]	9.40E-01	unitless	9.40E-01	unitless	9.40E-01	unitless
15117-96-1	Uranium-235 [d]	6.00E-02	unitless	6.00E-02	unitless	4.00E-02	unitless
15229-37-5	Bismuth-211 [d]	1.50E-01	unitless	1.50E-01	unitless	1.10E-01	unitless
15510-73-3	Curium-242	9.40E-01	unitless	9.40E-01	unitless	9.40E-01	unitless
15585-10-1	Europium-154	5.00E-02	unitless	5.00E-02	unitless	3.00E-02	unitless
15594-54-4	Thorium-229	6.00E-02	unitless	6.00E-02	unitless	4.00E-02	unitless
15605-10-8	Thorium-234 [d]	9.40E-01	unitless	9.40E-01	unitless	9.40E-01	unitless
15623-45-7	Radium-223 [d]	6.00E-02	unitless	6.00E-02	unitless	4.00E-02	unitless
15623-47-9	Thorium-227 [d]	6.00E-02	unitless	6.00E-02	unitless	4.00E-02	unitless
15690-73-0	Thallium-209 [d]	5.00E-02	unitless	5.00E-02	unitless	3.00E-02	unitless
15755-40-5	Astatine-218 [d]	9.40E-01	unitless	9.40E-01	unitless	9.40E-01	unitless
15756-32-8	Antimony-126 [d]	4.00E-02	unitless	4.00E-02	unitless	3.00E-02	unitless
15756-32-8m	Antimony-126m [d]	5.00E-02	unitless	5.00E-02	unitless	3.00E-02	unitless
15756-41-9	Francium-221 [d]	9.40E-01	unitless	9.40E-01	unitless	1.20E-01	unitless
15756-98-6	Francium-223 [d]	9.40E-01	unitless	9.40E-01	unitless	6.00E-02	unitless
15757-87-6	Curium-243	6.00E-02	unitless	6.00E-02	unitless	4.00E-02	unitless
15776-20-2	Bismuth-213 [d]	6.00E-02	unitless	6.00E-02	unitless	4.00E-02	unitless
15816-77-0	Lead-211 [d]	9.00E-02	unitless	9.00E-02	unitless	6.00E-02	unitless
15832-50-5	Tin-126	9.00E-02	unitless	9.00E-02	unitless	6.00E-02	unitless
378253-40-8	Barium-137m	6.00E-02	unitless	6.00E-02	unitless	4.00E-02	unitless
378782-82-2	Niobium-93m [d]	9.40E-01	unitless	9.40E-01	unitless	9.40E-01	unitless
7440-08-6	Polonium-211 [d]	9.40E-01	unitless	9.40E-01	unitless	9.40E-01	unitless

Table 8-10 Bald Eagle, Great Blue Heron, and Mink Gamma Radiation Absorption Fractions

CAS Registry Number	Constituent	Bald Eagle Absorption Factor	Bald Eagle Absorption Factor	Great Blue Heron Absorption Factor	Great Blue Heron Absorption Factor	Mink Absorption Factor	Mink Absorption Factor
7440-29-1	Thorium-232	9.40E-01	unitless	9.40E-01	unitless	9.40E-01	unitless
7440-61-1	Uranium-238	9.40E-01	unitless	9.40E-01	unitless	9.40E-01	unitless

Reference (source) for Bald Eagle, Great Blue Heron, and Mink Gamma Absorption Factor

Sample BE, Aplin MS, Efroymson RA, Suter II GW, and Welsh CJE. 1997. *Methods and Tools for Estimation of the Exposure of Terrestrial Wildlife to Contaminants*, ORNL/TM-13391. Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN (Table 2, fraction D for the eagle and heron, fraction C for the mink).

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Appendix A

Tabulation of Gamma Energy Absorption Factors for Mammals

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Appendix A
Tabulation of Gamma Energy Absorption Factors for Mammals

The data table below presents a tabulation of Table 2 data from *Methods and Tools for Estimation of the Exposure of Terrestrial Wildlife to Contaminants* (Sample, et. al., 1997). The table is arranged by increasing order of average gamma energy of decay (in MeV). Gamma energy absorption factors for radioisotopes not listed in Table 2 of the reference were derived by assigning an absorption factor from a surrogate radioisotope of equivalent gamma decay energy.

Average Gamma Energy of Decay	Absorbed Fractions (gamma)				
	A	B	C	D	E
0.001	0.63	0.79	0.94	0.94	0.94
0.002	0.63	0.79	0.94	0.94	0.94
0.003	0.63	0.79	0.94	0.94	0.94
0.005	0.63	0.79	0.94	0.94	0.94
0.007	0.63	0.79	0.94	0.94	0.94
0.008	0.63	0.79	0.94	0.94	0.94
0.009	0.63	0.79	0.94	0.94	0.94
0.010	0.63	0.79	0.29	0.35	0.52
0.012	0.55	0.63	0.93	0.93	0.93
0.025	0.09	0.126	0.16	0.21	0.36
0.026	0.09	0.126	0.16	0.21	0.36
0.033	0.04	0.05	0.12	0.16	0.3
0.035	0.027	0.04	0.11	0.15	0.29
0.047	0.027	0.04	0.11	0.15	0.29
0.049	0.012	0.017	0.06	0.09	0.2
0.057	0.012	0.017	0.06	0.09	0.2
0.061	0.012	0.017	0.06	0.09	0.2
0.125	0.01	0.012	0.04	0.06	0.15
0.134	0.01	0.0105	0.04	0.06	0.15
0.148	0.01	0.011	0.04	0.06	0.15
0.156	0.01	0.0115	0.04	0.06	0.14
0.186	0.01	0.011	0.04	0.06	0.14
0.204	0.01	0.01	0.04	0.06	0.14
0.250	0.01	0.01	0.04	0.06	0.14
0.597	0.011	0.015	0.04	0.06	0.15
0.971	0.01	0.0127	0.04	0.06	0.14
1.155	0.085	0.0123	0.03	0.05	0.12
1.165	0.085	0.0123	0.03	0.05	0.12
1.242	0.085	0.0123	0.03	0.05	0.12
1.508	0.085	0.0123	0.03	0.05	0.12
1.548	0.085	0.0123	0.03	0.05	0.12
1.555	0.085	0.0123	0.03	0.05	0.12

Average Gamma Energy of Decay	Absorbed Fractions (gamma)				
	A	B	C	D	E
1.919	0.085	0.0123	0.03	0.05	0.12
2.193	0.085	0.0123	0.03	0.05	0.12
2.504	0.01	0.01	0.03	0.04	0.11
2.834	0.01	0.01	0.03	0.04	0.11
3.375	0.01	0.01	0.03	0.04	0.11

Reference:

Sample BE, Aplin MS, Efroymson RA, Suter II GW, and Welsh CJE. 1997. *Methods and Tools for Estimation of the Exposure of Terrestrial Wildlife to Contaminants*, ORNL/TM-13391. Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN.

Attachment 5
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REISSUE
(362 Pages Excluding Cover Sheet)

Hanford Facility RCRA Permit Modification WTP-002
Supplement 5

Hanford Tank Waste Treatment and Immobilization Plant Risk Assessment Air Quality Modeling Protocol

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History Sheet

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3	13 Feb 2018	Revised to include EMF and Lab data and identify new inputs to regulatory version of Calpuff. Removed model results for presentation in the Preliminary Risk Assessment report. Updated references as necessary. Minor technical editing as needed.	Kathryn Henckel
4	05 Dec 2018	Revised to include regulator input. The acronym list and project description were updated.	Kathryn Henckel
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Acronyms

ACV	active confinement ventilation system
AERMOD	American Meteorological Society-Environmental Protection Agency Regulatory Model
AHL	analytical hot cell laboratory equipment system
ARL	analytical radiological laboratory equipment system
BARCT	best available radionuclide control technology
BPIP	Building Profile Input Program
COPC	constituent of potential concern
CRV	concentrate receipt vessel
CXP	Cesium Ion Exchange Process System
DEM	Digital Elevation Model
DFLAW	Direct Feed Low-Activity Waste
DST	double-shell tank
DVP	Direct Feed LAW Effluent Management Facility Vessel Vent Process System
Ecology	Washington State Department of Ecology
EMF	Effluent Management Facility
EPA	US Environmental Protection Agency
FEP	Waste Feed Evaporation Process System
FRP	Waste Feed Receipt Process System
HEME	high-efficiency mist eliminator
HEPA	high-efficiency particulate air (filter)
HFP	HLW Melter Feed Process System
HLP	HLW Lag Storage and Feed Blending Process System
HLW	High-Level Waste
HMP	HLW Melter Process System
HOP	HLW Melter Offgas Treatment Process System
IHLW	immobilized high-level waste
ILAW	immobilized low-activity waste
ISCST3	Industrial Source Complex Short-Term Model
IWAQM	Interagency Workgroup on Air Quality Modeling
LAW	Low-Activity Waste
LCP	LAW Concentrate Receipt Process System
LFP	LAW Melter Feed Process System

LMP	LAW Melter Process System
LOP	LAW Primary Offgas Process System
LVP	LAW Secondary Offgas/Vessel Vent Process System
MFV	melter feed vessel
MFPV	melter feed preparation vessel
MM5	Mesoscale Model 5
NLCD	National Land Cover Data
PJM	pulse jet mixer
PJV	pulse jet ventilator
PJV	Pulse Jet Ventilation System
PNNL	Pacific Northwest National Laboratory
PTF	Pretreatment Facility
PVP	Pretreatment Vessel Vent Process System
PVV	Process Vessel Vent Exhaust System
RFD	reverse flow diverter
SBS	submerged bed scrubber
SCR	selective catalytic reduction
SLERAP	Screening level ecological risk assessment protocol
SVOC	semivolatile organic compound
T-BACT	best available control technology for toxic air pollutants
TCO	thermal catalytic oxidation
TLP	Treated LAW Evaporation Process System
TRU	transuranic
UFP	Ultrafiltration Process System
UTM	Universal Transverse Mercator
VOC	volatile organic compound
WDOH	Washington State Department of Health
WESP	wet electrostatic precipitator
WTP	Hanford Tank Waste Treatment and Immobilization Plant

1 Introduction

The Hanford Tank Waste Treatment and Immobilization Plant (WTP) is included as Operating Unit Group 10 in the Hanford Site dangerous waste permit (WTP DWP [WA7890008967]) issued by the Washington State Department of Ecology (Ecology). Permit Condition III.10.C.11 requires the US Department of Energy (DOE) to prepare and submit a risk assessment report "addressing direct and indirect human health and ecological risks." The WTP is required to perform an ecological and human health risk assessment to determine the effects of the WTP emissions. The WTP will use the CALPUFF modeling system to estimate hourly and annual contaminant airborne concentrations and depositional fluxes at a series of receptor locations as defined in *Environmental Risk Assessment Work Plan for the Hanford Tank Waste Treatment and Immobilization Plant* (24590-WTP-RPT-ENV-14-002).

The purpose of this air quality modeling protocol is to describe the model methods, model parameters, meteorology, and receptor locations to be used in the CALPUFF modeling process. The protocol also briefly describes the WTP, including plant layout, facility operations, and air pollution control technologies.

2 Project Description

2.1 Project Rationale

Approximately 56 million gallons of radioactive and mixed dangerous waste is stored on the Hanford Site in aging underground tanks. The WTP project will convert a portion of the tank wastes to a solid vitrified form of borosilicate glass. The vitrified wastes and secondary waste resulting from the WTP processes will be transferred to permitted treatment, storage, or disposal units.

2.2 Facility Description and Location

The WTP is located on the Hanford Site, in south-central Washington State (see Figure 2-1). DOE is responsible for managing the Hanford Site, including the design, construction, and commissioning of the WTP.

2.3 Process Description

The WTP will store and treat waste feed transferred from the Hanford Site double-shell tank (DST) system. DST waste is composed of a blend of low-activity waste (LAW), which is generally the supernate portion of the waste, and high-level waste (HLW), which consists primarily of solids and sludges. Vitrification of the tank waste will occur at two separate vitrification facilities specific to these waste fractions. The LAW Vitrification Facility will vitrify waste after separation of solids and specific radionuclides (namely, ^{137}Cs) while the HLW Vitrification Facility is dedicated to vitrifying the high-level portion of the waste. To support near term Hanford tank waste treatment WTP is designed to operate in two possible configurations: 1) an interim (or Direct Feed Low-Activity Waste) operating configuration where pretreated LAW will be fed directly from the Hanford Tank Farms to the LAW Facility; and 2) an integrated (or baseline) configuration with the capability to fully separate LAW and HLW through the PTF, with subsequent vitrification in the LAW and HLW facilities. The two WTP configurations do not operate simultaneously.

In the baseline configuration, the WTP consists of three processing facilities (see Figure 2-2), a supporting analytical laboratory, an evaporator, and the balance of facilities (e.g., various supporting facilities that supply electricity, heat, water, and process air). Detailed process information is provided in Chapter 4 of the DWP. The processing facilities are:

- Pretreatment Facility (PTF) – The function of the PTF is to separate low-activity waste (LAW) and high-level waste (HLW). During pretreatment, water is removed from the waste by evaporators (as needed) to concentrate it, solids are filtered out, and soluble highly radioactive isotopes in the low-activity waste (primarily cesium) are removed by ion exchange units and transferred to the high-level waste fraction. In some situations, prior to filtration, oxidation and/or precipitation is used to dissolve solids and remove unwanted components from the LAW for transfer to the HLW fraction. Waste processing offgas is treated through a system of control devices such as a scrubber, mist eliminator, filters, oxidizer, and carbon absorber. Exhausts from pulse jet ventilators (PJVs are devices used to mix or transfer waste in vessels) are vented through a demister and filters. Building ventilation is passed through filters before release. Liquid effluents from LAW and HLW operations are returned to the PTF for treatment (e.g., evaporation).

- Low-Activity Waste Facility – The LAW Facility is where the low-activity fraction of the waste is solidified by vitrification. The low-activity waste goes into a melter preparation vessel, where silica and other glass-forming materials are added. The mixture is fed into a melter, heated to between 1750 and 2100°F by passing electricity through it (a process known as *joule heating*), then poured into stainless steel containers. The containers will be transferred to permitted burial trenches elsewhere on the Hanford Site. LAW Facility offgas is treated through a system of control devices such as scrubbers, electrostatic precipitator, filters, carbon absorber, and oxidizer/catalytic reducer.

- High-Level Waste (HLW) Facility – The HLW Facility is where the high-activity fraction of the waste, including waste that was separated from the low-activity fraction in the PTF, is solidified by vitrification. High-level waste from the PTF is mixed with glass-formers and vitrified in a melter of similar design to the LAW melters, then poured into stainless steel canisters. The canisters will be temporarily stored at Hanford. Eventually, they will be shipped to a federal geological repository. HLW Facility offgas is treated through a system of control devices such as a scrubber, electrostatic precipitator, mist eliminator, filters, carbon adsorber, silver mordenite column, and oxidizer/catalytic reducer.

Additional details on these facilities are presented in Section 5.2 of this document.

To achieve near term production of glass, the Direct Feed LAW (DFLAW) configuration is being implemented which includes an additional emissions unit. In the DFLAW operating configuration tank waste supernatant will be transferred from the Hanford Tank Farms directly to the LAW Facility. In the DFLAW configuration, effluents from LAW vitrification are evaporated in the facility described below.

- Effluent Management Facility (EMF) – The radioactive liquid effluents resulting from the LAW Facility melter offgas control equipment require treatment in the EMF. The liquid effluents requiring treatment in EMF include submerged bed scrubber condensate, caustic scrubber effluent, wet electrostatic precipitator drains, and flushing or draining of transfer lines to and from Tank Farms due to operations related to the transfer of tank waste to the LAW Facility. EMF offgas is treated through one of two banks of high-efficiency particulate air (HEPA) filters.

The Lab is also considered an emission source in both the baseline and DFLAW configurations. This source is defined:

- Analytical Laboratory (Lab) – The Laboratory provides a WTP support function by preparing and analyzing sample materials from the PT, HLW, EMF, and LAW facilities. The Laboratory is designed to incorporate the features and capability necessary to ensure efficient WTP operations and meet permitting, process control, authorization basis, and waste form qualification requirements. The Laboratory contains both high-activity and low-activity laboratories. High-activity samples are managed in the analytical hotcell laboratory (AHL). The AHL will not operate in the DFLAW configuration. Low-activity samples are managed and analyzed in the analytical radiological laboratory (ARL) also known as the Rad Labs. The ARL also includes a sample receiving/shipping area designed to manage the inflow of manually transported samples. Lab offgas is treated through one of two banks of high-efficiency particulate air (HEPA) filters.

Figure 2-1 WTP Location

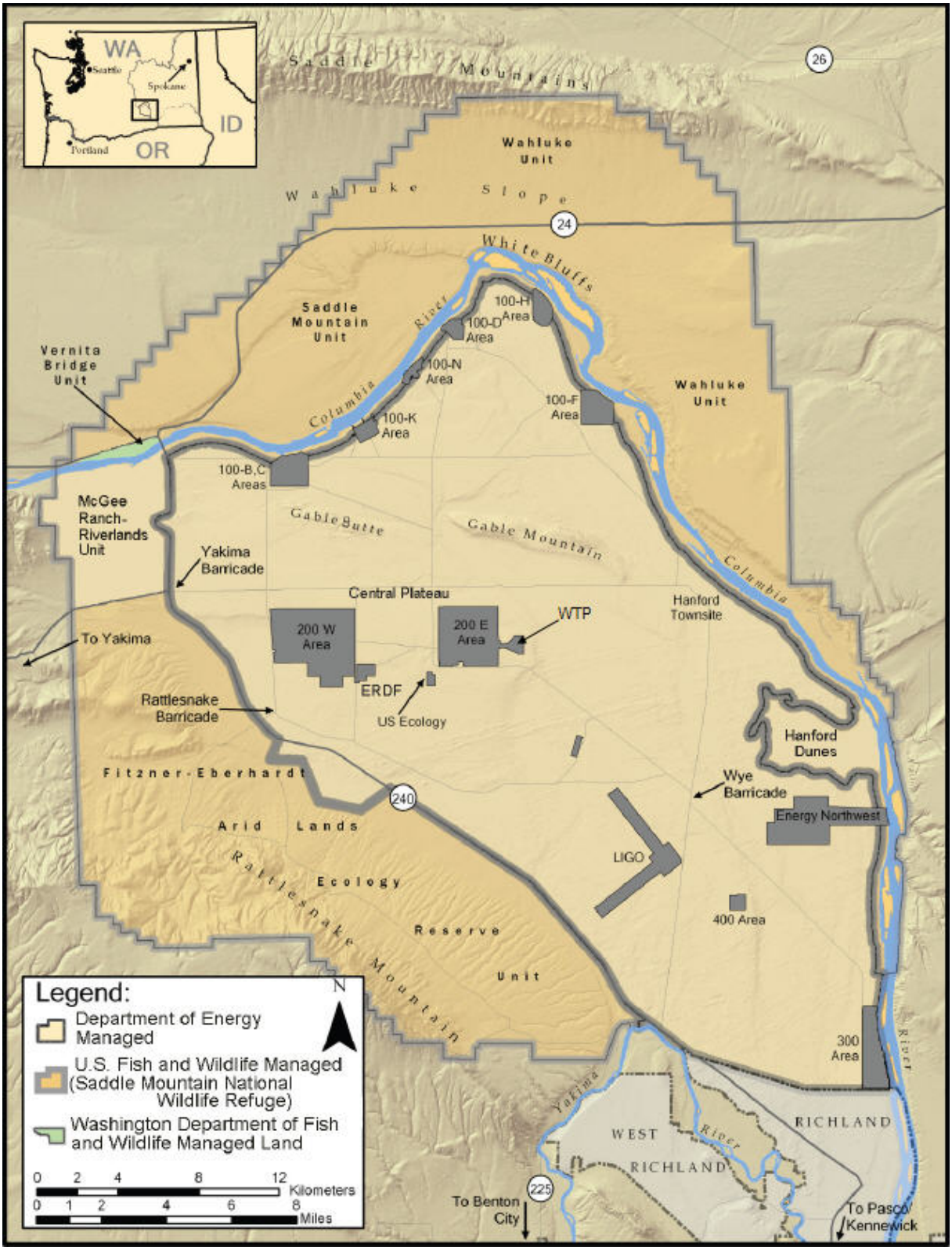
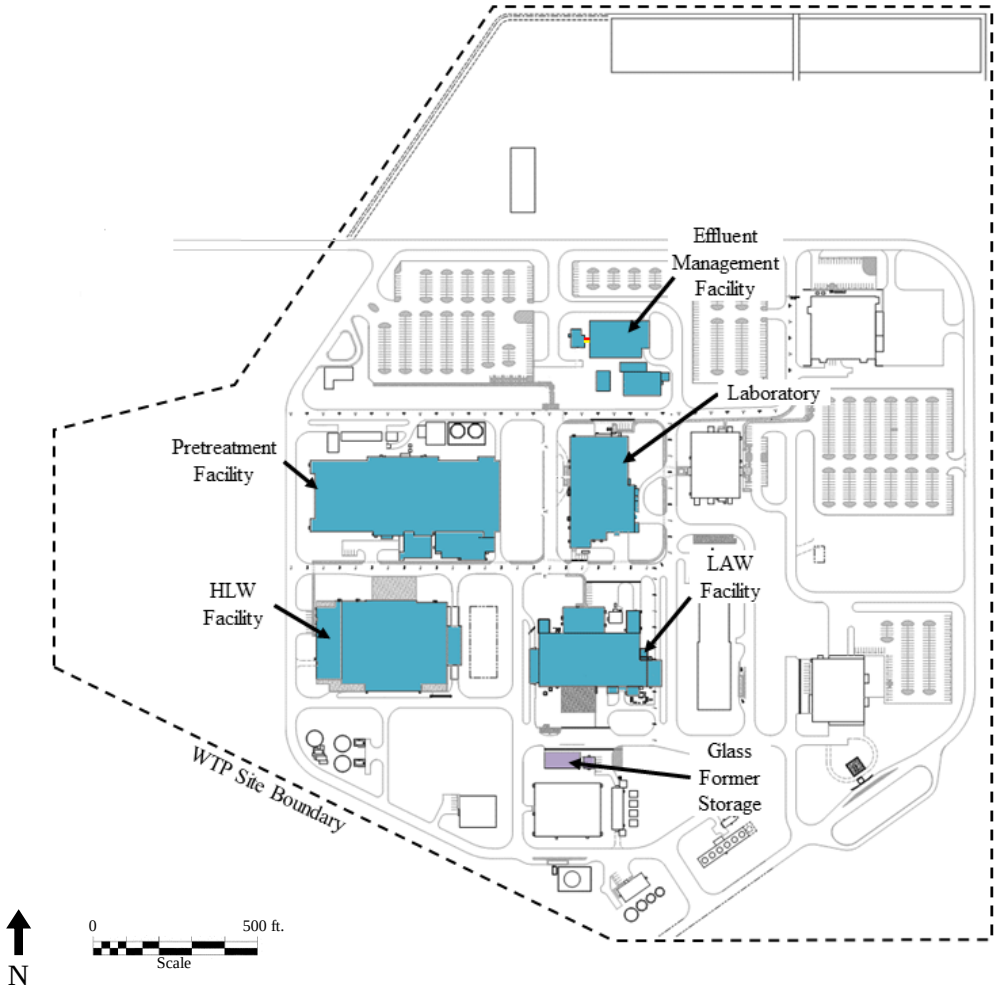


Figure 2-2 WTP Facility Layout



3 Expected Emission Rates

During the pretreatment and vitrification processes, some airborne emissions will occur. Each processing facility for the baseline configuration has a 200-foot stack, the EMF has a 150-foot stack, and the Lab has a 118-foot stack through which the emissions are released. Each process stack and the Lab stack have multiple release points or flues bundled in a structural lattice (see Figure 3-1); however, the flues in the EMF come together in the Utility Building to exhaust through a single release point. For air dispersion modeling purposes, individual flues were combined into a single emission point (consolidated virtual stack) for each facility: PTF, LAW, HLW, Lab and EMF. *WTP Stack Parameters Consolidation* (24590-WTP-RPT-ENV-17-005) documents the stack parameter and flow combination process for PTF, LAW, HLW, EMF and Lab. The virtual stacks described in the report do not include the C2 flues since the C2 flues are not located in the central stack lattice and their associated ventilation systems do not service any rooms where hazardous or radioactive materials are stored or processed. Table 3-1 identifies the virtual stacks (consolidation of facility flues) and associated parameters.

The airborne vapor and particulate emissions from the pretreatment and vitrification processes will be minimized by engineered air pollution control equipment, described in Sections 5.2.1.2, 5.2.2.2, 5.2.3.2, 5.2.4.2, and 5.2.5.1. Once the emissions leave the WTP stacks, they will be carried by air currents and deposited on the surface of soil and vegetation around the WTP and on the surface of the Columbia River. An air dispersion model, Professional CALPUFF, will be used to calculate how the emitted chemicals and radionuclides will be dispersed. CALPUFF is a multi-layer, multi-species, non-steady-state puff dispersion model that simulates the effects of time- and space-varying meteorological conditions on pollution transport, transformation, and removal. CALPUFF can be used to model air dispersion for either the DFLAW operating configuration (with emissions from the LAW Facility, EMF, and Lab), or for the baseline WTP operating configuration (PT Facility, LAW Facility, HLW Facility, and the Lab). The CALPUFF results will be used as one input to the human health and ecological risk assessments. The risk assessments will define and evaluate risks, or the potential for harm, to human and ecological receptors located at various distances from the WTP.

The WTP will model a unitized emission rate of 1 gram per second (1 curie/second for radionuclides). The resultant concentration and deposition results are based on the unitized emissions rate (gram per second emitted). The CALPUFF unitized model results will be combined with the WTP constituents of potential concern (COPC) emissions estimates (in units of g/s) as an input to the WTP risk assessment model. The emission rates for inorganic, organic, and radionuclide COPCs are to be evaluated in the risk assessment model.

The process for combining the unitized CALPUFF results and the emission estimates is described in 24590-WTP-RPT-ENV-14-002. The COPCs and estimated emission rates are documented in 24590-WTP-RPT-ENV-14-002 as well.

Table 3-1 Combined WTP Process Stack Parameters

Stack Location							
Source ID	**UTM Easting (X) (km)**	**UTM Northing (Y) (km)**	**UTM Zone (NAD 83)**	**Latitude (WGS 1984)**	**Longitude (WGS 1984)**	**Base Elevation (m)**	**Base Elevation (ft)**
Pretreatment Stack	307.9682	5158.3613	11	46.5514	119.5050	206.6544	678.0000
LAW Facility Stack	308.0493	5158.2515	11	46.5504	119.5040	207.5688	681.0000
HLW Facility Stack	307.8631	5158.2171	11	46.5501	119.5064	207.8736	682.0000
EMF Stack	308.1654	5158.5001	11	46.5527	119.5025	204.5000	670.9318
LAB Stack	308.0961	5158.4397	11	46.5521	119.5034	206.3500	677.0013

Consolidated Stack Height, Temperature, and Flowrates				
Description	**Stack Height (ft)**	**Effective Diam. (inches)**	**Temp (deg F)**	**Gas Velocity (ft/sec)**
Pretreatment Stack	200	112	95	71
LAW Facility Stack	198.5	79	139	64
HLW Facility Stack	200	80	107	68
EMF Stack	150	38	95	68
LAB Stack	118	82	91	62
Description	**Stack Height (m)**	**Effective Diam. (m)**	**Temp (deg C)**	**Gas Velocity (m/s)**
Pretreatment Stack	61.0	2.84	35	22
LAW Facility Stack	60.5	2.00	59	20
HLW Facility Stack	61.0	2.04	42	21
EMF Stack	45.7	0.97	35	20
LAB Stack	36.0	2.08	33	19

UTM = Universal Transverse Mercator

Figure 3-1 Photos of the LAW Facility Stack

The LAW Facility stack

LAW flues enclosed within the stack lattice

4 Rationale for Model Selection

The dangerous waste permit requires the WTP to use the current versions of the EPA protocol documents *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (EPA 2005) and the *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (EPA 1999). Both documents recommend the use of the Industrial Source Complex Short-Term Model (ISCST3). However, the protocols allow the use of other models that "may be more appropriate if they better meet the selection criteria due to study-specific objectives or assessment area characteristics." Since the publication of the risk assessment protocols, EPA has approved the use of American Meteorological Society-Environmental Protection Agency Regulatory Model (AERMOD) for air dispersion modeling. However, the CALPUFF system for the WTP risk assessment air dispersion modeling is approved by Ecology via incorporation of 24590-WTP-RPT-ENV-14-002 into Appendix 6.2 of the WTP DWP. There are several reasons for using CALPUFF instead of ISCST3 or AERMOD for WTP risk assessment modeling:

1. The CALPUFF modeling system provides access to data from an extensive network of 30 meteorological monitoring stations located on or near the Hanford Site. The CALPUFF modeling system allows use of the temperature, wind direction, wind speed, and precipitation data from these stations. Figure 4-1 identifies the 30 meteorological monitoring stations . Figure 4-2 shows historic wind rose data. Four of the stations were not used in the CALPUFF modeling study. The stations that were not used were located at Beverly (Station 8), Rattlesnake Mountain (Station 20), Benton City (Station 26), and Roosevelt (Station 28). Stations 8, 26, and 28 were deemed too far removed and/or upwind of the prevailing westerly winds near the WTP to be of significant value for this modeling effort. A comparison of CALPUFF results and actual weather observations indicated that Station 20 was not appropriate for use in the study because its inclusion in CALPUFF caused a "bulls-eye" effect. That is, Station 20 is not representative of the area over which it has influence within the model (24590-CM-HC4-HKYM-00001-01-00002, *Modeling Verification and Methods Report, River Protection Project, Hanford Tank Waste Treatment and Immobilization Plant*). CALMET, the predictive wind and temperature model within CALPUFF, was over-predicting/applying the effects of measurements obtained from Station 20.

   Table 4-1 identifies the 26 Hanford Site meteorological stations included in the modeling study. Figure 4-1 identifies the locations of the surface stations included in the modeling study, using the station number for identification.

2. CALPUFF also allows the use of precipitation data from multiple stations. Precipitation data is collected at 20 of the 30 meteorological monitoring stations. Seven of the stations were selected for inclusion in the CALPUFF modeling study. These stations were selected based on location after a review of the wind rose data presented in Figure 4-2. The Yakima Barricade station was selected to represent an upwind location. The other six stations were selected based on their downwind locations and because they are located within or near several of the receptor scenarios. Section 5.3 discusses the model domain and each receptor grid location.

   Table 4-2 lists the seven precipitation stations used in the modeling study. Figure 4-1 identifies the location of the stations.

3. CALMET uses three-dimensional weather data from the Fifth-Generation Mesoscale Model (MM5), developed by Pennsylvania State University and the National Center for Atmospheric Research, to produce gridded upper air wind field data. This option is not available in AERMOD or ISCST3.

The combination of these advancements and features results in a more realistic and representative characterization of Hanford Site air dispersion.

Table 4-1 Surface Meteorological Station Information

Station ID	Hanford Name	Hanford ID (See Figure 4-1)	UTM Easting (km)	UTM Northing (km)	Time zone	Anemometer Height (m)
Prosser	PROS	1	314.551	5140.409	8	9
Emergency Operations Center	EOC	2	304.950	5140.758	8	9
Army	ARMY	3	304.207	5151.580	8	9
Rattlesnake Springs	RSPG	4	292.846	5153.809	8	9
EDNA	EDNA	5	316.335	5162.078	8	9
200 East Area	200E	6	306.725	5158.930	8	9
200 West Area	200W	7	295.855	5157.795	8	9
Fast Flux Test Facility	FFTF	9	318.692	5144.479	8	9
Yakima Barricade	YAKB	10	291.166	5161.888	8	9
300 Area	300A	11	324.144	5137.059	8	9
WYE Barricade	WYEB	12	316.462	5150.394	8	9
100 N	100N	13	304.952	5173.749	8	9
Energy Northwest	WPPS	14	319.982	5148.957	8	9
Franklin County	FRNK	15	328.022	5142.851	8	9
Gable Mountain	GABL	16	311.575	5163.482	8	9
Ringold	RING	17	328.448	5157.029	8	9
Richland	RICH	18	322.796	5130.034	8	9
Plutonium Finishing Plant	PFP	19	298.169	5158.014	8	9
Hanford Met. Station	HMS	21	300.794	5159.861	8	9
Pasco	PASC	22	337.050	5124.791	8	9
Gable Mountain West	GABW	23	304.132	5165.206	8	9
100F	100F	24	312.298	5167.479	8	9
Vernita Bridge	VERN	25	291.260	5168.897	8	9
Vista Field	VSTA	27	330.228	5120.661	8	9
100 K	100K	29	302.799	5170.313	8	9
Hammer	HAMR	30	321.068	5136.275	8	9

Table 4-2 Precipitation Meteorological Station Information

Station ID	Hanford Name	Hanford ID (See Figure 4-1)	CALMET ID	Grid Coordinates	
				UTM Easting (km)	UTM Northing (km)
Prosser	PROS	1	450001	314.551	5140.409
Yakima Barricade	YAKB	10	450010	291.117	5161.888
300 Area	300A	11	450011	324.142	5137.059
Wye Barricade	WYEB	12	450012	316.461	5150.394
Ringold	RING	17	450017	328.449	5157.029
Hanford Met. Station	HMS	21	450021	300.792	5159.861
100 F	100F	24	450024	312.298	5167.479

Figure 4-1 Hanford Meteorological Monitoring Network (from PNNL 2005a)

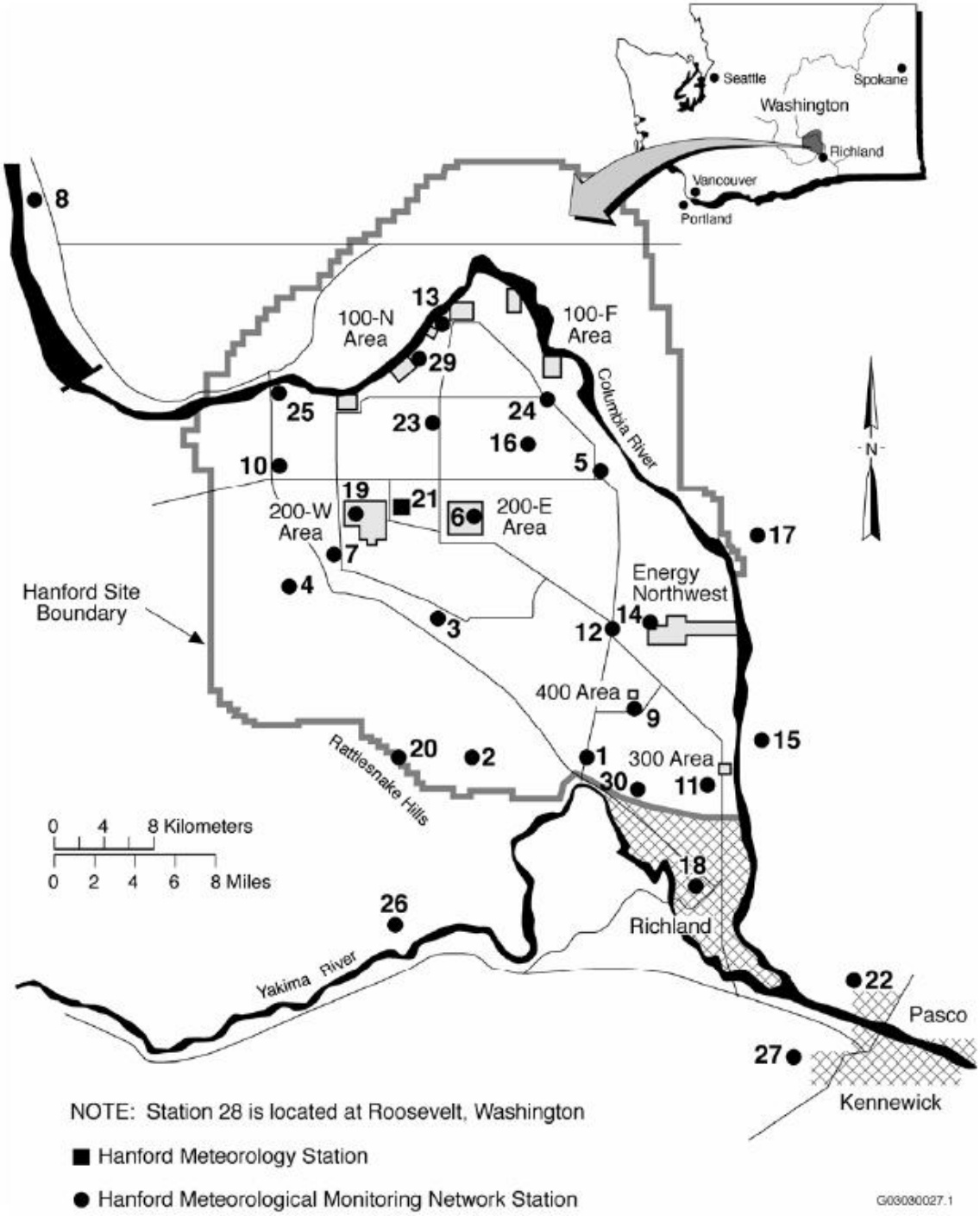
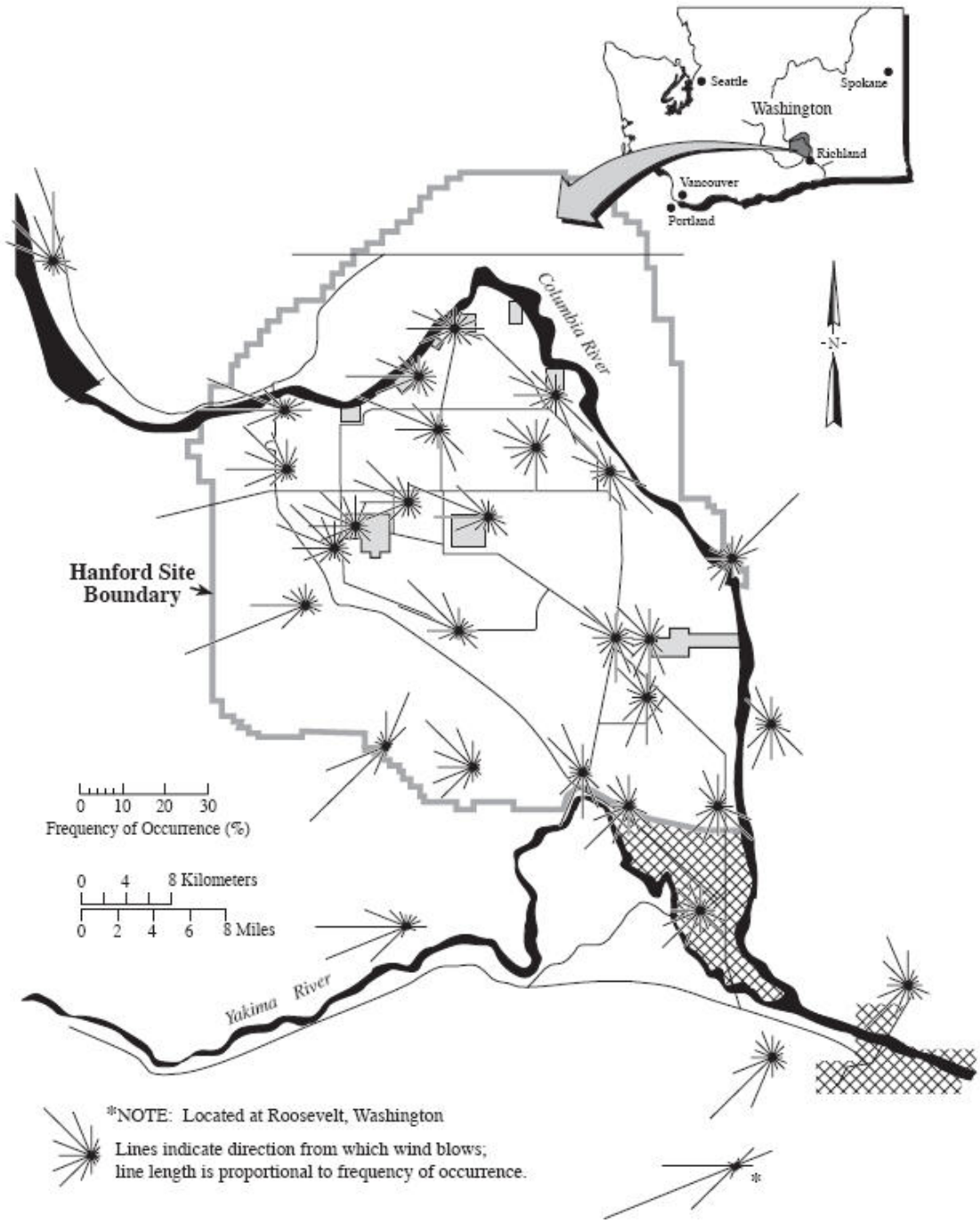


Figure 4-2 Hanford Meteorological Monitoring Network Wind Roses, 2004 (from PNNL 2005b)



5 Modeling Description

5.1 Modeling Assumptions

The regulatory CALMET/CALPUFF v. 5.8 model was run using the Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 recommendations, with minor exceptions (24590-CM-HC4-HKYM-00001-01-00002). Appendix A identifies the IWAQM or default model settings and the WTP settings. WTP met with Ecology and EPA on August 15, 2007, to review model settings and assumptions. In a subsequent meeting, WTP and Ecology concurred on removing the Rattlesnake Mountain meteorological station (Station 20) from the CALMET inputs (CCN 194345, *Modeling Particle-bound Constituents in CalPuff*). Modeling will be conducted using the settings agreed to during these meetings.

Appendix B provides a description of the WTP CALPUFF modeling process. Appendices C, D, and E are sample CALMET, CALPUFF, and CALPOST input files, respectively, and provide the settings used in modeling.

5.2 Facility Operations

The following sections describe relevant WTP waste processing facilities and systems that will be used to treat Hanford Site tank waste. Note that minor changes to the facility descriptions presented here are expected as the WTP design progresses. These design changes will be incorporated into the DWP in accordance with WAC 173-303-830.

5.2.1 Pretreatment Facility

The PTF is designed to receive, separate, and prepare the LAW and HLW feeds for vitrification. Waste and emissions are processed though the following primary PTF systems:

- Waste Feed Receipt Process System (FRP)
- HLW Lag Storage and Feed Blending Process System (HLP)
- Waste Feed Evaporation Process System (FEP)
- Ultrafiltration Process System (UFP)
- Cesium Ion Exchange Process System (CXP)
- Treated LAW Evaporation Process System (TLP)
- Pretreatment Vessel Vent Process System (PVP)
- Process Vessel Vent Exhaust System (PVV)
- Pulse Jet Ventilation System (PJV)

Figure 5-1 is a simplified diagram of the pretreatment unit processes and offgas treatment system.

5.2.1.1 Pretreatment Building Waste Processing Systems

Waste is transferred from the tank farms to the PTF, where it is initially stored in the FRP (and can be returned to the tank farms from the FRP if necessary). The FRP consists of four waste receipt vessels and

ancillary support equipment. Each waste receipt vessel has a design volume of approximately 402,300 gallons (24590-PTF-MVD-FRP-00005, *24590-PTF-MV-FRP-VSL-00002A, Waste Feed Receipt Vessel*). The FRP is designed to receive LAW, but also provides lag storage for intermediate pretreated LAW melter feed, process recycles, and HLW. The vessels can receive waste with less than 3.8 wt% solids (24590-PTF-3YD-FRP-00001, *System Description for Waste Feed Receipt Process* [FRP]).

Normally, HLW is received by the HLP. The HLP consists of a single feed receipt tank (for tank farms waste transfers) with an approximate design volume of 235,400 gallons (24590-PTF-MVD-HLP-00006, *Mechanical Data Sheet: Vessel, Plant Item No. 24590-PTF-MV-HLP-VSL-00022 - HLW Feed Receipt Vessel*), two lag storage tanks (for pretreated process slurries of HLW solids and precipitates from the UFP) with an approximate design volume of 112,900 gallons each (24590-PTF-MVD-HLP-00007), and ancillary support equipment. The HLP provides feed to the HLW Facility. Like the FRP, the HLP can return waste to the tank farms if necessary. The HLP can transfer waste to the FEP or FEP bypass from the feed receipt tank if necessary (24590-PTF-3YD-HLP-00001).

Depending on the sodium content of the waste feed, low sodium concentration (less than 5 molar) waste is concentrated in the FEP. The FEP consists of two parallel, continuous, forced-circulation, vacuum evaporation systems and ancillary support equipment. The FEP receives LAW and HLW and can process recycle streams along with waste material. Waste is concentrated via water evaporation in the FEP to a target sodium concentration of 4 to 6 molar. Pulse jet mixer (PJM) agitation (see below) is used to prevent settling of undissolved solids. The evaporator offgas stream is processed through condensers. The condensates are collected and transferred to condensate tanks for discharge to the Hanford Site Liquid Effluent Retention Facility or the Effluent Treatment Facility for subsequent treatment. The non-condensable gases are routed to the PTF PVP (24590-PTF-3YD-FEP-00001, *System Description for the Waste Feed Evaporation Process [FEP]*).

The UFP removes entrained solids from the concentrated waste feed. The UFP consists of two filter trains with a filter surface area of 1500 ft^2 per train and seven waste processing/storage vessels of varying volumes, along with ancillary support equipment. For certain waste feed, strontium and transuranic (TRU) compounds are precipitated by adding reagents (strontium nitrate and sodium permanganate) to the waste feed prior to ultrafiltration. The precipitate containing strontium and TRU compounds is concentrated and washed (caustically leached and washed with sodium permanganate and sodium hydroxide) in the UFP before incorporation into the HLW feed. The UFP is also used for oxidative leaching (with sodium hydroxide) to remove glass production-limiting components (aluminum, chromium, phosphate, etc.) from the solids. The liquid separated by ultrafiltration is LAW feed, and the solid portion from the ultrafiltration is HLW feed (24590-PTF-3YD-UFP-00001, *System Description for the Ultrafiltration Process System [UFP]*).

The LAW feed passes through the CXP to separate the cesium from the LAW feed. The CXP consists of four ion exchange columns: lead column, lag column, polishing column, and standby column. Once the lead column is loaded, it is removed from service and the lag column is placed in the lead position, the polishing column is placed in the lag position, and the standby column is put into service as the new polishing column. The former lead column is then regenerated by eluting cesium from the resin with nitric acid. After elution and concentration, the cesium concentrate is blended with the solids from ultrafiltration prior to being transferred to the HLW Facility. The eluant from the CXP system is further concentrated through the TLP. The operation of the treated LAW evaporator is similar to that of the waste feed evaporator. The concentrated LAW feed is then transferred to the LAW Facility (24590-PTF-3YD-CXP-00001, *System Description for the Cesium Ion Exchange Process- System CXP*).

The TLP concentrates pretreated LAW prior to transfer to the LAW Facility. The TLP consists of a continuous, forced-circulation, vacuum evaporation system and ancillary support equipment. The TLP is designed to concentrate treated LAW (along with recycle streams) without causing solids to precipitate. The TLP also receives submerged bed scrubber (SBS) recycle streams from the LAW Facility (24590-PTF-3YD-TLP-00001, *System Description for the Treated LAW Evaporation Process [TLP]*).

Waste is stored (and in some cases treated or combined with reagents) in vessels within each of the major process systems. In addition to waste, some of these vessels receive process recycles from pretreatment processes. Waste and process recycles in these vessels will be mixed by RFDs and PJM fluidic devices that will raise and lower the fluid level by withdrawing and expelling waste within the vessel. RFD and PJM offgas is collected though the PJV (described below). Spargers are also used to mix waste and ventilate vessel headspace. The vessel ventilation system offgas consists primarily of air, water vapor, and minor amounts of aerosols generated by the agitation or movement of vessel contents. Vessel ventilation exhaust is collected by the PVP (described below).

5.2.1.2 Pretreatment Building Ventilation and Process Offgas Treatment Systems

The rooms and working areas within the PTF are ventilated by four ventilation subsystems, C1V, C2V, C3V, and C5V, while waste vessels are ventilated by the PVP and PVV, and the PJV. This section briefly describes those systems (and control technologies) since they are the source of PTF emissions.

PTF room ventilation systems are divided into four subsystems, C1V, C2V, C3V, and C5V, to provide a hierarchy for pressure control and containment. Ventilation flow between the four subsystems cascades from areas of low or no contamination potential to areas of higher contamination potential. The C1V subsystem takes in outside air and ventilates areas that do not have direct contact with areas of contamination. The C2V subsystem ventilates tertiary confinement spaces that do not contain hazardous or radioactive substances or equipment. A portion of C2V flow is exhausted through high-efficiency particulate air (HEPA) filters to the atmosphere while the other portion of the flow is cascaded into the C3V and C5V subsystems. The C3V subsystem ventilates secondary confinement areas and acts as a buffer between C2V and C5V areas. Like the C2V subsystem, a portion of C3V flow is exhausted through HEPA filters to the atmosphere while another portion of the flow is cascaded into the C5V subsystem. The C3V subsystem also serves as the source of inbleed air for the PVV and PJV. The C5V subsystem ventilates primary confinement areas where equipment that stores or processes waste is located. Airflow from the C5V subsystem is vented to the atmosphere after passing through a series of HEPA filters. The C1V subsystem cascades entirely into other ventilation systems while the remaining ventilation subsystems ventilate partially or entirely to a dedicated, monitored exhaust flue (24590-PTF-3ZD-10-00001, *Pretreatment Facility C1, C2, C3, C5, and Atmospheric Reference Ventilation Systems Design Description*).

The PVP and PVV work in tandem to treat offgas from the vessel vent exhausts. Vessel vent exhaust is treated by a caustic scrubber, high-efficiency mist eliminator (HEME), HEPA filters, thermal catalytic oxidizer, and carbon absorber. The PVP includes the bulk of emissions controls (caustic scrubber, HEME, thermal oxidizer, and carbon absorber), while the PVV provides filtration (via HEPA filters) and maintains a negative pressure across the emissions treatment train by way of exhaust fans. The PVP will remove soluble nitrogen oxides (NO_x), acid gases, particulates, volatile organic compounds (VOC), and mists from vented vessel gases (24590-PTF-3YD-PVP-00001, *System Description for the Pretreatment Vessel Vent Process System, PVP*).

The PVP interfaces with the PVV for filtration of the gas stream to remove particulates. The PVV receives treated exhaust from the HEME in the PVP (24590-PTF-3ZD-PVV-00001, *PTF Vessel Vent*

Exhaust [PVV] System Design Description). Exhaust fans of the PVV draw air through the HEPA filters (PVV components) and PVP emissions control equipment. Heated inbleed air from the C3V subsystem is used to supplement the vessel offgas to protect downstream HEPAs from moisture.

The PJV is used to treat PJM/RFD emissions to remove mists and particulates. The PJV offgas is treated through a demister and HEPA filters, and routed to an exhaust flue, where it is monitored and vented to the atmosphere.

The caustic scrubber, HEME, injection of C3V air (delivered through a module comprised of a moderate efficiency filter, heater, and HEPA filter), a two-stage HEPA filter, and downstream exhaust fans are considered best available radionuclide control technology (BARCT) for some of the emissions units and are subject to conditions imposed by the Washington State Department of Health (WDOH 2017a to 2017e). The HEPA filters, caustic scrubber, and thermal catalytic oxidizer are considered best available control technology for toxic air pollutants (T-BACT) (24590-WTP-RPT-ENV-01-009, *Nonradioactive Air Emission Notice of Construction Permit Application for the River Protection Project - Waste Treatment Plant*).

PTF Offgas Control Equipment

The PTF control equipment will consist of the following:

- Caustic scrubber
- HEME
- HEPA filter
- Thermal catalytic oxidizer
- Carbon absorber

The NO_x emissions are removed through the caustic scrubber. The scrubber removes radioactive aerosols, acid gases, and NO_x emissions. The caustic scrubber is a column with a bed filled with packing material. Sodium hydroxide solution flows down through the bed. The offgas enters from the bottom and is drawn up through packing and caustic solution. Contact between the gas and the liquid in the bed causes a portion of the NO_x in the vent gas to dissolve and form sodium nitrate. The scrubbing liquor collects in the sump of the column and is transferred with any excess overflows to the PTF effluent collection.

There will be two HEMEs in service and one on standby. The HEME is a semi-passive filtration vessel designed for removal of at least 99 % of the airborne radioactive aerosols and particulates from the PVV. Removal is accomplished by flowing the exhaust through filter elements (glass fiber specifically selected for the given operating conditions and moisture) encased inside the HEME housing. The HEME also removes moisture (reducing the relative humidity to 70 % or less) from the offgas to protect downstream HEPA filters.

Particulates are removed through the HEPA filters. The HEPA filters are of radial flow design. The filters are made of fiberglass mesh bound by an adhesive supported by an internal and exterior stainless steel mesh and stainless steel bottom. The fiberglass media consists of a continuous mini-pleat filter pack with integral pleat separation and arranged in a circular configuration. The filters are designed to remove 99.97 % of the particulates when tested with aerosol 0.3 micron in diameter.

A thermal catalytic oxidizer removes organic compounds from the offgas. Organic compounds are oxidized to create CO_2, water, and a small amount of acid gases in the presence of high amounts of oxygen and heat. The thermal catalytic oxidizer is electrically powered, catalyzed, and regenerative. The oxidizer system consists of three heat transfer beds, electric heat elements within the reaction section, and a downstream trim cooler (after-cooler). The thermal oxidizer will operate at approximately 1600 °F, have a residence time of 1.0 seconds, and have an anticipated removal efficiency of 95 %.

The carbon bed absorber provides a polishing step for abatement of organics downstream of the thermal oxidizer. The carbon bed absorber removes organics from the offgas by adsorbing them onto activated carbon. A downstream filter is used to prevent carbon fines (dust) entrainment in the offgas exhaust. The unit removal efficiency varies from to 50 % to 98 %, depending on the specific VOC's affinity for carbon.

There will be two demisters in service and one on standby in the PJV (24590-PTF-3YD-PJV-00001, *System Description for the PTF Pulse Jet Ventilation System [PJV]*). The demister is a semi-passive device designed for the removal of radioactive mists and fine particulate. Removal is accomplished by flowing the offgas through glass fiber filter elements. The separation efficiency for the unit will be a minimum of 85 % for 1-micron particles (24590-PTF-MVD-PJV-00004, *Mechanical Data Sheet: 24590-PTF-MV-PJV-DMST-00002A/B/C – Demister*).

5.2.2 LAW Facility

The LAW Facility is designed to immobilize radioactive and hazardous constituents in the treated LAW feed through vitrification. Waste and emissions are processed though the following primary LAW systems:

- LAW Concentrate Receipt Process System (LCP)
- LAW Melter Feed Process System (LFP)
- LAW Melter Process System (LMP)
- LAW Primary Offgas Process System (LOP)
- LAW Secondary Offgas/Vessel Vent Process System (LVP)

Refer to Figure 5-2 for a simplified diagram of the LAW unit processes and offgas treatment system.

5.2.2.1 LAW Waste Processing Systems

The LAW Facility converts blended waste slurry and glass formers into molten glass (vitrification) which, in turn, is discharged to containers where it solidifies to immobilize radioactive and hazardous constituents. The LAW Facility receives treated, concentrated LAW from the PTF. The waste (LAW feed) is transferred to a concentrate receipt vessel (CRV), then to one of two melter feed preparation vessels (MFPV) where glass formers and reductants (sucrose) are added, and finally to one of two melter feed vessels (MFV). From the MFV, the waste is then continuously fed to the associated LAW melter where it is incorporated into molten glass. Within the LAW melter, VOCs and semi-volatile organic compounds (SVOC) are destroyed or boiled off the waste and swept into the melter emissions control system. The molten glass is discharged to specially designed canisters for thermal cooling and to allow the glass to solidify and immobilize waste constituents. The immobilized low-activity waste (ILAW) will be disposed of at a Hanford disposal facility.

The LCP receives pretreated LAW concentrate within the LAW Facility. The system includes two CRVs and associated ancillary support equipment. The LCP has the capability to transfer LAW concentrate to the LFP. Each CRV has design volume of approximately 15,435 gallons (24590-LAW-MVD-LCP-00004, *Mechanical Data Sheet: Vessel, Plant Item No. 24590-LAW-MV-LCP-VSL-00001 - LAW Concentrate Receipt Vessel*). A mechanical agitator is used to mix the LAW concentrate (24590-LAW-3ZD-LFP-00001, *LAW Melter Feed Process [LFP] and Concentrate Receipt Process [LCP] System Design Description*).

The LFP receives LAW concentrate from the LCP. The primary components of the LFP are two MFPVs, where glass formers and reductants (sucrose) are added to LAW concentrate to create a melter feed, and two MFVs, which store melter feed prior to introduction to the melter. The MFPVs and MFVs receive and transfer (by pump) waste in a batch mode and have a design volume of approximately 7689 gallons each (24590-LAW-MVD-LFP-00007, *Mechanical Data Sheet: Vessel, Plant Item No. 24590-LAW-LFP-VSL-00002 - Melter 1 Feed Vessel*; 24590-LAW-MVD-LFP-00010, *Mechanical Data Sheet: Vessel, Plant Item No. 24590-LAW-LFP-VSL-00001 - Melter 1 Feed Prep Vessel*). A mechanical agitator is used to mix the LAW melter feed (24590-LAW-3ZD-LFP-00001). Figure 5-5 is a simplified, generic schematic of a vitrification melter used at the WTP. The purpose of the LMP is to convert a blended slurry of liquid LAW feed and glass former additives into a durable ILAW product. The melters have a single internal chamber with a rectangular surface area where feed is incorporated into the glass pool. Electrodes mounted on opposite sides of the glass pool keep the glass melted by creating heat from the electrical resistance between the electrodes. The glass is discharged through either of two discharge chambers located within one of the long axis walls of the melter (24590-LAW-3ZD-LMP-00001, *Low-Activity Waste Melter Process System Design Description*).

During melter operation, a slurry of melter feed is delivered from the MFV to the melter through feed nozzles. As the slurry is fed, molten glass will accumulate in the melter. Air bubblers are used to mix and agitate the molten glass. At the surface of the melt (the interface between the melt pool and plenum air), a cold cap forms as lower temperature feed is introduced onto the melt pool. As the material in the cold cap heats and melts into the molten glass pool, more feed is added to maintain cold cap balance. Water and volatiles evaporate and/or decompose and are drawn off through the offgas system. Non-volatiles react to form their respective oxides and become part of the melt pool. During operation, feed rate, cold cap coverage, and molten glass discharge rate are balanced to achieve the desired throughput. Molten glass is discharged to steel canisters. Once filled, the canisters are moved to a storage area within the WTP for thermal cooling. Later, the canisters are relocated to a Hanford site disposal facility.

Waste is processed through vessels within each of the major process systems. In addition to waste, some of these vessels receive process recycles from offgas control equipment. The vessel ventilation system offgas consists primarily of air, water vapor, and minor amounts of aerosols generated by the agitation or movement of vessel contents. Vessel ventilation exhaust is collected by the LVP (described below).

5.2.2.2 LAW Building Ventilation and Process Offgas Treatment Systems

Similar to PTF, the LAW Facility has a ventilation system for the working spaces, and a separate ventilation system for vessels. The LAW Facility also has a ventilation system for melter offgas.

The rooms and working areas within the LAW Facility are ventilated by a four ventilation subsystems C1V, C2V, C3V, and C5V, to provide a hierarchy for pressure control and containment similar to the PTF, while the waste vessels are ventilated by the LVP. Ventilation flow between the four subsystems cascades from areas of low or no contamination potential to areas of higher contamination potential. The

melter offgas enters the LOP and then proceeds through the LVP to the exhaust stack. This section briefly describes those systems (and control technologies).

The C1V subsystem takes in outside air and ventilates areas that do not have direct contact with areas of contamination. The C2V subsystem ventilates tertiary confinement spaces that do not contain hazardous or radioactive substances or equipment. A portion of C2V flow is exhausted through HEPA filters to the atmosphere while the other portion of the flow is cascaded into the C3V and C5V subsystems. The C3V subsystem ventilates secondary confinement areas and acts as a buffer between C2V and C5V areas. Like the C2V subsystem, a portion of C3V flow is exhausted through HEPA filters to the atmosphere while another portion of the flow is cascaded into the C5V subsystem. The C1V subsystem cascades entirely into other ventilation systems while the remaining ventilation subsystems ventilate to dedicated monitored exhaust flues (24590-LAW-3ZD-20-00001, *LAW Ventilation Systems Design Description*).

The melters generate offgas resulting from decomposition, oxidation, and vaporization of feed material. Constituents of the offgas include NO_x from decomposition of metal nitrates in the melter feed, chloride, fluoride, and sulfur as oxides, acid gases, and particulates including salts, cesium, and technetium as the radionuclides of significance, entrained feed material, and glass. In addition, the LAW melters generate small quantities of other volatile compounds including iodine-129, carbon-14, tritium, and VOCs. Carbon-14 and tritium are in the form of carbon dioxide and water, respectively. The melters are ventilated by the LOP in series with the LVP. The purpose of the LOP is to cool the offgas and remove aerosols generated by the melter. The primary components consist of film coolers, SBSs, and a wet electrostatic precipitators (WESP).

Vessel vent exhausts are combined with melter offgas at the interface of the LOP and LVP; thus, melter emissions are treated by LOP and LVP controls, and vessel vent offgas is treated by the LVP controls. The LVP control equipment includes HEPA filters, carbon absorbers, a thermal catalytic oxidation/ selective catalytic reduction (TCO/SCR) unit, and a caustic scrubber (24590-LAW-3ZD-LOP-00001, *LAW Primary Offgas [LOP] and Secondary Offgas/Vessel Vent [LVP] System Design Description*).

The film cooler, SBS, WESP, a two-stage HEPA filter (and associated preheaters), downstream exhaust fans, and carbon absorber are considered BARCT for some of the emissions units and are subject to conditions imposed by the Washington State Department of Health (WDOH 2017f to 2017i). The HEPA filters and TCO/SCR are considered T-BACT (24590-WTP-RPT-ENV-01-009).

LAW Facility Offgas Control Equipment

The particulate emissions from the building ventilation systems are treated primarily through HEPA filters. The LAW melter offgas treatment system consists of the following components:

- Film cooler
- SBS
- WESP
- HEPA filter
- Carbon absorber
- TCO/SCR unit
- Caustic scrubber

The primary function of the film cooler is to cool melter offgas and entrained molten glass droplets below the glass sticking temperature to minimize glass deposition on the offgas piping walls. The offgas exits

the melter and is mixed with steam or steam/air mixture in the offgas film cooler. The film cooler is a double-walled pipe designed to introduce air/steam axially along the walls of the offgas pipe through a series of holes or slots in the inner wall. Each melter has a primary and a secondary film cooler.

Each LAW melter has a dedicated SBS. After each film cooler, the offgas enters the SBS column for additional cooling and solids removal. The SBS is a passive device designed for aqueous scrubbing of entrained particulate from melter offgas, cooling and condensation of melter vapor emissions, and interim storage of condensed fluids. The offgas enters the SBS and then bubbles up through the packed bed. The packing breaks larger bubbles into smaller ones to increase the gas-to-water contacting surface, thereby increasing particulate removal. The scrubbed offgas discharges through the top of the SBS and is routed to the WESP (one per melter) for further particulate removal.

Next, the offgas enters at the top of the WESP, passes through a distribution plate, and flows downward through the tubes, which act as positive electrodes. Each tube has a single negatively charged electrode which runs down the center of the tube. A strong electric field is generated along the electrodes, giving a negative charge to the aerosols passing through the tubes. The negatively charged particles move toward the positively charged tube walls for collection. Collected particles are then washed from the tube walls along with collected mists. As the gas passes through the tubes, the first particles captured are the water droplets. As the water droplets gravity drain through the electrode tubes, the collected particles are washed off, and the final condensate is collected in the WESP dished bottom area. The WESP is the final piece of control equipment in the LOP; the remaining downstream control equipment is considered part of the LVP.

Particulates are removed through the HEPA filters. Upstream electric heaters are used to increase the offgas temperature to protect the downstream HEPA filters from condensation. The HEPA filters are of radial flow design. The filters are made of fiberglass mesh bound by an adhesive supported by an internal and exterior stainless steel mesh and stainless steel bottom. The fiberglass media consists of a continuous mini-pleat filter pack with integral pleat separation and arranged in a circular configuration. The filters are designed to remove 99.97 % of particles when tested with an aerosol that contains particles of 0.3 micron in diameter.

The offgas then flows through a carbon bed absorber that is made up of a lead and lag bed to remove mercury from the offgas by adsorbing them onto activated carbon. Each absorber has a carbon bed volume of about 250 ft^3. The mercury concentration in the offgas is reduced to a maximum of 45 µg/dscm, and the outlet concentration is measured with a process emissions monitor. Although the absorbers are not individually credited for VOC removal, the units are expected to reduce VOCs by up to 99%, depending on the specific VOC's affinity for carbon.

To remove organics and NO_x in the offgas stream, a TCO/SCR is used. In the TCO, organic compounds are oxidized to carbon dioxide, water vapor, and acid gases with the aid of a platinum-based catalyst and heat (approximately 540 to 800°F). The TCO is designed for a removal efficiency of 95 %. In the SCR, NO_x is reacted with ammonia to reduce it to nitrogen gas and water vapor. After the organic compound catalyst, the offgas enters a chamber where a gas mixture of ammonia, CO_2, and water vapor is injected through an atomized spray and allowed to mix with the offgas so that the NO_x reduction reactions can be carried out as the offgas travels through NO_x catalyst modules. The NO_x catalyst modules are designed to achieve a removal efficiency of greater than 98 %.

The caustic scrubber further treats the offgas by removing acid gases (i.e., 97 % removal efficiency for combined SO_2 and SO_3) and providing final offgas cooling. The caustic scrubber is a column with a bed filled with packing material. The offgas stream enters the bottom of the scrubber and flows upward

through a packed bed. Contaminants in the offgas stream are absorbed into the liquid stream through interaction of the gas, liquid, and packing media. The scrubbing liquid flows downward through the packing bed and drains into the caustic collection vessel, where it is recirculated through the scrubber. To neutralize the collected acid gases, a sodium hydroxide solution is added periodically to the caustic collection vessel. The clean offgas is discharged through a mist eliminator to prevent droplet carryover. After passing through the caustic scrubber and mist eliminator, the offgas is released to the environment via a flue in the facility stack.

5.2.3 HLW Facility

The HLW Facility is designed to immobilize radioactive and hazardous constituents in the HLW feed through vitrification. Waste and emissions are processed though the following primary HLW systems:

- HLW Melter Feed Process System (HFP)
- HLW Melter Process System (HMP)
- HLW Melter Offgas Treatment Process System (HOP)
- Process Vessel Vent Exhaust System (PVV)
- Pulse Jet Ventilation System (PJV)

Refer to Figure 5-3 for a simplified diagram of the HLW Facility processes unit processes and offgas treatment system.

5.2.3.1 HLW Waste Processing Systems

The HLW Facility converts blended waste slurry and glass formers into molten glass (vitrification). The molten glass is discharged to containers (canisters), where it solidifies to immobilize radioactive and hazardous constituents. The HLW Facility receives blended HLW from the PTF. The waste (HLW feed) is transferred to one of two MFPVs, where glass formers are added, and then it is transferred to one of two melter feed vessels MFVs. From the MFV, the waste is continuously fed to the associated HLW melter, where it is incorporated into molten glass. Within the HLW melter, water, VOCs, and SVOCs are boiled off the waste and swept into the melter emissions control system. The molten glass is discharged to specially designed canisters for thermal cooling and to allow the glass to solidify and immobilize waste constituents. The immobilized high-level waste (IHLW) will be disposed of at federal geologic repository.

Unlike the LAW Facility, there are no concentrate receipt vessels in the HLW Facility. The HFP receives blended HLW directly from the PTF. The primary components of the HFP are two MFPVs, where glass formers are added to the HLW to create a melter feed, and two MFVs, which store melter feed prior to introduction to the melter. The MFPVs and MFVs receive and transfer (by pump) waste in a batch mode, and has an operating volume of approximately 7650 gallons each (24590-HLW-MVD-HFP-00010, *Mechanical Systems Data Sheet: Plant Item No. 24590-HLW-MV-HFP-VSL-00001, 24590-HLW-MV-HFP-VSL-00005 - HLW Melter 1 Feed Preparation Vessel HFP-VSL-00001 & HLW Melter 2 Feed Preparation Vessel HFP-VSL*-00005; and 24590-HLW-MVD-HFP-00011, *Mechanical Systems Data Sheet: Plant Item No. 24590-HLW-MV-HFP-VSL-00002, 24590-HLW-MV-HFP-VSL-00006 - HLW Melter 1 Feed Vessel HFP-VSL-00002 & HLW Melter 2 Feed Vessel HFP-VSL-00006*). A mechanical agitator is used to mix the HLW melter feed (24590-HLW-3ZD-HFP-00001, *HLW Melter Feed Process (HFP) and Concentrate Receipt Process [HCP] System Design Description*). Figure 5-5 is a simplified, generic schematic of a vitrification melter used at the WTP. The purpose of the HMP system is to convert a blended slurry of HLW feed and glass former additives to a durable IHLW product. The melters have a

single internal chamber with a rectangular surface area where feed is incorporated into the glass pool. Electrodes mounted on opposite sides of the glass pool keep the glass melted by creating heat from the electrical resistance between the electrodes. The glass is discharged through either of two discharge chambers located within one of the long axis walls of the melter (24590-HLW-3ZD-HMP-00001, *HLW Melter Process System [HMP] System Design Description*).

The principles of HLW melter operation are the same as those for LAW melters. During melter operation, a slurry of melter feed is delivered from the MFV to the melter through feed nozzles. As the slurry is fed, molten glass accumulates in the melter. Air bubblers are used to mix and agitate the molten glass. At the surface of the melt (the interface between the melt pool and plenum air), a cold cap forms as lower temperature feed is introduced onto the melt pool. As the material in the cold cap heats and melts into the molten glass pool, more feed is added to maintain cold cap balance. Water and volatiles evaporate and/or decompose and are drawn off through the offgas system. Non-volatile compounds react to form their respective oxides and become part of the melt pool. During operation, feed rate, cold cap coverage, and molten glass discharge rate are balanced to achieve the desired throughput. Molten glass is discharged to steel canisters. Once filled, the canisters are moved to a storage area within the WTP for thermal cooling. Later, the canisters are relocated to a Hanford Site storage facility and eventually disposed of at a federal repository.

The melters generate offgas (NO_x, acid gases, particulates, and volatile compounds, etc.) resulting from the vitrification of feed material. Melter offgas is collected and treated by the HOP (described below).

There are some vessels in the HLW Facility which receive process recycles and wastes from offgas control equipment. Material in these vessels will be mixed by PJM/RFD fluidic devices that will raise and lower the fluid level by withdrawing and expelling waste within the vessel. PJM/RFD offgas is collected though the HLW PJV system (described below). Vessel ventilation exhaust is collected by the HOP (described below).

5.2.3.2 HLW Building Ventilation and Process Offgas Treatment Systems

Similar to PTF and the LAW Facility, the HLW Facility has a ventilation system for the working spaces and a separate ventilation system for vessels and melter offgas.

The rooms and working areas within the HLW Facility are ventilated by four ventilation subsystems, C1V, C2V, C3V, and C5V (to provide a hierarchy for pressure control and containment similar to the PTF and LAW Facility), while the waste vessels and melters are ventilated by the HOP. Ventilation flow between the subsystems cascades from areas of low or no contamination potential to areas of higher contamination potential. Vessel fluidic devices (such as PJVs) are ventilated by the HLW PJV system. This section briefly describes those systems (and control technologies).

The C1V subsystem takes in outside air and ventilates areas that do not have direct contact with areas of contamination. The C2V subsystem ventilates tertiary confinement spaces that do not contain hazardous or radioactive substances or equipment. A portion of C2V flow is exhausted through HEPA filters to the atmosphere while the other portion of the flow is cascaded into the C3V and C5V subsystems. The C3V subsystem ventilates secondary confinement areas and acts as a buffer between C2V and C5V areas. A portion of the C3V subsystem is dedicated to ventilation of the canister storage area and has its own ventilation flue. Like the C2V subsystem, a portion of C3V flow is exhausted through HEPA filters to the atmosphere while another portion of the flow is cascaded into the C5V subsystem. The C1V subsystem cascades entirely into other ventilation systems while the remaining ventilation subsystems

ventilate to a dedicated monitored exhaust flue (24590-HLW-3ZD-C5V-00001, *HLW C3, C5, and Atmospheric Reference Ventilation Systems Design Description - System Design Description*).

The melters generate offgas resulting from decomposition, oxidation, and vaporization of feed material. Constituents of the offgas include NO_x from decomposition of metal nitrates in the melter feed, chloride, fluoride, and sulfur as oxides, acid gases, and particulates including salts, dangerous radionuclides and metals (in the form of particles and aerosols), entrained feed material, and glass. In addition, the HLW melters generate small quantities of other volatile compounds including iodine-129, carbon-14, tritium, and VOCs. Carbon-14 and tritium are in the form of carbon dioxide and water, respectively. The melters are ventilated by the HOP. The purpose of the HOP is to cool and treat the melter offgas (and vessel ventilation offgas) to a level that is protective of human health and the environment. The HOP consists of a film cooler, an SBS, a WESP, a HEME, HEPA filters, a carbon adsorber, a silver mordenite iodine adsorption unit, and a TCO/SCR. Vessel vent exhausts are combined with melter offgas at the junction between the WESP and the HEME (24590-HLW-3ZD-HOP-00001, *HLW PVV and HOP System Design Description*).

The HLW RFD/PJM exhausts are treated through HEPA filters and routed to the HLW plant stack, where they are monitored and vented to the atmosphere (24590-HLW-3ZD-PJV-00001, *HLW Pulse Jet Ventilation [PJV] System Design Description*).

The film cooler, SBS, WESP, the injection of air through the vessel vent header, HEME, two-stage HEPA filters (and associated preheater), downstream booster fans, silver mordenite bed, and exhaust fans are considered BARCT for some of the emissions units and are subject to conditions imposed by the Washington State Department of Health (WDOH 2017j to 2017p). The HEPA filters, silver mordenite adsorber, and TCO/SCR are considered T-BACT (24590-WTP-RPT-ENV-01-009).

HLW Facility Offgas Control Equipment

The particulate emissions from the building ventilation systems and pulse jet ventilation offgas are treated primarily through HEPA filters. The HLW melter offgas treatment system consists of the following components. The vessel ventilation offgas treatment system consists of those components that are downstream of the WESP.

- Film cooler
- SBS units
- WESP
- HEME
- HEPA filter
- Carbon adsorber
- Silver mordenite iodine adsorption unit
- TCO/SCR

The HLW Facility and LAW Facility melter film coolers and SBS units are of common design. The other HLW Facility and LAW Facility offgas treatment units are standardized and comparable to the extent practical.

The primary function of the film cooler is to cool melter offgas and entrained molten glass droplets below the glass sticking temperature to minimize glass deposition on the offgas piping walls. The offgas exits

the melter and is mixed with steam or steam/air mixture in the offgas film cooler. The film cooler is a double-walled pipe designed to introduce air/steam axially along the walls of the offgas pipe through a series of holes or slots in the inner wall. Each melter has a primary and a secondary film cooler.

After each film cooler, the offgas enters the SBS column for further cooling and solids removal. The SBS is a passive device designed for aqueous scrubbing of entrained particulate from melter offgas, cooling and condensation of melter vapor emissions, and interim storage of condensed fluids. The offgas enters the SBS and then bubbles up through the packed bed. The packing breaks larger bubbles into smaller ones to increase the gas-to-water contacting surface, thereby increasing particulate removal. The scrubbed offgas discharges through the top of the submerged bed scrubber and is routed to the WESP (one per melter) for further particulate removal.

Next, the offgas enters at the top of the WESP, passes through a distribution plate, and flows downward through the tubes, which act as positive electrodes. Each tube has a single negatively charged electrode, which runs down the center of the tube. A strong electric field is generated along the electrodes, giving a negative charge to the aerosols passing through the tubes. The negatively charged particles move toward the positively charged tube walls for collection. Collected particles are then washed from the tube walls along with collected mists. As the gas passes through the tubes, the first particles captured are the water droplets. As the water droplets gravity drain through the electrode tubes, the collected particles are washed off, and the final condensate is collected in the WESP dished bottom area.

A HEME is used to remove particulates and aerosols not captured by the upstream SBS and WESP. The HEME is a semi-passive filtration vessel designed for removal of at least 99 % of the airborne aerosols and particulates from the melter and PVV. Removal is accomplished by flowing the exhaust through filter elements (glass fiber specifically selected for the given operating conditions and moisture) encased inside the HEME housing. The HEME also removes moisture (to reduce the relative humidity to or below 70 %) from the offgas to protect downstream HEPA filters.

Particulates are removed through the HEPA filters. The HEPA filters are of radial flow design. The filters are made of fiberglass mesh bound by an adhesive and supported by an internal and exterior stainless steel mesh and stainless steel bottom. The fiberglass media consists of a continuous mini-pleat filter pack with integral pleat separation and arranged in a circular configuration. Two sets of HEPA filter banks are designed to have a minimum particulate removal efficiency of 99.999 % for particles of 0.3 micron in diameter.

The offgas then flows through two carbon bed adsorber units in series to remove mercury. A primary carbon bed contains sulfur-impregnated activated carbon (approximately 220 ft^3) (24590-HLW-MVD-HOP-00015). The unit is designed to have a removal efficiency of greater than 99.9% for mercury. The mercury concentration in the offgas is reduced to a maximum of 45 µg/dscm, and the outlet concentration is measured with a continuous emissions monitor. Although the adsorbers are not individually credited for organics removal, the units are expected to reduce organics by up to 99 % depending on the specific organic's affinity for carbon.

The offgas from the activated carbon units is cooled and passed through a silver mordenite adsorption column. The purpose of the silver mordenite column is to remove gaseous iodine-129 from the melter offgas stream. The removal efficiency of the column for iodine is 99.9 %. The silver mordenite will adsorb volatile forms of chlorine and fluorine as well as iodine. Halide gasses HI, HCl, and HF react with the silver in the presence of oxygen to bind into the solids AgI, AgCl, and AgF (leaving behind water/steam in the offgas stream).

To remove organics and NO_x in the offgas stream, a TCO/SCR is used. In the TCO, organic compounds are oxidized to carbon dioxide, water vapor, and acid gases with the aid of a platinum-based catalyst and heat (approximately 540 to 800°F). The TCO is designed for a removal efficiency of 95 %. In the SCR, NO_x is reacted with ammonia to reduce it to nitrogen gas and water vapor. After the organic compound catalyst, the offgas enters a chamber where a gas mixture of ammonia, CO_2, and water vapor is injected through an atomized spray and allowed to mix with the offgas so that the NO_x reduction reactions can be carried out as the offgas travels through NO_x catalyst modules. The NO_x catalyst modules are designed to achieve a removal efficiency of greater than 98 %.

5.2.4 EMF

The EMF is designed to manage liquid effluents in the DFLAW configuration. The EMF will have one emission unit with the potential to emit radioactive air emissions from two independent sources: (1) evaporator/process vessel ventilation and (2) an active confinement ventilation system supporting building ventilation. See Figure 5-4 for a simplified diagram of the EMF.

5.2.4.1 EMF Evaporator Process Vessel Ventilation

Liquid effluents from the LAW Facility and Lab radioactive liquid waste disposal system vessels will be transferred through the EMF evaporator feed vessel to the Direct Feed LAW Effluent Management Facility Process System (DEP) evaporator located in the EMF process building . Liquid effluents from transfer line flush water from the EMF low-point drain vessel will also be transferred through the evaporator feed vessel. The evaporator feed vessel will be purged with air drawn through the vessel head space and will be vented to the vessel vent header. This vessel will have the capability to receive sodium hydroxide for pH adjustment and demineralized water for flushing. Effluent will be continuously pumped from the feed vessel to the evaporator to maintain a constant liquid level in the evaporator.

The DEP system evaporator separator will receive feed from the evaporator feed vessel that has passed through the evaporator reboiler. The evaporator will be operated under vacuum to lower the boiling point of the concentrate. The overhead vapors, mainly water, will pass through an impingement plate to remove entrained liquid, with the overhead vapor continuing to the primary condenser. The majority of the bottom liquid will be recycled through the reboiler, with a small amount sent to the evaporator concentrate vessels.

Overhead vapor from the evaporator and steam from the steam-jet air ejectors will be condensed and collected in the overhead sampling vessels. Spent caustic scrubber solution from the LAW Facility offgas caustic scrubber will also be collected in the EMF overhead sampling vessels. The overhead sampling vessel effluent is then transferred to the existing Hanford Site 200 Area Liquid Effluent Retention Facility / Effluent Treatment Facility.

Concentrate (bottoms) will be pumped from the EMF evaporator to the evaporator concentrate vessels and back to the evaporator to maintain a constant solution density in the evaporator and to prevent buildup of settled solids in the waste. The primary path for evaporator concentrate is to recycle the bottoms back to the LAW Facility for vitrification. The secondary option is to return bottoms to the Tank Farm double-shell tank system. The process vessels and evaporator offgas are ventilated to the Direct Feed LAW Effluent Management Facility Vessel Vent Process System (DVP) high-efficiency particulate air (HEPA) filters (dual-stage).

The evaporator itself will operate at approximately 116 °F (nominal) and 150 °F (maximum). The condensers will operate at a temperature of approximately 109 °F and the HEPA filter preheaters will operate at approximately 127 °F.

5.2.4.2 EMF Active Confinement Ventilation System

The building ventilation system that serves EMF is referred to as the active confinement ventilation system (ACV). This system operates on a once-through ventilation strategy whereby air is cascaded from areas of lower contamination potential to areas of higher contamination potential before being exhausted from the facility. The ACV has supply and exhaust components. The supply component of the ACV system generally follows the design of contamination area C2V ventilation supply systems used in other WTP facilities, while the exhaust component of the ACV system generally follows the design of contamination area C3V ventilation exhaust systems used in other WTP facilities.

The EMF ventilation system uses the cascade principle with the direction of airflow from areas of low or no contamination to areas of higher potential contamination. Conditioned air supplied to the EMF cascades through these areas and exits via the ACV exhaust system's single-stage HEPA filtered exhaust. The ACV airflow will be approximately 24,000 cfm. The vessels, piping, vessel ventilation, and fume hood act as the primary confinement, while the ACV system provides secondary confinement for the EMF. The following buildings and associated areas make up the EMF buildings.

EMF Electrical Building

The EMF electrical building will consist of electrical, battery, and computer equipment rooms. There are no radioactive air emissions associated with this building. The building has its own independent HVAC system independent of the ACV system and is not included in air dispersion modeling.

EMF Utility Building

The EMF utility building will consist of non-process operating areas containing supporting utility equipment and the ACV HEPA filters room. Filtered and tempered air will be supplied to this building by the ACV supply system and will be cascaded to the adjacent LAW effluent process building. The building can normally be accessed in street clothes and does not require personal protective equipment. The following activities have the potential to emit radioactive emissions into the ACV system:

- Transporting personal protective equipment
- Changing out HEPA filters, aerosol testing, and transporting spent filters
- Replacing equipment

The area where these activities will be conducted include the heating, ventilation, and air conditioning area / utility room and the filter room. The activities with the potential to emit will be performed consistent with ALARA principles.

EMF Process Building and Effluent Drain Tank Building

The EMF process building will consist of areas with potential for lower contamination and areas with potential for higher contamination. Access is via a subchange room. Air will be drawn from ACV supply in the LAW effluent utility building and cascaded through the areas with low potential contamination into areas with higher potential contamination. Air cascaded into these areas will be from adjacent subchange

rooms. In some areas where higher flow may be required, boundary walls will be provided with engineered transfer grilles equipped with backflow dampers.

The areas of higher contamination include the EMF evaporator and the concentrate handling pumps. Air will be cascaded into these areas from adjacent lower contamination areas and then extracted by the ACV system. The ACV exhaust system will be comprised of a single-stage of HEPA filters and variable speed fans. Fans designed to maintain continuous system operation will drive the airflow. The following EMF effluent process building activities have the potential to emit radioactive emissions into the ACV system:

- Transporting personal protective equipment
- Changing out HEPA filters, aerosol testing, and transporting spent filters
- Replacing equipment

If additional activities with the potential to emit radioactive material other than those listed above are necessary within the ACV area, a determination will be made whether the contemplated change constitutes a modification to the emission unit as defined in WAC 246-247-030(16).

5.2.5 Lab Facility

The Lab will provide support for WTP process control samples, select tank farm waste acceptance samples, and samples from other DOE facilities as needed. Regulatory analysis for air, liquid, soil, sludge samples, and tank farm grab samples will be outsourced to an off-site laboratory or may be analyzed at the Lab. Radionuclide particulate and aerosols are expected in the Lab exhaust systems due to the handling and analysis of various samples.

5.2.5.1 Lab Offgas Treatment System

The preparation and analysis of sample material is performed by two systems, which includes the analytical radiological laboratory (ARL) and the analytical hot cell laboratory equipment system (AHL). The analytical laboratory ventilation systems include C1V, C2V, C3V, and C5V systems to provide a hierarchy for pressure control and containment similar to other WTP facilities.

The ARL consists of thirteen laboratories and will support analyses of low and medium-level radioactive samples. The laboratories also support the analyses of samples diluted, digested, and prepared in the AHL. Each laboratory has specific analytical equipment to perform the intended function. The ARL system also includes a sample management area designed to manage the inflow of manually transported samples that will be analyzed at the Lab, as well as samples that will be analyzed at off-site laboratories. Fume hoods in these laboratories will be handled by the C3 ventilation system and vented through emission unit LB-S1. The building ventilation air associated with general Lab work areas will be vented through emission unit LB-C2. These streams will be processed through a one-stage HEPA filtration system. Within the ARL, non-organic liquid wastes will be disposed in the lab sink drain and drained to the associated collection vessel (RLD-VSL-00164) for eventual recycle back into the WTP process. The vessel is vented through the C5 ventilation system. The ARL will operate in the DFLAW and integrated (WTP baseline) configuration.

The AHL consists of 14 hotcells, one hood assembly, and three glovebox assemblies adjoining the hotcell structure. Samples will be moved into and between the hotcells using the trolley or monorail. Ventilation flow from the hotcell area, will be routed to the C5 HEPA filtration system. Air cascading into the C5 areas from the adjacent C2 and/or C3 areas will be exhausted through the emission unit LB-S2 by the C5

exhaust fans after passing through two stages of HEPA filter banks. Within the ARL, non-organic liquid wastes will be disposed in the hotcell floor drain and drained to the associated collection vessel (RLD-VSL-00165) for eventual recycle back into the WTP process. The vessel is vented through the C5 ventilation system. The AHL will operate in the integrated (WTP baseline) configuration. Associated hotcell laboratories, tank systems, and ventilation systems, will be isolated in the DFLAW configuration, and will not operate until Pretreatment/HLW operations begin.

5.3 Model Domain, Grid, Receptor Locations

The WTP modeling domain consists of a 100 by 100 km grid with 1 km grid node spacing (Figure 5-6). The lower right (southwest) corner of the model domain has the following Universal Transverse Mercator coordinates:

Easting	257.988 km
Northing	5108.358 km

As a screening technique to determine probable downwind locations, CALPUFF model (v. 5.8) was run using gridded receptor locations at 1 km spacing for calendar year 2002. The highest annual average concentrations and depositional fluxes were determined to occur within just a few kilometers of the WTP emission sources. As a result of the domain model results, finer grid (smaller spacing) receptor locations within the overall model domain were selected for modeling potential exposures. Each receptor grid represents a geographical subset within the model domain where finer grid node spacing is used to interpolate potential downwind concentration and deposition values a receptor may be exposed to. The CALPUFF model will be run for different receptor scenarios within the modeling domain in accordance with 24590-WTP-RPT-ENV-14-002. Depending on the exposure scenario, a receptor could be exposed within one or more of the receptor exposure grids. Table 5-1 provides the receptor exposure grid, grid node spacing, and number of grid nodes for each receptor scenario. Figures 5-7 through 5-12 show the six receptor exposure grids. Figure 5-13 shows all the receptor exposure grids relative to the WTP location, Hanford site boundary, land use, and surface contours.

The onsite exposure grid is an area on the outside of the WTP fence line, representing potential exposure locations in all directions (north, south, east, west) given unknowns about potential Hanford worker locations near and directly downwind WTP at any given hour. The offsite and Columbia River grid locations were established based on earlier CALPUFF screening runs that showed these locations to be downwind of the WTP. The Gable Mountain exposure grid was established because of its potential cultural significance and proximity to WTP. The hunter/gatherer grid (current and future) was established over large portions of the Hanford site as a conservative means of capturing all potential concentration and deposition values, given the uncertainties regarding specific hunting/gathering areas. Grid spacing within each exposure grid represents a compromise between the desire to identify representative maximum and high-end values, while not establishing a grid density that could result in prohibitively long CALPUFF model runs.

5.4 Topography and Receptor Grids

Figure 5-14 shows a three-dimensional relief of the topography of the WTP air quality model study area. Also shown are the locations of the WTP, the meteorological stations, and receptor grids. Refer to Table 4-1 for more detailed identification and location information for the meteorological stations.

The following legend identifies other features shown on the figure.

- Red = Onsite receptor grid
- Charcoal gray = Offsite receptor grid
- Green = Hunter/gatherer receptor grid (current and future timeframe)
- Magenta = Hunter/gatherer receptor grid (future timeframe)
- Brown = Gable Mountain receptor grid
- Blue = Columbia River receptor grid
- Rust/clear cross = Surface meteorological station
- Aquamarine = River, lake/reservoir, tributary/creek
- Magenta line = Roadway

5.5 Meteorology

5.5.1 Surface Meteorology Data

DOE operates 30 meteorological stations on the Hanford Site. Surface meteorological data from 26 of the stations (see Table 4-1) was obtained from PNNL for calendar years 2002, 2003, 2004, 2005, and 2006 in comma-delimited format. Examples of the raw meteorological data files received from PNNL in comma-delimited format follow (note that the heading row and column parsing is shown for information and is not part of the raw data). Values of 0, when used for ceiling height, surface visibility, and sky cover, indicate missing data.

Example Hanford Met. Station Surface Data File (Comma-Delimited File HMS_SFC.01)

```
yr   month day hour ceiling ht. (100's of ft) visibility (miles) press (mbar) dew point temp (ºF) wd (10's of degrees) ws (mph) press (in. of Hg) air temp (ºF) wet bulb (ºF) RH (%) total sky cover rain snow water equiv. snow fall weather indicator solar radiation
----|--|--|--|---|----|------|---|--|--|-----|---|---|---|--|--|--|--|-|----
2003, 1, 1, 1,  0,15.0,1021.4, 30, 4, 5,29.36, 33, 32, 90, 0, 0, 0, 0,8,0.00
2003, 1, 1, 2,  0,15.0,1022.0, 30, 8, 3,29.38, 31, 31, 93, 0, 0, 0, 0,8,0.00
2003, 1, 1, 3,  0,15.0,1022.4, 30,34, 4,29.39, 31, 31, 93, 0, 0, 0, 0,8,0.00
2003, 1, 1, 4,  0,15.0,1022.1, 31,30, 5,29.37, 32, 31, 95, 0, 0, 0, 0,8,0.00
2003, 1, 1, 5,  0,15.0,1022.1, 31,33, 6,29.37, 33, 32, 92, 0, 0, 0, 0,8,0.00
2003, 1, 1, 6,  0,15.0,1021.2, 30,31, 4,29.35, 32, 32, 93, 0, 0, 0, 0,8,0.00
2003, 1, 1, 7,250,15.0,1021.7, 31,32, 5,29.36, 32, 32, 94,10, 0, 0, 0,0,0.00
2003, 1, 1, 8,120,15.0,1021.7, 32,32, 8,29.36, 33, 32, 94,10, 0, 0, 0,0,0.00
2003, 1, 1, 9,120,15.0,1021.7, 32,31, 6,29.36, 34, 34, 93,10, 0, 0, 0,0,0.01
2003, 1, 1,10,120,15.0,1021.5, 33,32, 6,29.36, 35, 34, 91,10, 0, 0, 0,0,0.05
```

Format of the HMS Surface Observation Data

```
  date and time   (YYYYMMDDHH) (ALWAYS PST)  ****** 4 digit year ******
 *ceiling height  (100's ft)
 *surface visibility  (miles)
  sea level pressure  (mbs)
  dew point temperature  (degrees F)
```

```
 wind direction  (10's of degrees)
 wind speed  (miles per hour)
 station atmospheric pressure  (inches of Hg)
 ambient air temperature  (degrees F)
 wet bulb temperature  (degrees F)
 relative humidity  (percent)
*total sky cover (tenths)
 amount of rain (hundredths of inches; 50=trace)
 amount of snow water equivalent (hundredths of inches; 50=trace)
 snow fall (hundredths of inches; 50=trace)
*weather indicator  (0=nothing to indicate, 8=unmanned, 9=weather event
                     ended during the hour)
 solar radiation  (Langley's; gram calories / cm2 / minute)

*NOTE: (4/95)
 Beginning April 29, 1995, the weather station will have a forecaster
 on duty for day shifts only on weekends and holidays.  Some of
 this surface observation data will not be recorded because an
 observer is required.  To indicate this, the weather indicator will
 contain an 8 if there was no forecaster on duty.
```

Format of the Raw Wind Telemetry Data File

Each data file has one record per hour.

All 30 stations are listed in each record with the direction (tens of degrees) listed first followed by the speed (miles per hour). A value of "880, 88" indicates data is unavailable (in the early years, all 30 stations were not yet online), and "990, 99" indicates missing data (note that the heading row and column parsing is shown for information and is not part of the raw data).

Example Raw Wind Telemetry File (Comma-Delimited File Telem01w.dlm)

```
     date          time  Station 1 wind direction  Station 1 wind speed (mph)  Station 2 wind direction  Station 2 wind speed (mph)  Station 3 wind direction  Station 3 wind speed (mph)  Station 4 wind direction  Station 4 wind speed (mph)  Station 5 wind direction  Station 5 wind speed (mph)  Station 6 wind direction  Station 6 wind speed (mph)  and so on for the remaining stations 6 through 30
----------|-----|---|--|---|--|---|--|---|--|---|--|---|--|---|--|---|--|
01/01/2002,13:00,350,12,330,19,320,12,320,10,360,10,290, 9, etc.
01/01/2002,14:00,340,11,340,17,320,11,340,11,360, 9,310, 7, etc.
01/01/2002,15:00,350, 9,340,17,310, 8,340, 9,330, 7,290, 5, etc.
01/01/2002,16:00,320,12,330,16,300, 8,330, 8,310, 6,280, 6, etc.
01/01/2002,17:00,330,11,330,15,290, 7,320, 6,300, 5,290, 7, etc.
01/01/2002,18:00,320,12,320,15,280, 7,320, 8,340, 5,280, 8, etc.
01/01/2002,19:00,320,11,320,12,290, 8,280, 8,300, 6,280,11, etc.
01/01/2002,20:00,320,11,330,14,290, 8,250, 6,320, 5,280,11, etc.
01/01/2002,21:00,330,12,330,14,290, 8,250, 5,310, 7,280,11, etc.
01/01/2002,22:00,330,12,320,15,290, 9,260, 5,330, 4,280, 9, etc.
```

Format of the Raw Temperature Telemetry Data File

The temperatures are all degrees Fahrenheit. A value of "888.8" indicates that data is unavailable and "999.9" indicates that data is missing (note that the heading row and column parsing is shown for information and is not part of the raw data).

Example Raw Temperature Telemetry File (Comma-Delimited File Telem01t.dlm)

```
date        time  Station 1 temp. (ºC)  Station 2 temp. (ºC)  Station 3 temp. (ºC)  Station 4 temp. (ºC)  Station 5 temp. (ºC)  Station 6 temp. (ºC)  Station 7 temp. (ºC)  and so on for the remaining stations 8 through 30
----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
01/01/2001,01:00, 32.2, 31.9, 30.9, 31.6, 30.2, 31.7, 31.0, etc.,
01/01/2001,02:00, 31.8, 32.8, 32.2, 32.3, 31.4, 31.7, 31.9, etc.,
01/01/2001,03:00, 32.0, 32.3, 32.2, 33.5, 32.3, 31.5, 33.1, etc.,
01/01/2001,04:00, 32.1, 31.8, 32.3, 33.4, 32.5, 32.0, 33.0, etc.,
01/01/2001,05:00, 32.4, 31.7, 32.9, 33.4, 33.3, 32.7, 33.1, etc.,
01/01/2001,06:00, 32.6, 32.2, 33.2, 33.3, 33.4, 32.8, 33.1, etc.,
01/01/2001,07:00, 32.7, 32.2, 32.9, 33.2, 33.2, 33.1, 32.8, etc.,
01/01/2001,08:00, 32.6, 32.6, 33.3, 33.2, 33.5, 33.2, 32.7, etc.,
01/01/2001,09:00, 32.6, 32.8, 33.6, 33.0, 33.4, 33.6, 33.1, etc.,
```

CALMET File Format

CALMET reads hourly surface observations in National Climatic Data Center standard data formats. One of the standard formats is CD-144. WTP extracted the required surface observations from the raw PNNL data files and “built” CD-144 files for each station for each year, or 130 CD-144 files. The CD-144 files become the input files for CALMET.

The following describes the layout of the CD144 output file:

Field Position	Parameter Name
1-5	National Weather Service Station Number
6-7	Year
8-9	Month
10-11	Day
12-13	Hour
14-16	Ceiling Height
39-40	Wind Direction
41-42	Wind Speed
43-46	Atmospheric pressure (in. Hg)
47-49	Dry Bulb Temperature
53-55	Relative Humidity
56	Total Cloud Cover
79	Opaque Cloud Cover

Example PNNL Meteorological Data in CD-144 File Format

```
Station ID
year
month
day
hour
ceiling
no data / not used
wind direction
wind speed
atmospheric pressure (in. Hg)
dry bulb temp. (ºF)
no data / not used
relative humidity
sky cover[1]
no data / not used
opaque cloud cover
|-----|--|--|--|--|---| ---------------------- |--|--|----|---|---|---|-|----------------------|-|
00001000801000 00                                18042921071   051-                      -
00001000801010 00                                14032923069   049-                      -
00001000801020 00                                19032925067   055-                      -
00001000801030 00                                20032925065   051-                      -
00001000801040 00                                21062925064   052-                      -
00001000801050 00                                21032926068   047-                      -
00001000801060 00                                19032926074   039-                      -
00001000801070 00                                17032926078   034-                      -
00001000801080 00                                16072926079   030-                      -
00001000801090 00                                16052925082   027-                      -
```

5.6 Meteorological Data Substitution and Quality Control Procedures

After each CD-144 file was prepared, it was parsed into columns and rows and evaluated for missing wind direction, wind speed, and temperature data. In addition to identifying missing hours, each hourly observation from the WTP CD-144 file was compared to the same hourly observation from the raw PNNL data file. To perform this comparison, each hourly observation from the WTP CD-144 file was subtracted from the corresponding hourly observation from the PNNL file. If the minimum and maximum difference between the PNNL observation and the WTP observation was less than 1, the WTP value was considered to be equivalent to the PNNL reading. Small differences in the values are attributed to rounding error.

The number of missing or unavailable observations was also evaluated. If a meteorological station had more than 10 % missing data, the station would not be used for that year. There were no stations that exceeded the 10 % missing data threshold (refer to Table 5-2). Missing wind speed, wind direction, and temperature were filled using guidance provided by the EPA. Appendix F is a copy of the EPA guidance document *Procedure for Substituting Values for Missing NWS Meteorological Data for Use in Regulatory Air Quality Models* (EPA 1992).

Table 5-3 is an example of the data fill methods and conversion of wind speed from miles per hour to knots. The wind speed conversion was performed to be compatible with the CD-144 format. Once the data to be filled was identified and values determined, the CD-144 file was revised to add the missing data.

Another test used to assess the quality of the PNNL surface data was to compare the change in wind speed and temperature hour to hour. If an hourly observation was more than 20 miles per hour or 20 degrees different than the previous hour, the value was evaluated for accuracy. Table 5-4 identifies an

[1] Hyphen represents 100% sky cover in CD-144 format.

example of a temperature that appears to be incorrect. Data from other stations for the same period was reviewed to determine if the suspect reading was correct. In the example provided, the temperature reading of 2.1 degrees was corrected to 24 degrees. The CD-144 file format does not accept fractional degrees.

Table 5-5 provides an example of anomalous wind speed data. The same process described above was used to assess and correct wind speed data.

5.6.1 Precipitation Data

Precipitation data for seven of the meteorological stations operated by PNNL was received for calendar years 2002, 2003, 2004, 2005, and 2006 in comma-delimited format.

Format of the Raw Precipitation Data File

The following is an example of PNNL precipitation data in comma-delimited format. Below is an example of the raw PNNL precipitation data (note that the heading row and column parsing is shown for information and is not part of the raw data). A value of 99.99 indicates that data is unavailable or missing. The data is reported in inches.

Example Raw Precipitation File (Comma-Delimited)

```
date (mon./day/year)  hour   Station 1 precipitation  Station 2 precipitation  Station 3 precipitation  Station 4 precipitation  Station 5 precipitation  Station 6 precipitation  Station 7 precipitation  Station 8 precipitation  and so on for the remaining stations 9 through 30
----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----
01/01/2006,01:00, 0.00, 0.00, 0.00, 0.00,99.99, 0.00, 0.00, 0.00,etc.
01/01/2006,02:00, 0.00, 0.00, 0.00, 0.00,99.99, 0.00, 0.00, 0.00,etc.
01/01/2006,03:00, 0.00, 0.00, 0.00, 0.00,99.99, 0.00, 0.00, 0.00,etc.
01/01/2006,04:00, 0.00, 0.00, 0.00, 0.00,99.99, 0.00, 0.00, 0.00,etc.
01/01/2006,05:00, 0.00, 0.00, 0.00, 0.00,99.99, 0.00, 0.00, 0.00,etc.
01/01/2006,06:00, 0.00, 0.00, 0.00, 0.00,99.99, 0.00, 0.00, 0.00,etc.
01/01/2006,07:00, 0.00, 0.00, 0.00, 0.00,99.99, 0.00, 0.00, 0.00,etc.
01/01/2006,08:00, 0.00, 0.00, 0.00, 0.00,99.99, 0.00, 0.00, 0.00,etc.
01/01/2006,09:00, 0.00, 0.00, 0.00, 0.00,99.99, 0.00, 0.00, 0.00,etc.
01/01/2006,10:00, 0.00, 0.00, 0.00, 0.00,99.99, 0.00, 0.00, 0.00,etc.
01/01/2006,11:00, 0.00, 0.00, 0.00, 0.00,99.99, 0.00, 0.00, 0.00,etc.
01/01/2006,12:00, 0.01, 0.02, 0.02, 0.01,99.99, 0.01, 0.01, 0.04,etc.
```

Precipitation data from seven meteorological stations was used to “build” a free-formatted precipitation data file suitable for use by CALMET. Table 4-2 identifies the surface meteorological stations used to extract precipitation data. PNNL precipitation data was reported in inches per hour. The units were converted to millimeters per hour to be compatible with the CALMET input requirements. The following is an example of the WTP precipitation input file.

Example Precipitation File in CALMET Format

```
PRECIP.DAT                              2.0
1
Produced by WTP:     Free-formatted Precipitation.dat file
NONE
  2006   1   0  2006 365   23    8    7
450001
450010
450011
450012
450017
450021
450024
2006   1   0     0.000    0.000    0.000    0.000    0.000    0.000    0.000
2006   1   1     0.000    0.000    0.000    0.000    0.000    0.000    0.000
2006   1   2     0.000    0.000    0.000    0.000    0.000    0.000    0.000
2006   1   3     0.000    0.000    0.000    0.000    0.000    0.000    0.000
2006   1   4     0.000    0.000    0.000    0.000    0.000    0.000    0.000
2006   1   5     0.000    0.000    0.000    0.000    0.000    0.000    0.000
2006   1   6     0.000    0.000    0.000    0.000    0.000    0.000    0.000
2006   1   7     0.000    0.000    0.000    0.000    0.000    0.000    0.000
2006   1   8     0.000    0.000    0.000    0.000    0.000    0.000    0.000
2006   1   9     0.000    0.000    0.000    0.000    0.000    0.000    0.000
2006   1  10     0.000    0.000    0.000    0.000    0.000    0.000    0.000
2006   1  11     0.254    0.254    0.000    0.254    0.000    0.254    0.508
2006   1  12     0.000    0.000    0.000    0.000    0.000    0.000    0.254
2006   1  13     0.000    0.000    0.000    0.000    0.000    0.000    0.000
```

The free-formatted WTP precipitation file was checked for accuracy by comparison to the appropriate raw data received from PNNL. Table 5-6 is an example of one of the WTP precipitation data quality review files. As previously described, the WTP value was subtracted from the PNNL value for the corresponding hour after converting the PNNL values to millimeters per hour. Differences of greater or less than 0.0 were investigated and revised as necessary.

5.7 Building Downwash

The CALPUFF model will be run with building downwash turned on (see the MTIP setting in Appendix A). Table 5-7 identifies the building height and width for each flow vector that was determined through the EPA Building Profile Input Program (BPIP).

Table 5-1 Receptor Exposure Grids and Grid Node Spacing

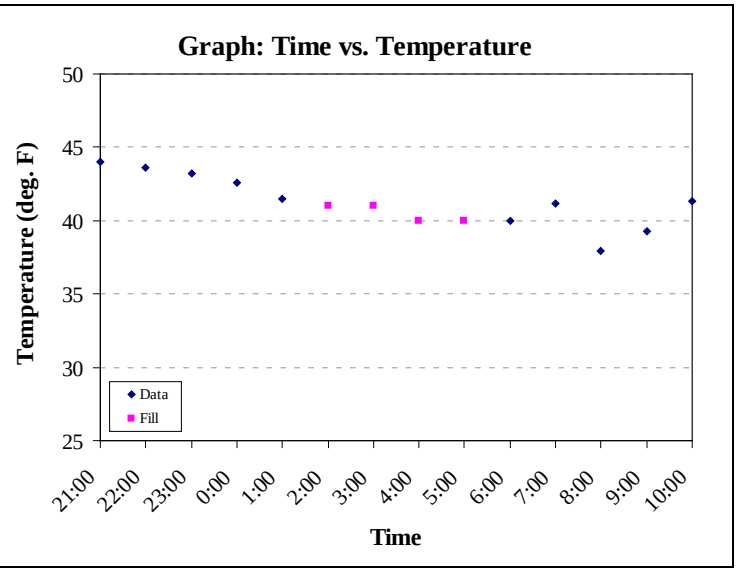
Figure Number	Receptor Exposure Grids	Grid Node Spacing	Number of Grid Nodes
Figure 5-7	Columbia River	500 meters	83
Figure 5-8	Gable Mountain	500 meters	53
Figure 5-9	Onsite	60 meters	1555
Figure 5-10	Offsite	500 meters	1,809
Figure 5-11	Hunter-Gatherer Current[2]	1 kilometer	768
Figure 5-12	Hunter-Gatherer Future	1 kilometer	1,380
Figure 5-13	All Receptor Grids	varies	3,894

Table 5-2 Missing Temperature, Wind Speed, and Wind Direction Analysis

Year	Hanford ID	CALMET ID	Maximum Missing Data Points (%)	Hanford ID	CALMET ID	Maximum Missing Data Points (%)	
			Temperature			Wind Speed	Wind Direction
2002	2	EOC	3.85	2	EOC	3.77	3.77
2003	27	VSTA	2.32	2	EOC	1.12	1.12
2004	13	100N	0.64	13	100N	0.57	0.57
2005	30	HAMR	3.98	14	WPPS	1.15	1.15
2006	5	EDNA	3.23	5	EDNA	2.03	2.03

Table 5-3 Example of Missing Data Fill Methods

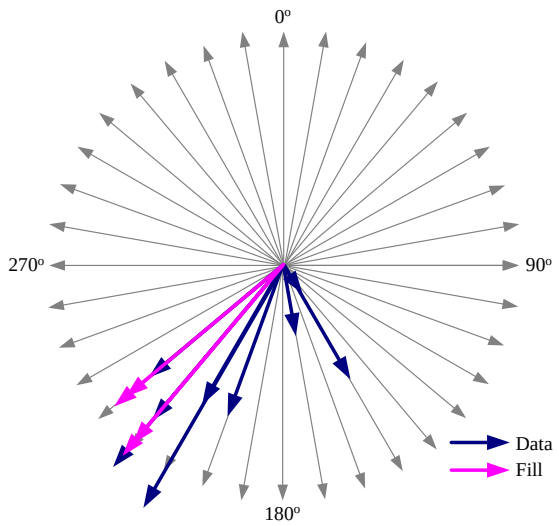
Date	Time	Temperature (deg. F)	
		Datum	Fill
1/26/2006	21:00	44	not req'd
1/26/2006	22:00	43.6	not req'd
1/26/2006	23:00	43.2	not req'd
1/26/2006	24:00	42.6	not req'd
1/27/2006	1:00	41.5	not req'd
1/27/2006	2:00	missing	41
1/27/2006	3:00	missing	41
1/27/2006	4:00	missing	40
1/27/2006	5:00	missing	40
1/27/2006	6:00	40	not req'd
1/27/2006	7:00	41.2	not req'd
1/27/2006	8:00	37.9	not req'd
1/27/2006	9:00	39.3	not req'd
1/27/2006	10:00	41.3	not req'd



[2] The Hunter-Gatherer Current grid is a subset of the Hunter-Gatherer Future grid. This can be seen in Figure 5-11 and Figure 5-12.

Table 5-3 Example of Missing Data Fill Methods cont.

Date	Time	Wind Direction (deg.)	
		Datum	Fill
1/26/2006	21:00	150	not req'd
1/26/2006	22:00	170	not req'd
1/26/2006	23:00	150	not req'd
1/26/2006	24:00	210	not req'd
1/27/2006	1:00	220	not req'd
1/27/2006	2:00	missing	220
1/27/2006	3:00	missing	220
1/27/2006	4:00	missing	230
1/27/2006	5:00	missing	230
1/27/2006	6:00	230	not req'd
1/27/2006	7:00	220	not req'd
1/27/2006	8:00	200	not req'd
1/27/2006	9:00	200	not req'd
1/27/2006	10:00	210	not req'd



date	time	Wind Speed (mph)	
		Datum	Fill
1/26/2006	21:00	9	not req'd
1/26/2006	22:00	5	not req'd
1/26/2006	23:00	2	not req'd
1/26/2006	24:00	19	not req'd
1/27/2006	1:00	18	not req'd
1/27/2006	2:00	missing	17
1/27/2006	3:00	missing	16
1/27/2006	4:00	missing	15
1/27/2006	5:00	missing	14
1/27/2006	6:00	12	not req'd
1/27/2006	7:00	14	not req'd
1/27/2006	8:00	11	not req'd
1/27/2006	9:00	11	not req'd
1/27/2006	10:00	11	not req'd

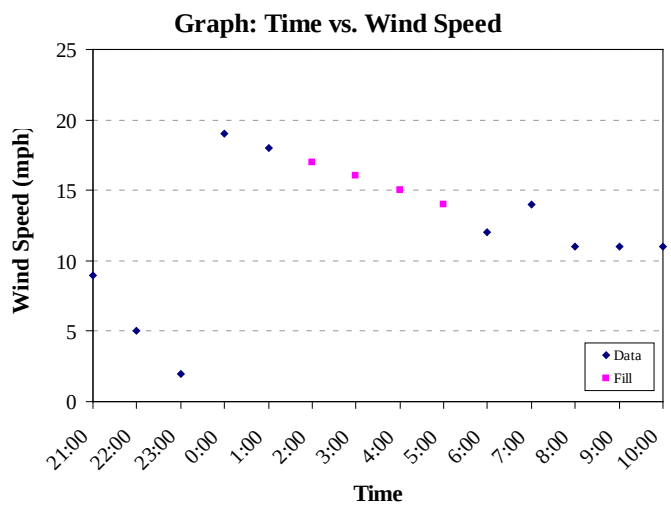


Table 5-4 Example of Anomalous Temperature Data

Date	Time	Sta. 1	Sta. 2	Sta. 3	Sta. 4	Sta. 5	Sta. 6
1/9/2005,	15:00,	33.4,	32.8,	33,	31.5,	31.8,	32.3
1/9/2005,	16:00,	31.6,	31.1,	31.7,	31.2,	31,	31.3
1/9/2005,	17:00,	27.5,	27.9,	30.9,	29,	28.7,	27.3
1/9/2005,	18:00,	25.6,	24.9,	29.7,	27.4,	26.7,	26.3
1/9/2005,	19:00,	25.5,	24,	29.2,	26.3,	24.8,	25.4
1/9/2005,	20:00,	24.2,	20.5,	28.9,	24.5,	23.6,	22.7
1/9/2005,	21:00,	25.3,	22.2,	28.9,	2.1,	26.8,	22.8
1/9/2005,	22:00,	25.9,	24.5,	28.9,	24.2,	27.3,	24
1/9/2005,	23:00,	26.1,	26.4,	28.5,	24.9,	27.1,	24.1
1/9/2005,	24:00,	24.8,	25.2,	28.8,	25.4,	27	
1/10/2005,	1:00,	26.3,	26.1,	28.6,	25.1,	27	
1/10/2005,	2:00,	26.5,	26.7,	28.2,	26.2,	26	
1/10/2005,	3:00,	26,	26,	28.2,	25.8,	26.7,	25.6
1/10/2005,	4:00,	25.8,	24.7,	27.7,	26.1,	26.7,	25.8
1/10/2005,	5:00,	26.1,	24.4,	27.5,	25.4,	26.1,	25.4
1/10/2005,	6:00,	26.1,	25.3,	27,	25.9,	25.8,	25.4
1/10/2005,	7:00,	25.8,	25.3,	26.8,	26.2,	25.7,	26.4
1/10/2005,	8:00,	26.2,	25.6,	26.7,	26.1,	25.8,	26.4

Anomalous Temperature Reading

Table 5-5 Example of Anomalous Wind Speed Data

Date	Time	Sta. 1 Wind Dir. (deg.)	Sta. 1 Wind Speed (mph)	Sta. 2 Wind Dir. (deg.)	Sta. 2 Wind Speed (mph)	Sta. 3 Wind Dir. (deg.)	Sta. 3 Wind Speed (mph)	Sta. 4 Wind Dir. (deg.)	Sta. 4 Wind Speed (mph)
1/1/2005,	23:00,	330,	14,	360,	4,	330,	8,	320,	11,
1/1/2005,	24:00,	330,	15,	360,	6,	330,	9,	330,	11,
1/2/2005,	1:00,	330,	16,	360,	6,	340,	9,	330,	12,
1/2/2005,	2:00,	330,	16,	50,	5,	360,	36,	320,	10,
1/2/2005,	3:00,	330,	16,	360,	6,	340,	10,	320,	8,
1/2/2005,	4:00,	330,	16,	360,	8,	340,	9,	320,	10,
1/2/2005,	5:00,	330,	16,	360,			9,		
1/2/2005,	6:00,	320,	17,	360,			10,		
1/2/2005,	7:00,	330,	16,	350,			10,		
1/2/2005,	8:00,	330,	16,	350,	5,	340,	9,	320,	11,
1/2/2005,	9:00,	330,	17,	330,	5,	330,	11,	320,	9,
1/2/2005,	10:00,	320,	18,	350,	7,	340,	11,	320,	10,
1/2/2005,	11:00,	330,	18,	350,	7,	340,	9,	320,	11,
1/2/2005,	12:00,	320,	19,	340,	6,	340,	11,	310,	10,
1/2/2005,	13:00,	320,	18,	340,	5,	340,	10,	310,	11,
1/2/2005,	14:00,	330,	14,	350,	5,	340,	8,	320,	10,
1/2/2005,	15:00,	330,	14,	330,	5,	320,	9,	310,	9,
1/2/2005,	16:00,	330,	14,	340,	5,	340,	8,	320,	9,

Anomalous Wind Direction Reading

Anomalous Wind Speed Reading

Table 5-6 Example of Precipitation Data Quality Review

B	C	D	E	F	G
Yr	**Julian Day**	**Hour**	**WTP Precip. File**	**PNNL Raw Data (Parsed)**	**Difference (Col. E - Col. F)**
2002	364	15	0	0	0
2002	364	16	0.508	0.508	0
2002	364	17	0.508	0.508	0
2002	364	18	0.762	0.762	0
2002	364	19	0.762	0.762	0
2002	364	20	0.762	0.762	0
2002	364	21	1.524	1.524	0
2002	364	22	1.27	1.27	0
2002	364	23	0.508	0.508	0
2002	364	24	0.254	0.254	0
2002	365	1	0	0	0
2002	365	2	0	0	0
				Count if Difference is >0	0

Table 5-7 Building Profile Input Program Parameters

Name	Building Parameter	Building Parameters for Each Flow Vector (m)											
		10°	**20°**	**30°**	**40°**	**50°**	**60°**	**70°**	**80°**	**90°**	**100°**	**110°**	**120°**
PT	Height	36.27	36.27	36.27	36.27	36.27	36.27	36.27	36.27	36.27	36.27	36.27	36.27
	Width	183.67	188.02	186.66	179.64	167.15	149.58	127.47	101.49	76.08	99.63	125.64	147.83
	Length	0	0	0	0	0	0	0	0	0	0	0	0
	XBAdj	0	0	0	0	0	0	0	0	0	0	0	0
	YBAdj	0	0	0	0	0	0	0	0	0	0	0	0
		130°	**140°**	**150°**	**160°**	**170°**	**180°**	**190°**	**200°**	**210°**	**220°**	**230°**	**240°**
PT cont.	Height	36.27	36.27	36.27	36.27	36.27	36.27	36.27	36.27	36.27	36.27	36.27	36.27
	Width	165.53	178.2	185.46	187.08	183.01	173.73	183.67	188.02	186.66	179.64	167.15	149.58
	Length	0	0	0	0	0	0	0	0	0	0	0	0
	XBAdj	0	0	0	0	0	0	0	0	0	0	0	0
	YBAdj	0	0	0	0	0	0	0	0	0	0	0	0
		250°	**260°**	**270°**	**280°**	**290°**	**300°**	**310°**	**320°**	**330°**	**340°**	**350°**	**360°**
PT cont.	Height	36.27	36.27	36.27	36.27	36.27	36.27	36.27	36.27	36.27	36.27	36.27	36.27
	Width	127.47	101.49	76.08	99.63	125.64	147.83	165.53	178.2	185.46	187.08	183.01	173.73
	Length	0	0	0	0	0	0	0	0	0	0	0	0
	XBAdj	0	0	0	0	0	0	0	0	0	0	0	0
	YBAdj	0	0	0	0	0	0	0	0	0	0	0	0
		10°	**20°**	**30°**	**40°**	**50°**	**60°**	**70°**	**80°**	**90°**	**100°**	**110°**	**120°**
LAW	Height	20.73	20.73	20.73	20.73	20.73	25.3	25.3	25.3	25.3	25.3	25.3	36.27
	Width	101.03	105.11	105.99	103.66	98.17	115.91	106.23	94.78	84.57	94.5	105.54	147.83
	Length	0	0	0	0	0	0	0	0	0	0	0	0
	XBAdj	0	0	0	0	0	0	0	0	0	0	0	0
	YBAdj	0	0	0	0	0	0	0	0	0	0	0	0

Table 5-7 Building Profile Input Program Parameters

Name	Building Parameter	Building Parameters for Each Flow Vector (m)											
		130°	**140°**	**150°**	**160°**	**170°**	**180°**	**190°**	**200°**	**210°**	**220°**	**230°**	**240°**
LAW cont.	Height	36.27	36.27	36.27	36.27	36.27	20.73	20.73	20.73	20.73	20.73	20.73	20.73
	Width	165.53	178.2	185.46	187.08	183.01	93.88	101.03	105.11	105.99	103.66	98.17	89.7
	Length	0	0	0	0	0	0	0	0	0	0	0	0
	XBAdj	0	0	0	0	0	0	0	0	0	0	0	0
	YBAdj	0	0	0	0	0	0	0	0	0	0	0	0
		250°	**260°**	**270°**	**280°**	**290°**	**300°**	**310°**	**320°**	**330°**	**340°**	**350°**	**360°**
LAW cont.	Height	20.73	20.73	20.73	20.73	20.73	20.73	20.73	20.73	20.73	20.73	20.73	20.73
	Width	78.51	64.93	49.38	64.93	78.51	89.7	98.17	103.66	105.99	105.11	101.03	93.88
	Length	0	0	0	0	0	0	0	0	0	0	0	0
	XBAdj	0	0	0	0	0	0	0	0	0	0	0	0
	YBAdj	0	0	0	0	0	0	0	0	0	0	0	0
		10°	**20°**	**30°**	**40°**	**50°**	**60°**	**70°**	**80°**	**90°**	**100°**	**110°**	**120°**
HLW	Height	25.3	25.3	25.3	25.3	36.27	25.3	25.3	25.3	25.3	25.3	25.3	25.3
	Width	119.04	123.99	125.16	124.53	167.15	115.91	106.23	94.78	84.57	94.5	105.54	115.28
	Length	0	0	0	0	0	0	0	0	0	0	0	0
	XBAdj	0	0	0	0	0	0	0	0	0	0	0	0
	YBAdj	0	0	0	0	0	0	0	0	0	0	0	0
		130°	**140°**	**150°**	**160°**	**170°**	**180°**	**190°**	**200°**	**210°**	**220°**	**230°**	**240°**
HLW cont.	Height	25.3	25.3	25.3	36.27	36.27	36.27	36.27	36.27	36.27	36.27	36.27	25.3
	Width	121.52	124.47	124.19	187.08	183.01	173.73	183.67	188.02	186.66	179.64	167.15	115.91
	Length	0	0	0	0	0	0	0	0	0	0	0	0
	XBAdj	0	0	0	0	0	0	0	0	0	0	0	0
	YBAdj	0	0	0	0	0	0	0	0	0	0	0	0

Table 5-7 Building Profile Input Program Parameters

Name	Building Parameter	Building Parameters for Each Flow Vector (m)											
		250°	**260°**	**270°**	**280°**	**290°**	**300°**	**310°**	**320°**	**330°**	**340°**	**350°**	**360°**
HLW cont.	Height	25.3	25.3	25.3	25.3	25.3	25.3	25.3	25.3	25.3	25.3	25.3	25.3
	Width	106.23	94.78	84.57	94.5	105.54	115.28	121.52	124.47	124.19	122.52	118.3	110.48
	Length	0	0	0	0	0	0	0	0	0	0	0	0
	XBAdj	0	0	0	0	0	0	0	0	0	0	0	0
	YBAdj	0	0	0	0	0	0	0	0	0	0	0	0
		10°	**20°**	**30°**	**40°**	**50°**	**60°**	**70°**	**80°**	**90°**	**100°**	**110°**	**120°**
EMF	Height	4.27	4.27	4.27	4.27	36.27	36.27	36.27	4.27	4.27	18.29	18.29	18.29
	Width	38.56	40.76	41.73	41.43	167.15	149.58	127.47	28.3	22.53	22.66	24.82	26.22
	Length	0	0	0	0	0	0	0	0	0	0	0	0
	XBAdj	0	0	0	0	0	0	0	0	0	0	0	0
	YBAdj	0	0	0	0	0	0	0	0	0	0	0	0
		130°	**140°**	**150°**	**160°**	**170°**	**180°**	**190°**	**200°**	**210°**	**220°**	**230°**	**240°**
EMF cont.	Height	18.29	11.28	11.28	11.28	0	0	4.27	4.27	4.27	4.27	4.27	4.27
	Width	26.83	58.59	58.5	56.64	0	0	38.56	40.76	41.73	41.43	39.87	37.1
	Length	0	0	0	0	0	0	0	0	0	0	0	0
	XBAdj	0	0	0	0	0	0	0	0	0	0	0	0
	YBAdj	0	0	0	0	0	0	0	0	0	0	0	0
		250°	**260°**	**270°**	**280°**	**290°**	**300°**	**310°**	**320°**	**330°**	**340°**	**350°**	**360°**
EMF cont.	Height	4.27	4.27	4.27	4.27	4.27	4.27	4.27	4.27	4.27	0	0	0
	Width	33.2	28.3	22.53	28.3	33.2	37.1	39.87	41.43	41.73	0	0	0
	Length	0	0	0	0	0	0	0	0	0	0	0	0
	XBAdj	0	0	0	0	0	0	0	0	0	0	0	0
	YBAdj	0	0	0	0	0	0	0	0	0	0	0	0

Table 5-7 Building Profile Input Program Parameters

Name	Building Parameter	Building Parameters for Each Flow Vector (m)											
		10°	**20°**	**30°**	**40°**	**50°**	**60°**	**70°**	**80°**	**90°**	**100°**	**110°**	**120°**
Lab	Height	12.19	12.19	12.19	36.27	36.27	36.27	36.27	36.27	36.27	12.19	12.19	12.19
	Width	74.37	86.73	96.47	179.64	167.15	149.58	127.47	101.49	76.08	102.15	104.35	103.38
	Length	0	0	0	0	0	0	0	0	0	0	0	0
	XBAdj	0	0	0	0	0	0	0	0	0	0	0	0
	YBAdj	0	0	0	0	0	0	0	0	0	0	0	0
		130°	**140°**	**150°**	**160°**	**170°**	**180°**	**190°**	**200°**	**210°**	**220°**	**230°**	**240°**
Lab cont.	Height	12.19	12.19	12.19	12.19	12.19	18.29	18.29	12.19	12.19	36.27	12.19	12.19
	Width	99.27	92.14	82.21	73.55	67.67	18.13	21.29	86.73	96.47	179.64	106.93	107.34
	Length	0	0	0	0	0	0	0	0	0	0	0	0
	XBAdj	0	0	0	0	0	0	0	0	0	0	0	0
	YBAdj	0	0	0	0	0	0	0	0	0	0	0	0
		250°	**260°**	**270°**	**280°**	**290°**	**300°**	**310°**	**320°**	**330°**	**340°**	**350°**	**360°**
Lab cont.	Height	12.19	12.19	12.19	12.19	12.19	12.19	12.19	12.19	12.19	12.19	12.19	12.19
	Width	104.5	98.55	96.85	102.15	104.35	103.38	99.27	92.14	82.21	73.55	67.67	59.74
	Length	0	0	0	0	0	0	0	0	0	0	0	0
	XBAdj	0	0	0	0	0	0	0	0	0	0	0	0
	YBAdj	0	0	0	0	0	0	0	0	0	0	0	0

Figure 5-1 Simplified Pretreatment Process Flow Diagram

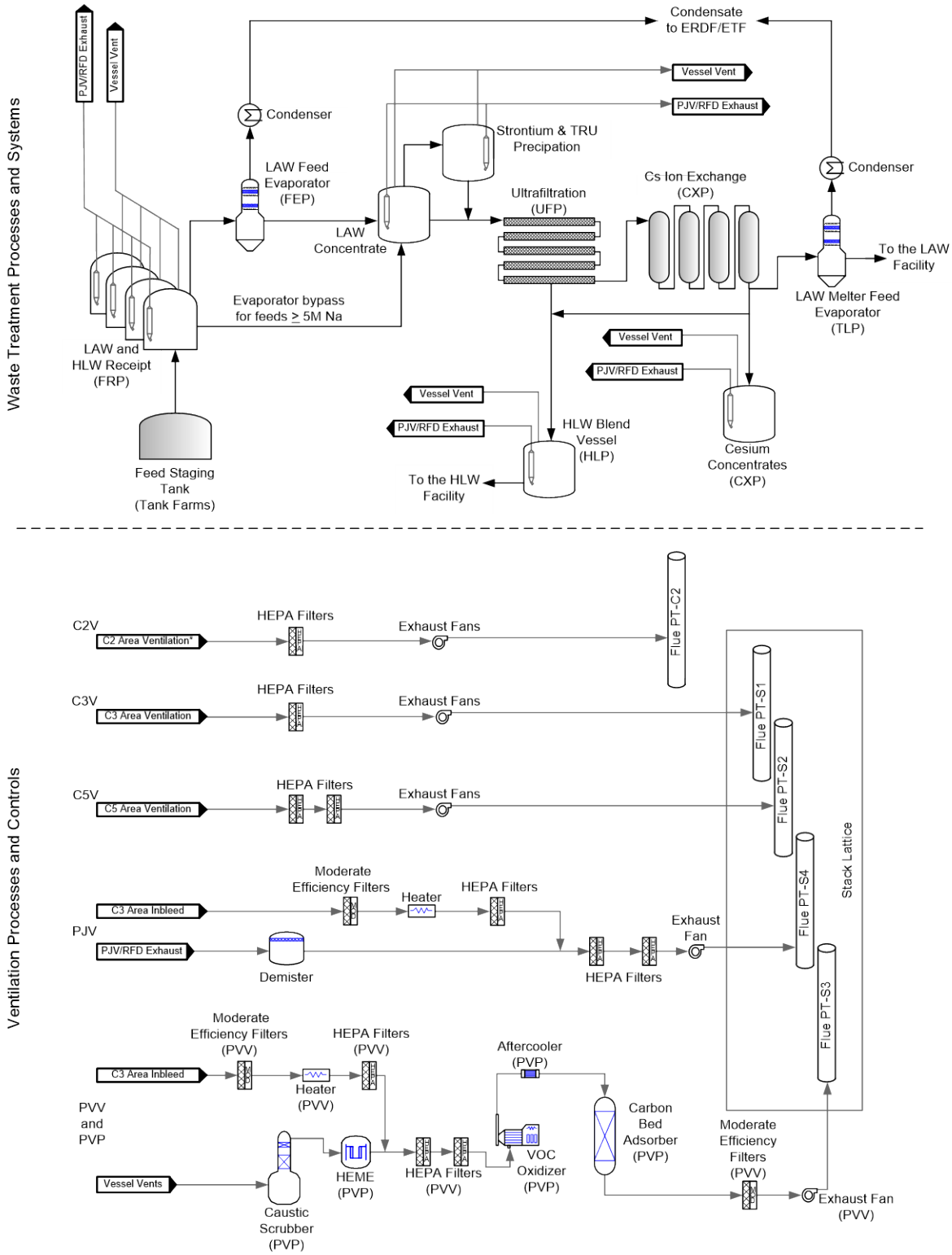


Figure 5-2 Simplified LAW Process Flow Diagram

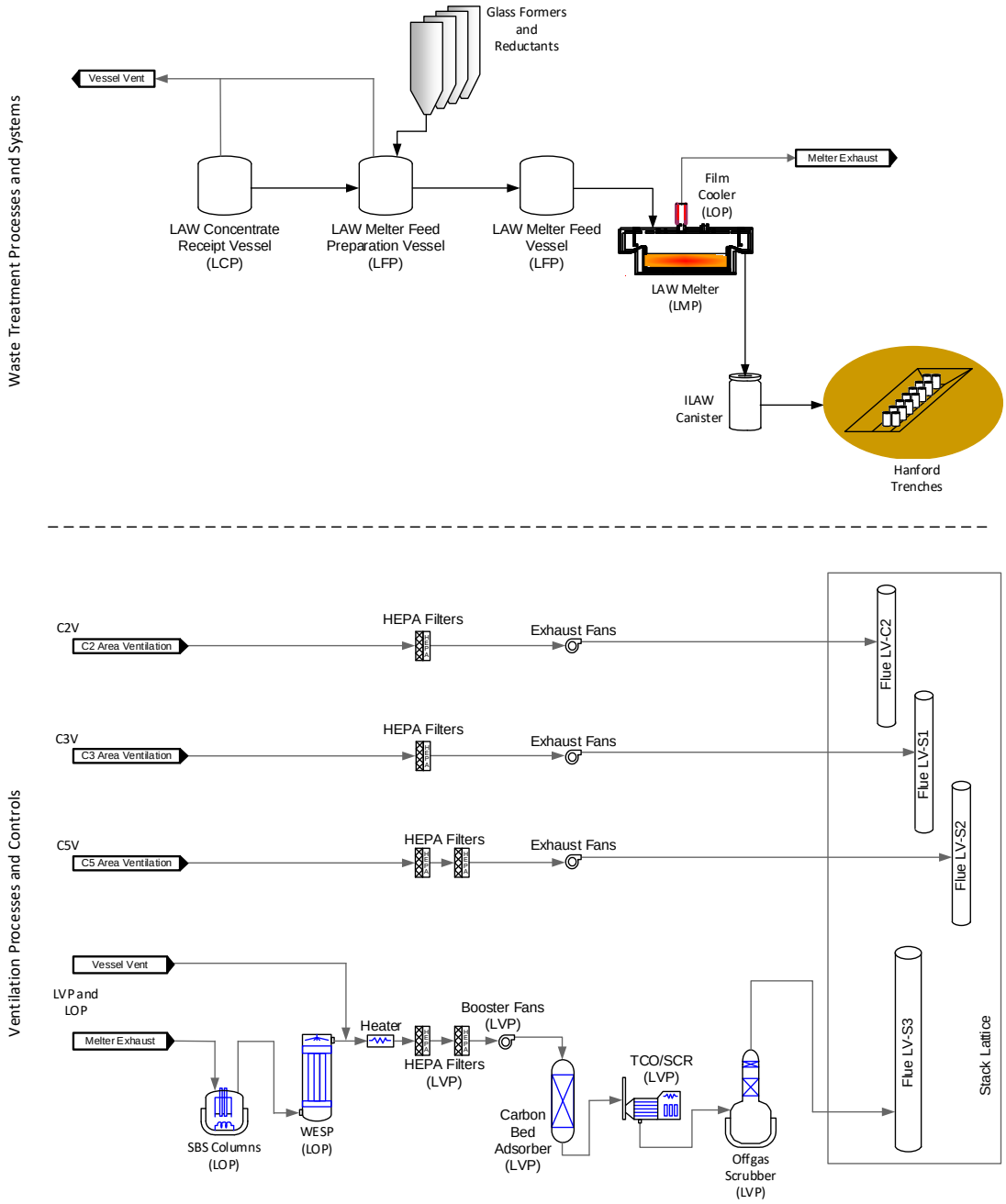


Figure 5-3 Simplified HLW Process Flow Diagram

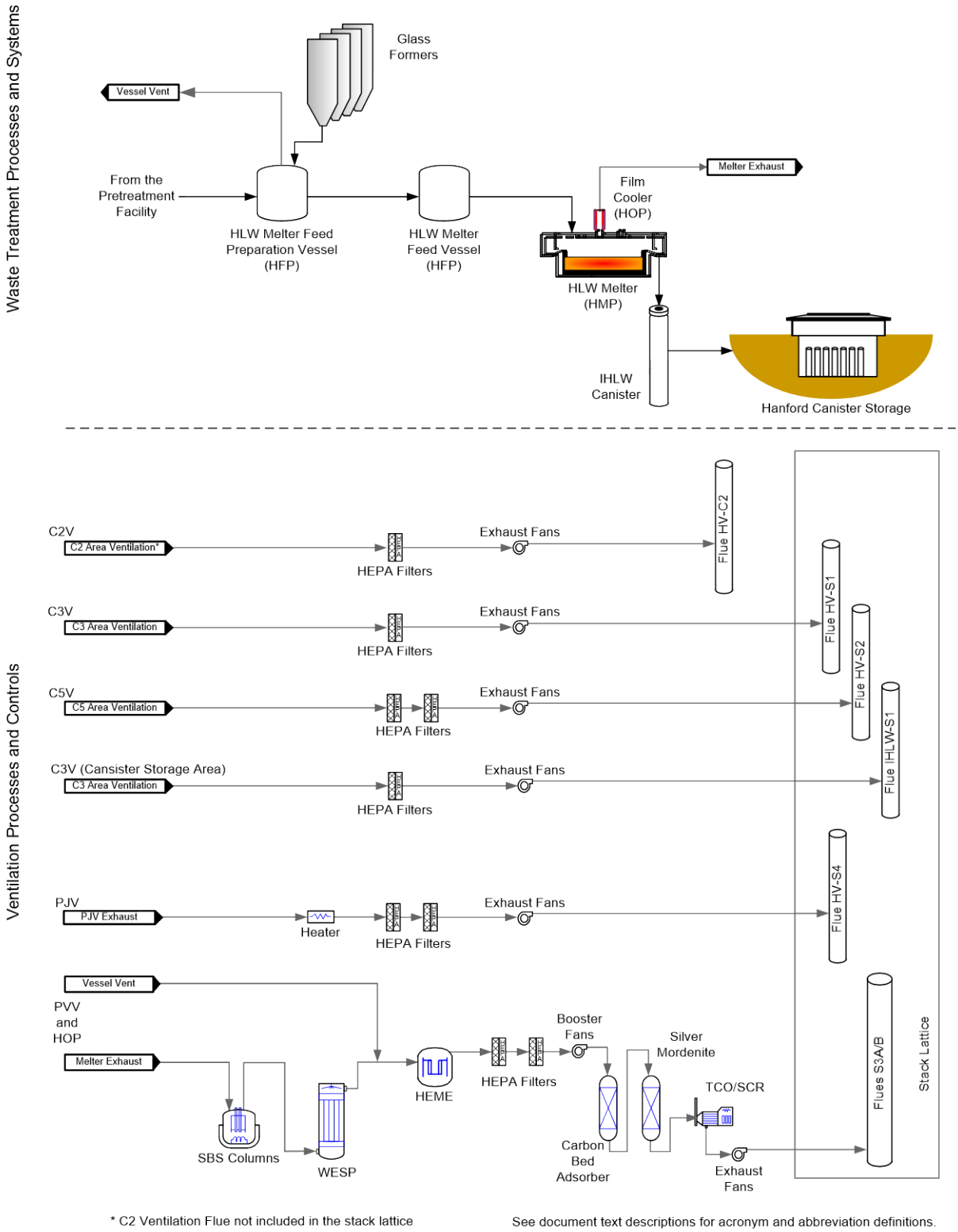


Figure 5-4 EMF Simplified Flow Diagram

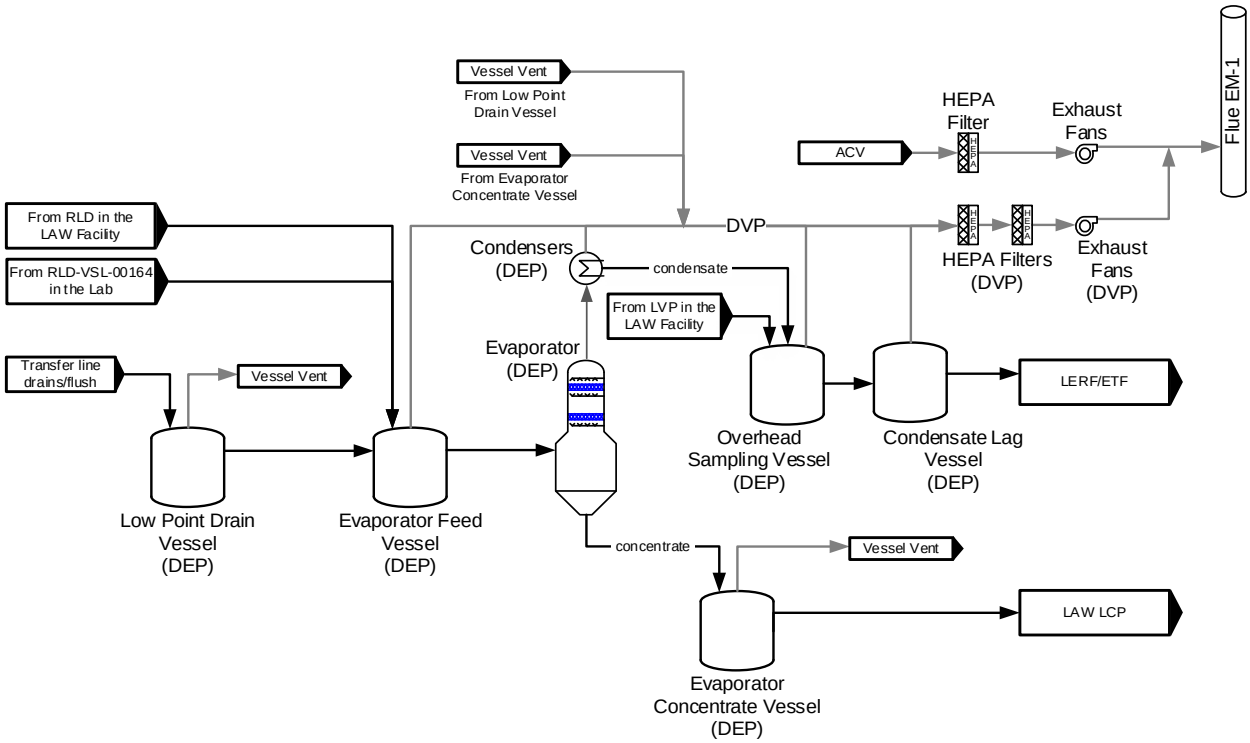


Figure 5-5 General Layout of a Melter

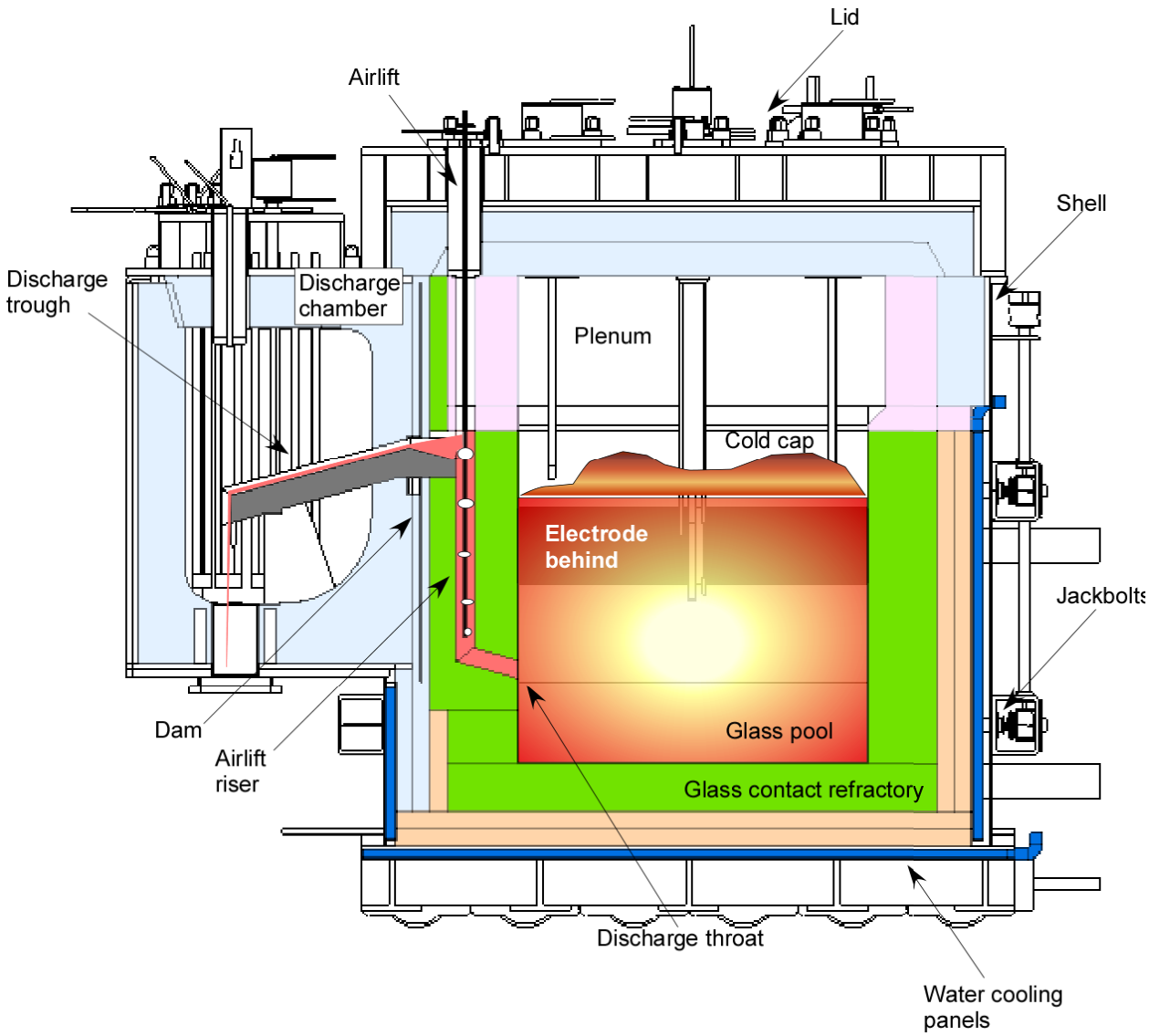


Figure 5-6 WTP Model Domain

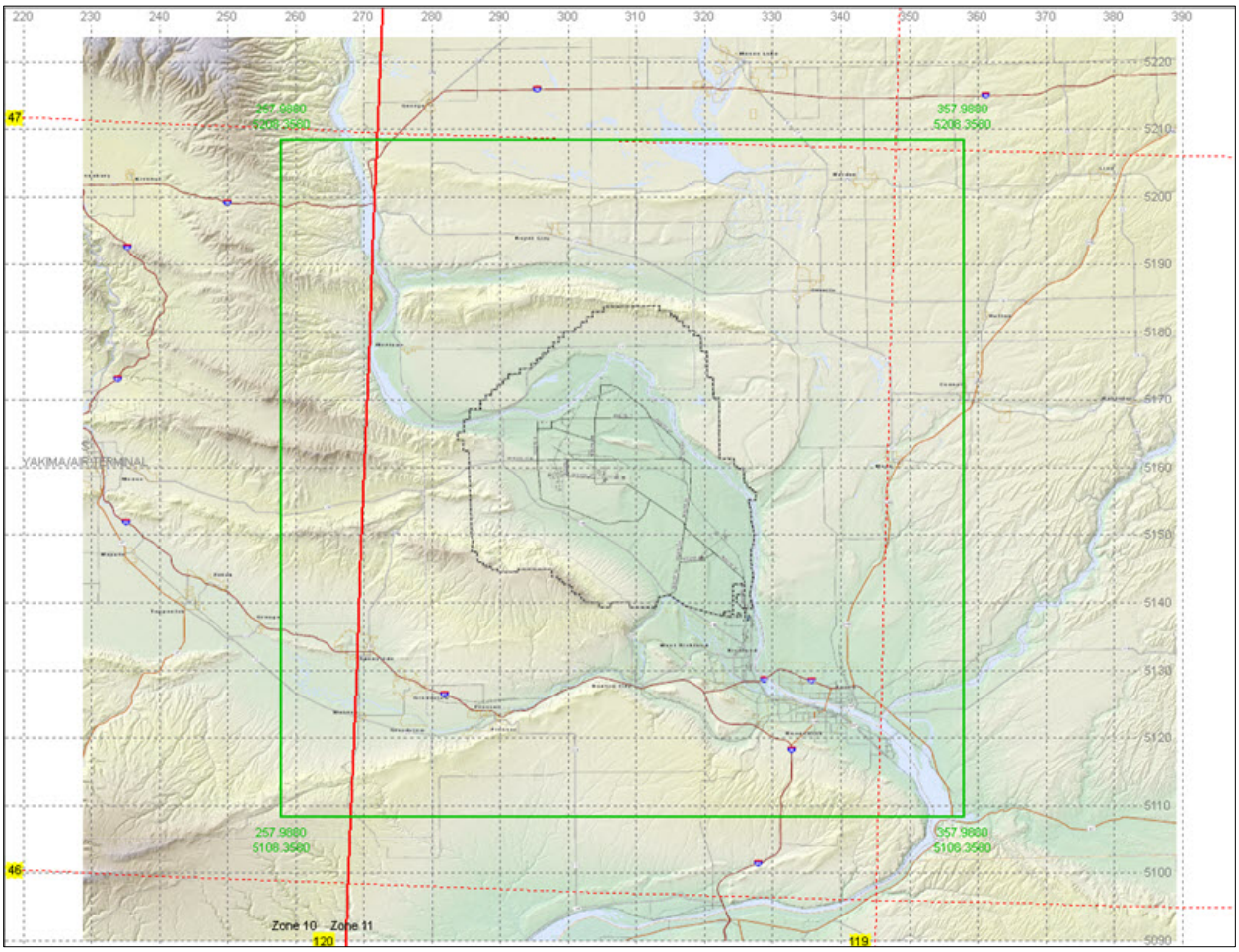


Figure 5-7 Columbia River Receptor Locations

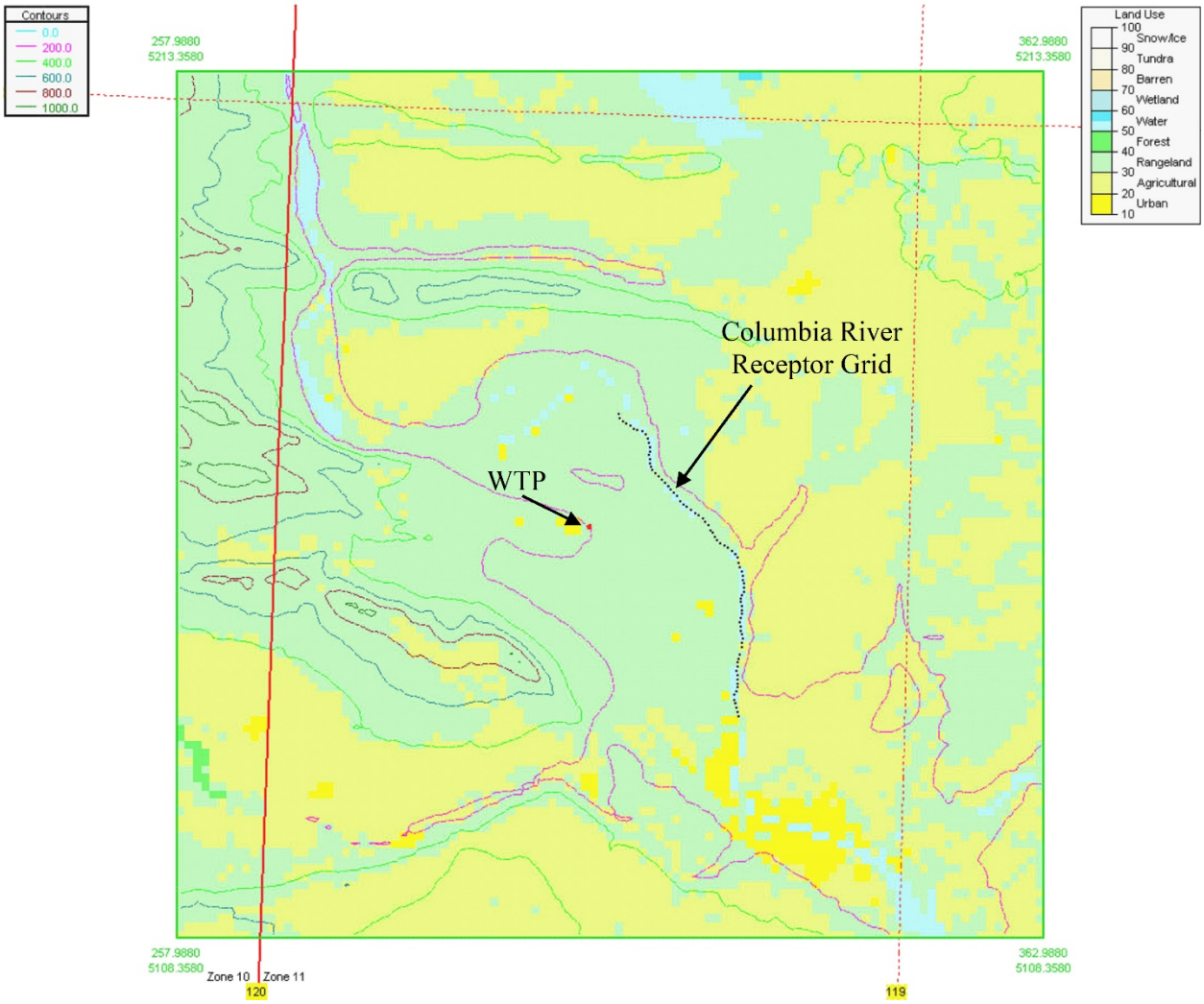


Figure 5-8 Gable Mountain Receptor Locations

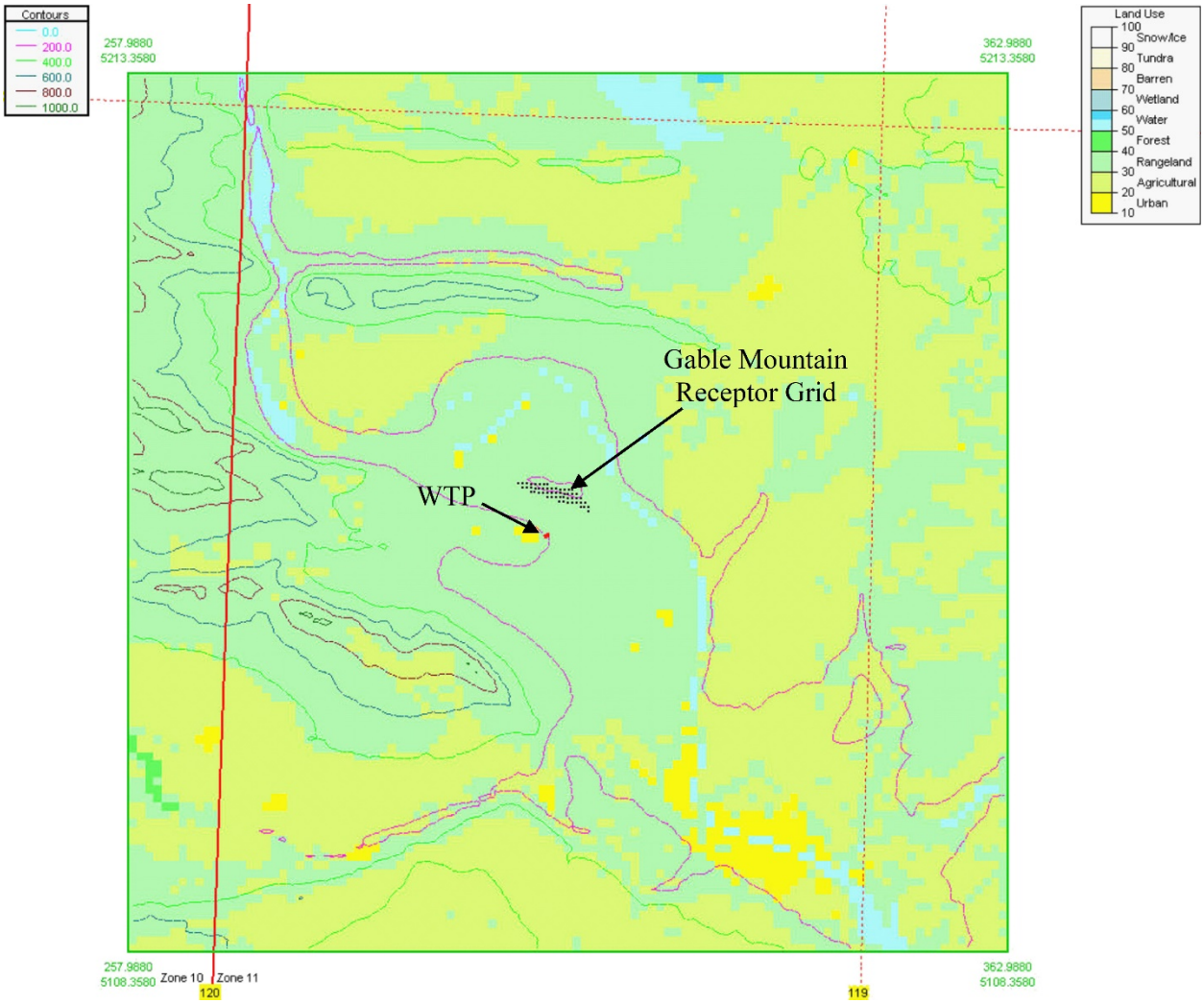


Figure 5-9 Onsite Receptor Locations

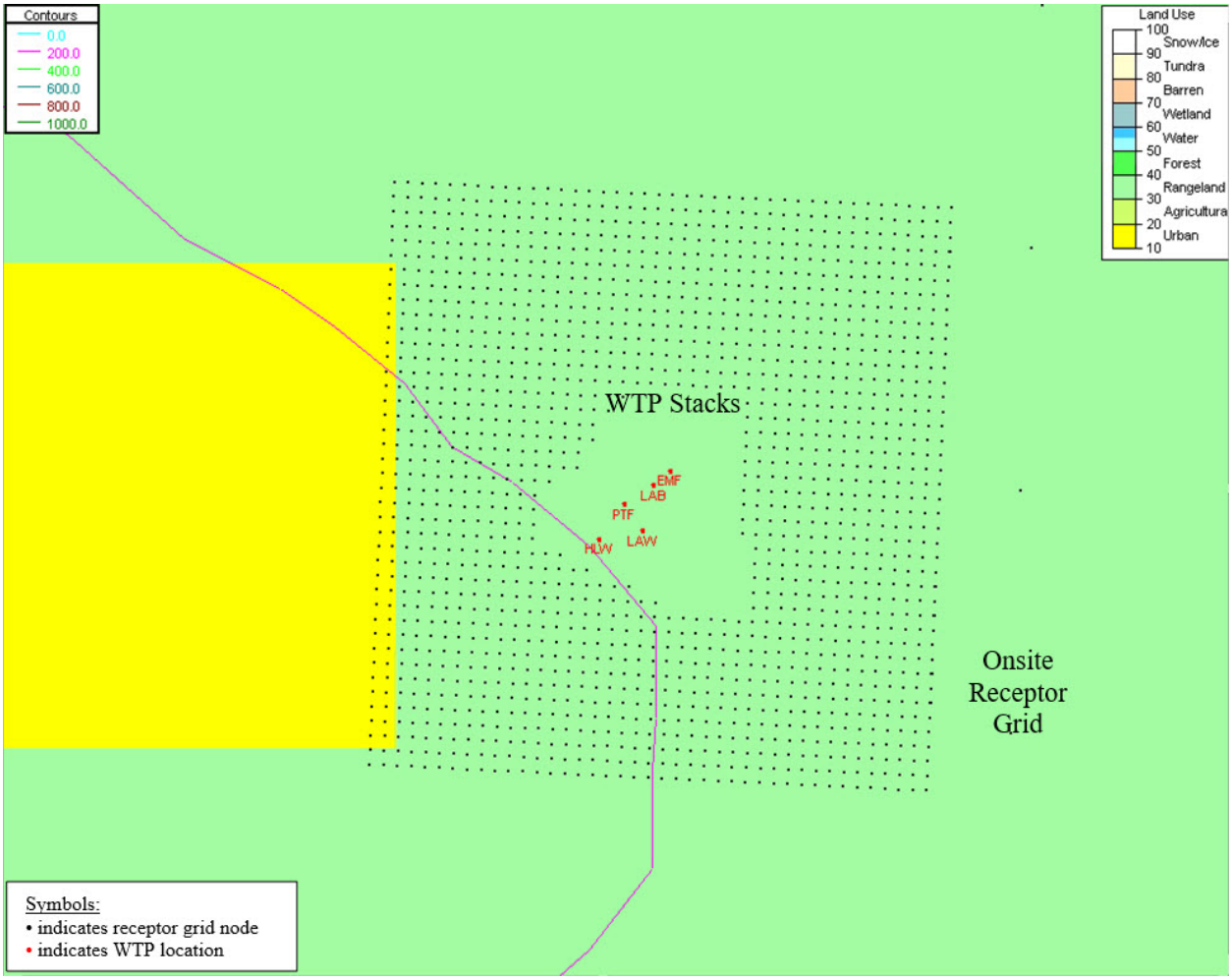


Figure 5-10 Offsite Receptor Locations

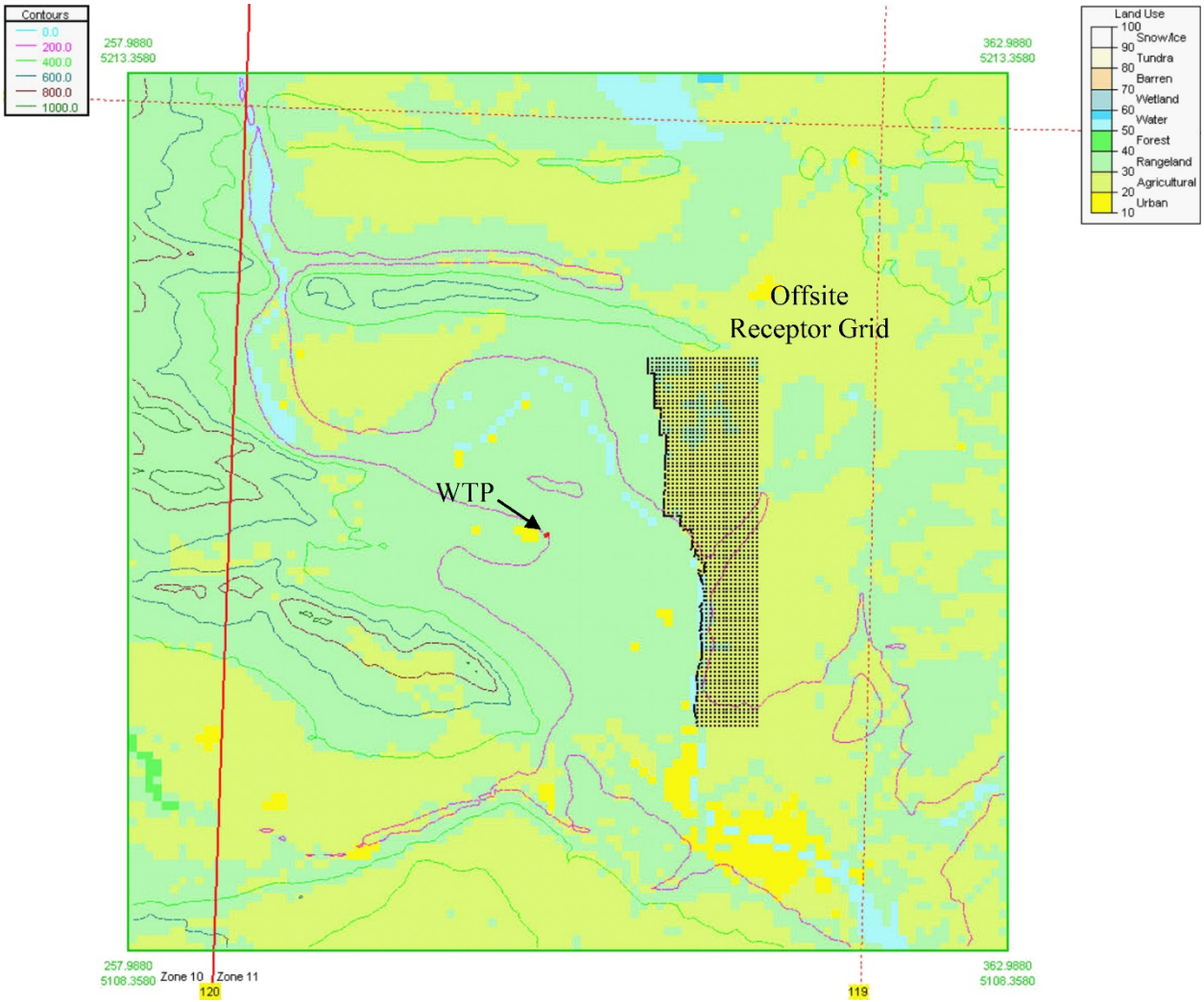


Figure 5-11 Hunter-Gatherer Current Receptor Locations

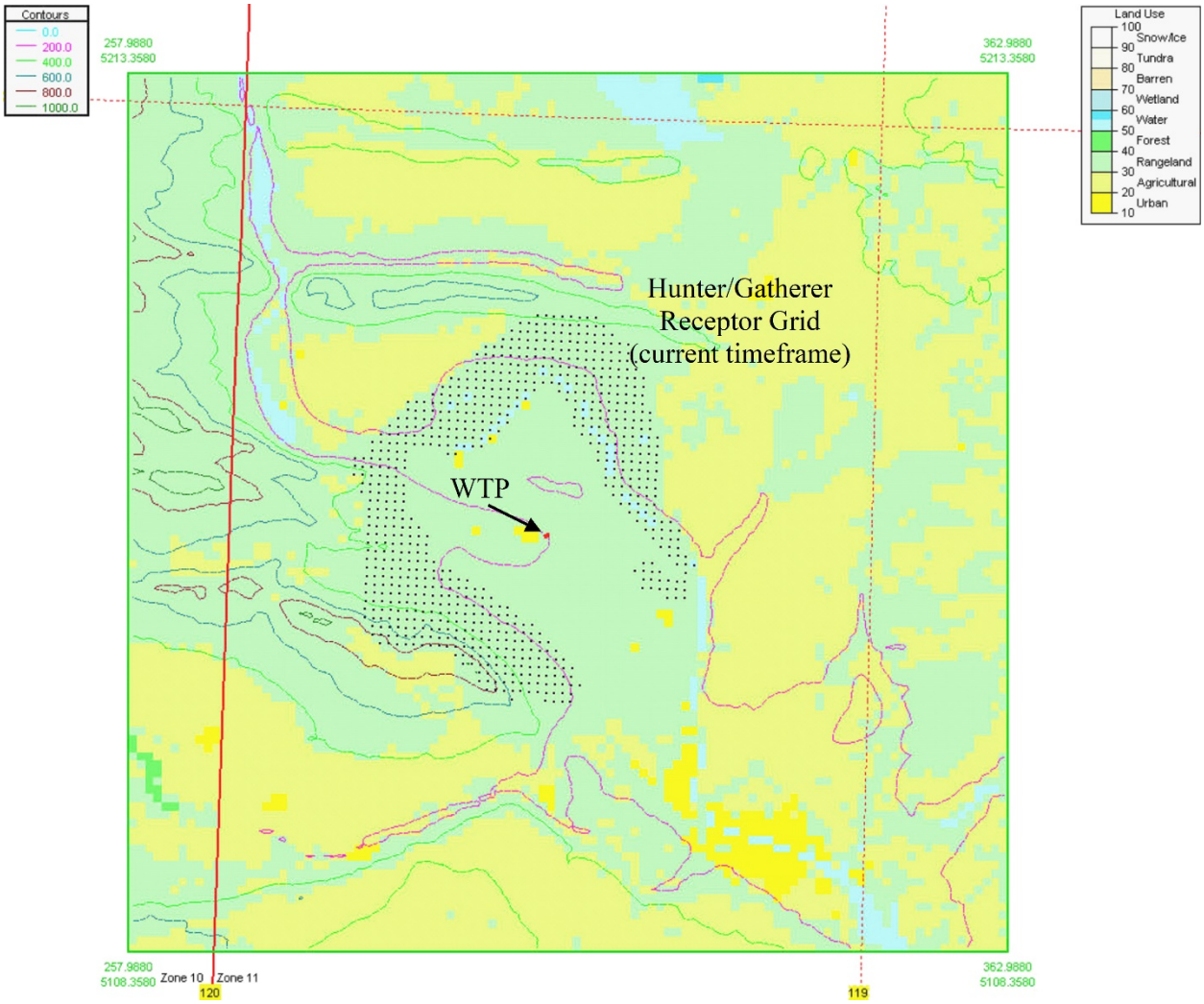


Figure 5-12 Hunter-Gatherer Future Receptor Locations

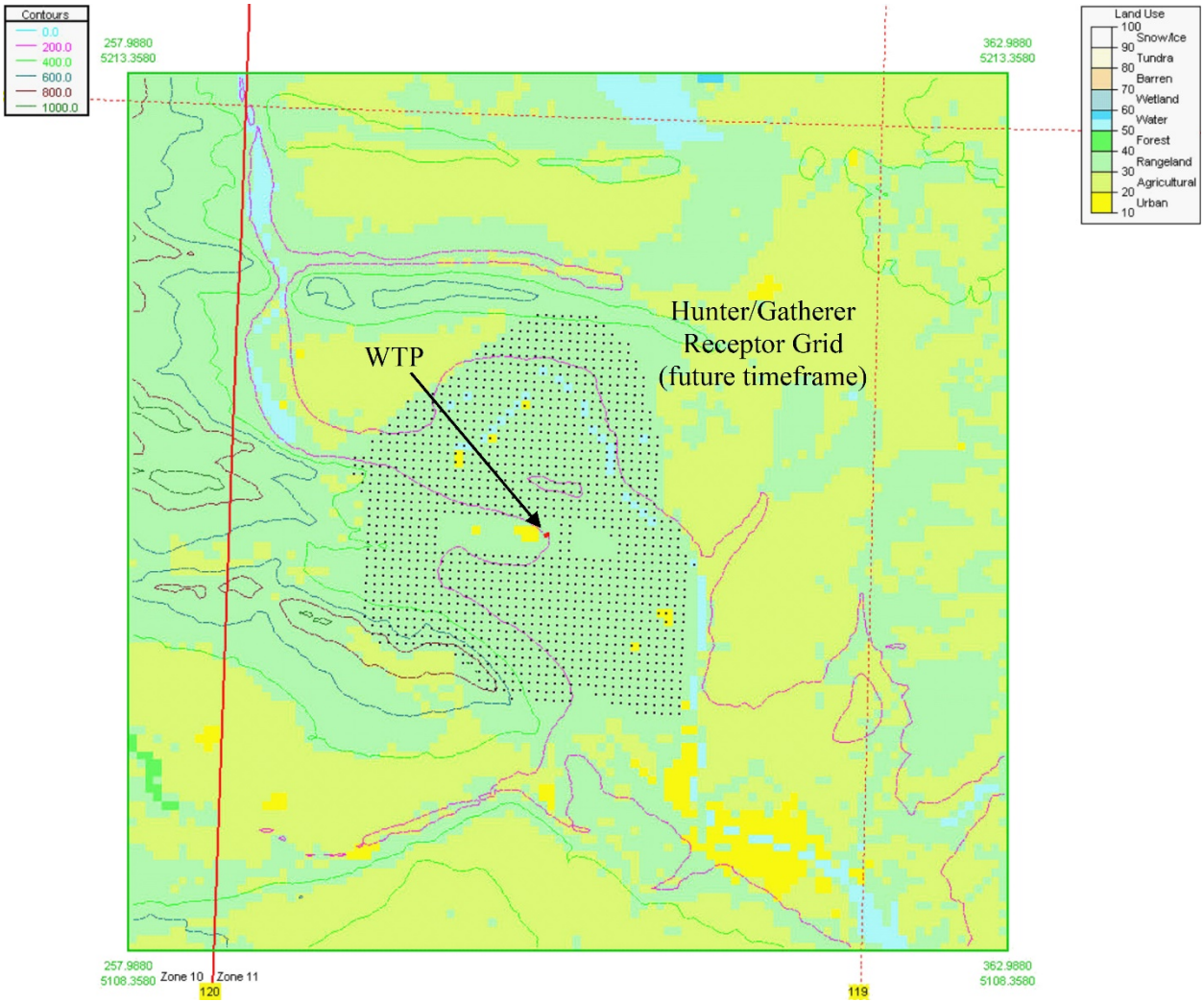


Figure 5-13 Receptor Locations, Site Boundary, Land Use, and Surface Contours

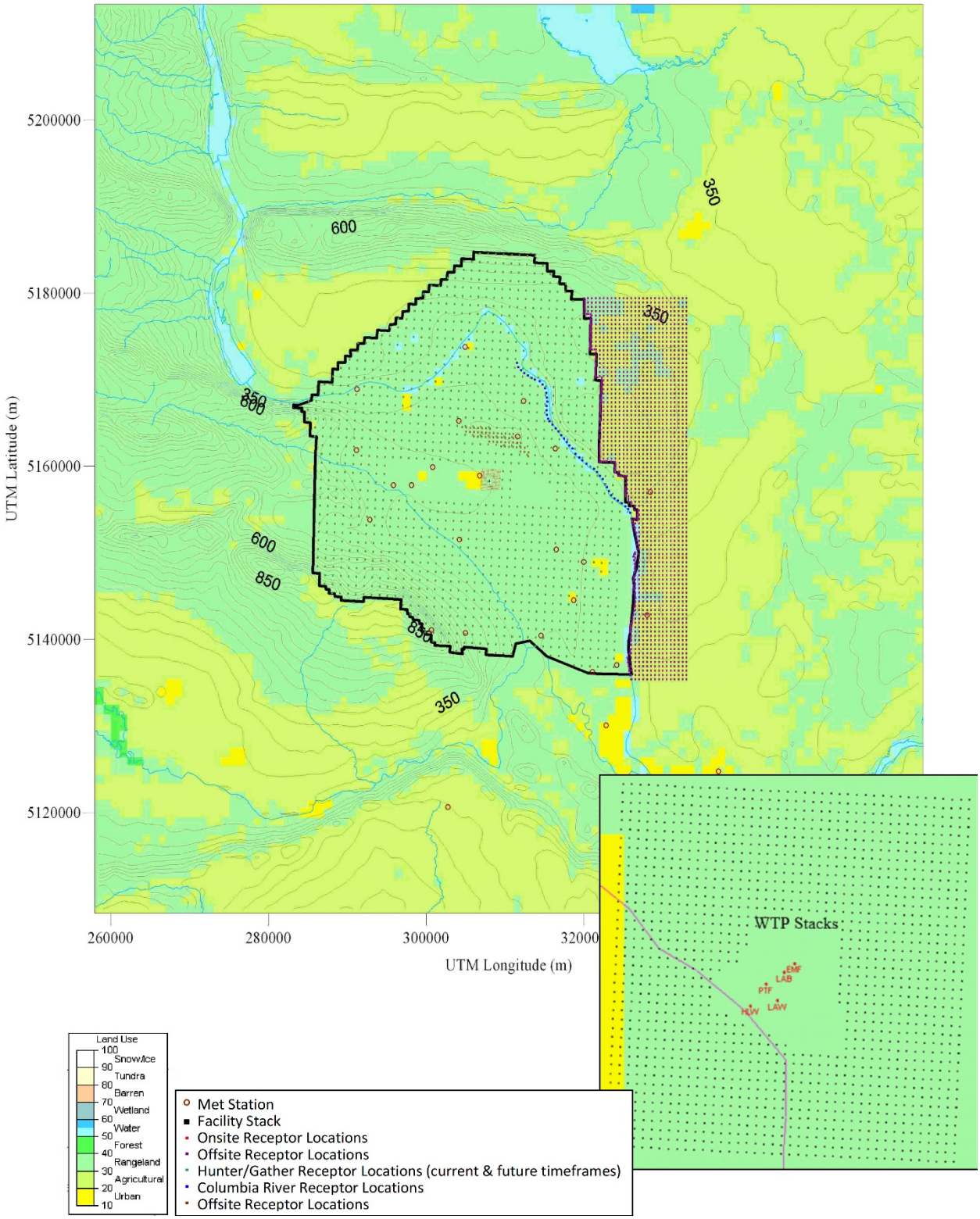
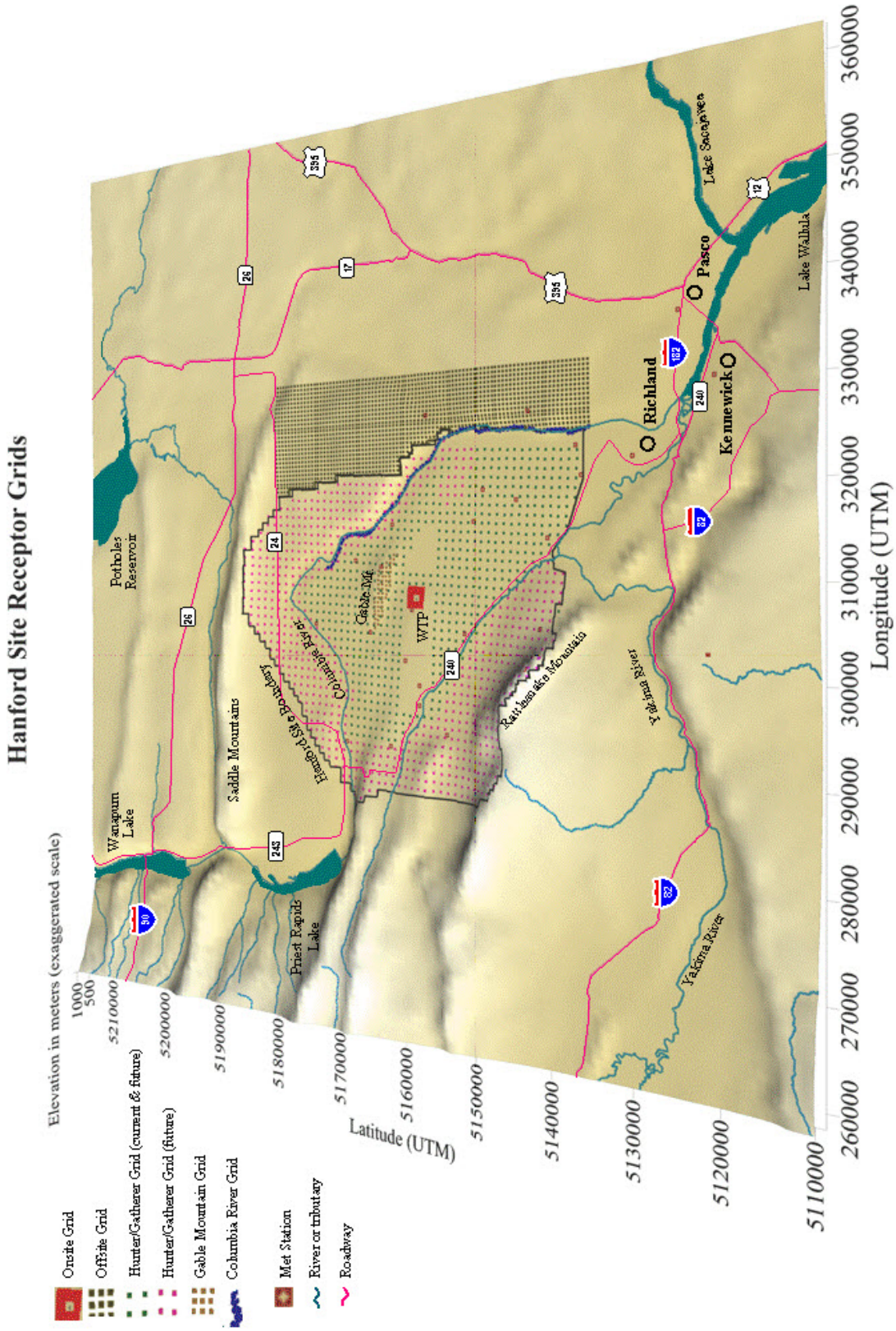


Figure 5-14 Major Landforms of the CALPUFF Model Study Area



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24590-HLW-MVD-HFP-00011, Rev 6, *Mechanical Systems Data Sheet: Plant Item No. 24590-HLW-MV-HFP-VSL-00002, 24590-HLW-MV-HFP-VSL-00006 - HLW Melter 1 Feed Vessel HFP-VSL-00002 & HLW Melter 2 Feed Vessel HFP-VSL-00006.*

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None.

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Appendix A

WTP CALMET/CALPUFF Model Settings

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Appendix A
WTP CALMET/CALPUFF Model Settings

Table A-1 CALMET Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
INPUT GROUP: 0 -- Input and Output File Names Subgroup (a)			
GEODAT	Name of Geophysical data file	GEO.DAT	MAKEGEO.DAT
SRFDAT	Name of Surface data file	SURF.DAT	SURF.DAT
CLDDAT	Name of Cloud data file	CLOUD.DAT	not used
PRCDAT	Name of Precipitation data file	PRECIP.DAT	PREC.DAT
WTDAT	Name of CALMET output file	WT.DAT	not used
METLST	Name of CALMET output file	CALMET.LST	calmet.lst
METDAT	Name of CALMET output data file	CALMET.DAT	calmet.dat
PACDAT	Name of PAC output file	PACOUT.DAT	not used
LCFILES	All file names will be converted to lower case if LCFILES = T Otherwise, if LCFILES = F, file names will be converted to UPPER CASE	T = lower case F = UPPER CASE	T
NUSTA	Number of upper air data sites	No default	0
NOWSTA	Number of overwater met stations	No default	0
NM3D	Number of MM4/MM5/3D.DAT files	No default	1
NIGF	Number of IGF-CALMET.DAT files	No default	0
INPUT GROUP: 0 -- Input and Output File Names Subgroup (b)			
UPDAT	Upper air files (one per station)	UPn.DAT	UPn.DAT
INPUT GROUP: 0 -- Input and Output File Names Subgroup (c)			
SEADAT	Overwater station files	SEA1.DAT	4007.DAT
INPUT GROUP: 0 -- Input and Output File Names Subgroup (d)			
M3DDAT	MM4/MM5/3D.DAT files	MM51.DAT	path/filename (see below)

Table A-1 CALMET Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
Default Name	Type	File Name (example using year 2006)	
---	---	---	
MM51.DAT	input	1 ! M3DDAT = E:\MM5 data\2006\0106.dat	
MM52.DAT	input	2 ! M3DDAT = E:\MM5 data\2006\0206.dat	
MM53.DAT	input	3 ! M3DDAT = E:\MM5 data\2006\0306.dat	
MM54.DAT	input	4 ! M3DDAT = E:\MM5 data\2006\0406.dat	
MM55.DAT	input	5 ! M3DDAT = E:\MM5 data\2006\0506.dat	
MM56.DAT	input	6 ! M3DDAT = E:\MM5 data\2006\0606.dat	
MM57.DAT	input	7 ! M3DDAT = E:\MM5 data\2006\0706.dat	
MM58.DAT	input	8 ! M3DDAT = E:\MM5 data\2006\0806.dat	
MM59.DAT	input	9 ! M3DDAT = E:\MM5 data\2006\0906.dat	
MM510.DAT	input	10 ! M3DDAT = E:\MM5 data\2006\1006.dat	
MM511.DAT	input	11 ! M3DDAT = E:\MM5 data\2006\1106.dat	
MM512.DAT	input	12 ! M3DDAT = E:\MM5 data\2006\1206.dat	
INPUT GROUP: 0 -- Input and Output File Names Subgroup (e)			
IGFDAT	IGF-CALMET.DAT files	IGFn.DAT	CALMET0.DAT
INPUT GROUP: 0 -- Input and Output File Names Subgroup (f)			
DIADAT	Other file names	DIAG.DAT	none specified
PRGDAT		PROG.DAT	
TSTPRT		TEST.PRT	
TSTOUT		TEST.OUT	
TSTKIN		TEST.KIN	
TSTFRD		TEST.FRD	
TSTSLP		TEST.SLP	
DCSTGD		DCST.GRD	
INPUT GROUP: 1 -- General run control parameters			
IBYR	Beginning year	No default	year
IBMO	Beginning month	No default	1
IBDY	Beginning day	No default	1
IBHR	Beginning hour	No default	1
IBTZ	Base time zone	No default	8
IRLG	Length of run (hours)	No default	hours in the year

Table A-1 CALMET Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
IRTYPE	Output file type to create (must be 1 for CALPUFF)	1	1
LCALGRD	Are w-components and temperature needed?	T	T
ITEST	Stop run after setup phase	2	2
MREG	Test options specified to see if they conform to regulatory values	No default	0
INPUT GROUP: 2 -- Map Projection and Grid control parameters			
PMAP	Map Projection	UTM	UTM
FEAST	False Easting and Northing (km) at the projection origin	0.0	0.000
FNORTH		0.0	0.000
IUTMZN	UTM zone (1 to 60) (Used only if PMAP=UTM)	No default	11
UTMHEM	Hemisphere for UTM projection (Used only if PMAP=UTM)	N	N
RLAT0	Latitude and Longitude (decimal degrees) of projection origin (Used only if PMAP= TTM, LCC, PS, EM, or LAZA)	No default	46.085913N
RLON0		No default	120.130371W
XLAT0	Southwest grid cell latitude	No default	30.0N
YLON0	Southwest grid cell longitude	No default	60.0N
DATUM	Datum-region for output coordinates	WGS-84	WGS-84
NX	Number of east-west grid cells	No default	100
NY	Number of north-south grid cells	No default	100
DGRIDKM	Grid spacing	No default	1.
XORIGKM	Southwest grid cell X coordinate	No default	257.988
YORIGKM	Southwest grid cell Y coordinate	No default	5108.358
NZ	Number of vertical layers	No default	9
ZFACE	Vertical cell face heights (NZ+1 values)	No default	0., 20., 40., 80., 160., 320., 670., 1400., 2600., 4000
INPUT GROUP: 3 -- Output Options			
LSAVE	Save met. data fields in an unformatted file?	T	T
IFORMO	Format of unformatted file (1 for CALPUFF)	1	1

Table A-1 CALMET Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
LPRINT	Print met. fields	F	F
IPRINF	Print interval (IPRINF) in hours	1	1
IUVOUT	Specify which layers of U, V wind component to print (IUVOUT(NZ))	NZ*0	0, 0, 0, 0, 0, 0, 0, 0, 0, 0
IWOUT	Specify which levels of the W wind component to print	NZ*0	0, 0, 0, 0, 0, 0, 0, 0, 0, 0
ITOUT	Specify which levels of the 3-D temperature field to print	NZ*0	0, 0, 0, 0, 0, 0, 0, 0, 0, 0
STABILITY USTAR MONIN MIXHT WSTAR PRECIP SENSHEAT CONVZI	Specify which meteorological fields to print	0	0
LDB	Print input meteorological data and internal variables	F	F
NN1	First time step for which debug data are printed	1	1
NN2	Last time step for which debug data are printed	1	1
LDBCST	Print distance to land internal variables	F	F
IOUTD	Control variable for writing the test/debug wind fields to disk files11	0	0
NZPRN2	Number of levels, starting at the surface, to print	1	0 (this print option is not used)
IPR0	Print the INTERPOLATED wind components	0	0
IPR1	Print the TERRAIN ADJUSTED surface wind components	0	0
IPR2	Print the SMOOTHED wind components and the INITIAL DIVERGENCE fields	0	0
IPR3	Print the FINAL wind speed and direction fields	0	0
IPR4	Print the FINAL DIVERGENCE fields	0	0

Table A-1 CALMET Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
IPR5	Print the winds after KINEMATIC effects are added	0	0
IPR6	Print the winds after the FROUDE NUMBER adjustment is made	0	0
IPR7	Print the winds after SLOPE FLOWS are added	0	0
IPR8	Print the FINAL wind field components	0	0
INPUT GROUP: 4 -- Meteorological data options			
NOOBS	No observation mode	0	1
NSSTA	Number of stations in SURF.DAT file	No default	26
NPSTA	Number of stations in PRECIP.DAT	No default	7
ICLOUD	Is cloud data to be input as gridded fields? (0 = No)	0	0
IFORMS	Format of surface data (2 = formatted)	2	2
IFORMP	Format of precipitation data (2 = formatted)	2	2
IFORMC	Format of cloud data (2 = formatted)	2	2
INPUT GROUP: 5 -- Wind Field Options and Parameters			
IWFCOD	Generate winds by diagnostic wind module? (1 = Yes)	1	1
IFRADJ	Adjust winds using Froude number effects? (1 = Yes)	1	1
IKINE	Adjust winds using kinematic effects? (1 = Yes)	0	0
IOBR	Use O'Brien procedure for vertical winds? (0 = No)	0	0
ISLOPE	Compute slope flows? (1 = Yes)	1	1
IEXTRP	Extrapolate surface winds to upper layers? (-4 = use similarity theory and ignore layer 1 of upper air station data)	-4	4
ICALM	Extrapolate surface calms to upper layers? (0 = No)	0	0
BIAS	Surface/upper-air weighting factors (NZ values)	NZ*0	0, 0, 0, 0, 0, 0, 0, 0, 0

Table A-1 CALMET Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
RMIN2	Distance (km) around an upper air site where vertical extrapolation is excluded (Set to -1 if IEXTRP = ±4)	4	-1.0
IPROG	Using prognostic or MM-FDDA data? (0 = No)	0	14
ISTEPPG	Timestep (hrs) of prognostic model data	1	1
IGFMET	Use coarse CALMET fields as initial guess fields	0	0
LVARY	Use varying radius to develop surface winds?	F	T
RMAX1	Max surface over-land extrapolation radius (km)	No default	12
RMAX2	Max aloft over-land extrapolation radius (km)	No default	12
RMAX3	Maximum over-water extrapolation radius (km)	No default	12
RMIN	Minimum extrapolation radius (km)	0.1	0.1
TERRAD	Radius of influence of terrain features (km)	No default	4
R1	Relative weight at surface of Step 1 field and obs	No default	10
R2	Relative weight aloft of Step 1 field and obs	No default	12
RPROG	Relative weighting parameter of the prognostic wind field data	No default	0
DIVLIM	Maximum acceptable divergence	5.00E-06	5.00E-06
NITER	Max number of passes in divergence minimization	50	50
NSMTH	Number of passes in smoothing (NZ values)	2,(mxnz-1)*4	1, 2, 2, 3, 3, 4, 4, 4, 4
NINTR2	Max number of stations for interpolations (NA values)	99	99, 99, 99, 99, 99, 99, 99, 99, 99
CRITFN	Critical Froude number	1	1
ALPHA	Empirical factor triggering kinematic effects	0.1	0.1

Table A-1 CALMET Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
FEXTR2	Multiplicative scaling factor for extrapolation of surface observations to upper layers (Used only if IEXTRP = 3 or -3	NZ*0.0	0., 0., 0., 0., 0., 0., 0., 0., 0.
NBAR	Number of barriers to interpolation of the wind fields	0	0
KBAR	Level (1 to NZ) up to which barriers apply	NZ	9
XBBAR	X coordinate of BEGINNING of each barrier	No defaults	not used (NBAR = 0)
YBBAR	Y coordinate of BEGINNING of each barrier	No defaults	not used (NBAR = 0)
XEBAR	X coordinate of ENDING of each barrier	No defaults	not used (NBAR = 0)
YEBAR	Y coordinate of ENDING of each barrie	No defaults	not used (NBAR = 0)
IDIOPT1	Compute temperatures from observations	0	0
ISURFT	Surface station to use for surface temperature (between 1 and NSSTA)	No defaults	6
IDIOPT2	Compute domain-average lapse rates? (0 = True)	0	0
IUPT	Station for lapse rates (between 1 and NUSTA)	No defaults	1
ZUPT	Depth of domain-average lapse rate (m)	200	200
IDIOPT3	Compute internally initial guess winds? (0 = True)	0	0
IUPWND	Upper air station for domain winds (-1 = 1/r**2 interpolation of all stations)	-1	-1
ZUPWND	Bottom and top of layer for 1st guess winds (m)	1., 1000.	1, 1000
IDIOPT4	Read surface winds from SURF.DAT? (0 = True)	0	0
IDIOPT5	Read aloft winds from UPn.DAT? (0 = True)	0	0
LLBREZE	Use Lake Breeze Module	F	F
NBOX	Number of lake breeze regions	none	0

Table A-1 CALMET Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
XG1	X Grid line 1 defining the region of interest	none	0.
XG2	X Grid line 2 defining the region of interest	none	0.
YG1	Y Grid line 1 defining the region of interest	none	0.
YG2	Y Grid line 2 defining the region of interest	none	0.
XBCST	X Point defining the coastline (Straight line)	none	0.
YBCST	Y Point defining the coastline (Straight line)	none	0.
XECST	X Point defining the coastline (Straight line)	none	0.
YECST	Y Point defining the coastline (Straight line)	none	0.
NLB	Number of stations in the region	none	0
METBXID	Station ID's in the region	METBXID(NLB)	0
INPUT GROUP: 6 -- Mixing Height, Temperature and Precipitation Parameters			
CONSTB	Neutral, mechanical equation	1.41	1.41
CONSTE	Convective mixing ht. equation	0.15	0.15
CONSTN	Stable mixing ht. equation	2400.	2400.
CONSTW	Overwater mixing ht. equation	0.16	0.16
FCORIOL	Absolute value of Coriolis parameter	1.0E-04	1.0E-04
IAVEXZI	Spatial averaging of mixing heights? (1 = True)	1	1
MNMDAV	Max averaging radius (number of grid cells)	1	1
HAFANG	Half-angle for looking upwind (degrees)	30.	30.
ILEVZI	Layer to use in upwind averaging (between and NZ)	1	1
IMIXH	Method to compute the convective mixing height	1	1

Table A-1 CALMET Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
THRESHL	Threshold buoyancy flux required to sustain convective mixing height growth overland	0.05	0.05
THRESHW	Threshold buoyancy flux required to sustain convective mixing height growth overwater	0.05	0.05
ITWPROG	Option for overwater lapse rates used in convective mixing height growth	0	0
ILUOC3D	Land Use category ocean in 3D.DAT datasets	16	16
DPTMIN	Minimum capping potential temperature lapse rate	0.001	0.001
DZZI	Depth for computing capping lapse rate (m)	200.	200.
ZIMIN	Minimum over-land mixing height (m)	50.	50.
ZIMAX	Maximum over-land mixing height (m)	3000.	3800
ZIMINW	Minimum over-water mixing height (m)	50.	50
ZIMAXW	Maximum over-water mixing height (m)	3000.	3800
ICOARE	OVERWATER SURFACE FLUXES METHOD and PARAMETERS	10	10
DSHELF	Coastal/Shallow water length scale	0	0
IWARM	COARE warm layer computation	0	0
ICOOL	COARE cool skin layer computation	0	0
ITPROG	3D temperature from observations or from prognostic data	0	1
IRAD	Form of temperature interpolation (1 = 1/r)	1	1
TRADKM	Radius of temperature interpolation (km)	500.	10
NUMTS	Max number of stations in temperature interpolations	5	5
IAVET	Conduct spatial averaging of temperature? (1 = True)	1	1

Table A-1 CALMET Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
TGDEFB	Default over-water mixed layer lapse rate (K/m)	-0.0098	-0.0098
TGDEFA	Default over-water capping lapse rate (K/m)	-0.0045	-0.0045
JWAT1	Beginning landuse type defining water	none	55
JWAT2	Ending landuse type defining water	none	55
NFLAGP	Method for precipitation interpolation (2 = 1/r**2)	2	2
SIGMAP	Precip radius for interpolations (km)	100.0	100.
CUTP	Minimum cut off precip rate (mm/hr)	0.01	0.01
INPUT GROUP: 7 -- Surface meteorological station parameters			
SSn	NSSTA input records for surface stations	No default	26 Stations

	Name	ID	X coord. (km)	Y cood. (km)	Time zone	Anem. Ht. (m)
SS1	='PRO1'	000001	314.548	5140.409	8	10
SS2	='EOC2'	000002	304.948	5140.759	8	10
SS3	='Arm3'	000003	304.205	5151.58	8	10
SS4	='RSP4'	000004	292.846	5153.809	8	10
SS5	='EDN5'	000005	316.335	5162.078	8	10
SS6	='2006'	000006	306.725	5158.93	8	10
SS7	='2007'	000007	295.855	5157.795	8	10
SS8	='FFT8'	000009	318.692	5144.479	8	10
SS9	='YAK9'	000010	291.116	5161.888	8	10
SS10	='3010'	000011	324.144	5137.059	8	10
SS11	='WY11'	000012	316.462	5150.394	8	10
SS12	='1012'	000013	304.952	5173.749	8	10
SS13	='WP13'	000014	319.982	5148.957	8	10
SS14	='FR14'	000015	328.022	5142.851	8	10
SS15	='GA15'	000016	311.575	5163.482	8	10
SS16	='RI16'	000017	328.448	5157.029	8	10
SS17	='RI17'	000018	322.796	5130.034	8	10
SS18	='PF18'	000019	298.169	5158.014	8	3.05
SS19	='HM19'	000021	300.794	5159.861	8	10
SS20	='PA20'	000022	337.050	5124.791	8	10
SS21	='GA21'	000023	304.132	5165.206	8	10
SS22	='1022'	000024	312.298	5167.479	8	10
SS23	='VE23'	000025	291.260	5168.897	8	10
SS24	='VS24'	000027	330.228	5120.661	8	10

Table A-1 CALMET Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
SS25 ='1025' 000029 302.799 5170.313 8 3.05 SS26 ='HA26' 000030 321.068 5136.275 8 10			
INPUT GROUP: 8 -- Upper air meteorological station parameters			
USn	NUSTA input records for upper-air stations	No default	NA
INPUT GROUP: 9 -- Precipitation station parameters			
PSn	NPSTA input records for precipitation stations	No default	7 Stations

Name	Station Code	X coord. (km)	Y coord. (km)
PS1 ='0001'	450001	314.551	5140.409
PS2 ='0002'	450010	291.117	5161.888
PS3 ='0003'	450011	324.142	5137.059
PS4 ='0004'	450012	316.461	5150.394
PS5 ='0005'	450017	328.449	5157.029
PS6 ='0006'	450021	300.792	5159.861
PS7 ='0007'	450024	312.298	5167.479

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
INPUT GROUP: 0 -- Input and Output File Names			
METDAT	CALMET input data filename	CALMET.DAT	..\calmet.dat
ISCDAT	ISC input data filename	ISCMET.DAT	not used
PLMDAT	PLM input data filename	PLMMET.DAT	not used
PRFDAT	PRF input data filename	PROFILE.DAT	not used
SFCDAT	SFC input data filename	SURFACE.DAT	not used
RSTARTB	RSTARTB input data filename	RESTARTB.DAT	not used
PUFLST	Filename for general output from CALPUFF	CALPUFF.LST	CALPUFF.LST
CONDAT	Filename for output concentration data	CONC.DAT	CONC.DAT
DFDAT	Filename for output dry deposition fluxes	DFLX.DAT	DFLX.DAT
WFDAT	Filename for output wet deposition fluxes	WFLX.DAT	WFLX.DAT
VISDAT	Filename for output relative humidities (for visibility)	VISB.DAT	VISB.DAT
PTDAT	Emission Files	PTEMARB.DAT	not used
VOLDAT		VOLEMARB.DAT	not used
ARDAT		BAEMARB.DAT	not used
LNDAT		LNEMARB.DAT	not used
OZDAT	Other files	OZ.DAT	OZONE.DAT
VDDAT		VD.DAT	not used
CHEMDAT		CHEM.DAT	not used
H2O2DAT		H2O2.DAT	not used
HILDAT		HILL.DAT	not used
RCTDAT		HILLRCT.DAT	not used
CSTDAT		COASTLN.DAT	not used
BDYDAT		FLUXBDY.DAT	not used
BCNDAT		BCON.DAT	not used
DEBUG		DEBUG.DAT	DEBUG.DAT
FLXDAT		MASSFLX.DAT	not used
BALDAT		MASSBAL.DAT	not used

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
FOGDAT		FOG.DAT	not used
LCFILES	All file names will be converted to lower case if LCFILES = T	No default	T
NMETDAT	Number of CALMET.DAT files for run	1	1
NPTDAT	Number of PTEMARB.DAT files for run	0	0
NARDAT	Number of BAEMARB.DAT files for run	0	0
NVOLDAT	Number of VOLEMARB.DAT files for run	0	0
INPUT GROUP: 0 -- Input and Output File Names Subgroup (0a)			
METDATn	CALMET.DAT filenames processed in sequence if NMETDAT>1	No default	user defined path/calmet.filename(s)
INPUT GROUP: 1 -- General run control parameters			
METRUN	Do we run all periods (1) or a subset (0)?	0	0
IBYR	Beginning year	No default	year
IBMO	Beginning month	No default	1
IBDY	Beginning day	No default	1
IBHR	Beginning hour	No default	1
XBTZ	Base time zone (PST)	No default	8
IRLG	Length of run (hours)	No default	hours in the year
NSPEC	Number of species modeled (for MESOPUFF chemistry)	5	15
NSE	Number of species emitted	3	15
ITEST	Flag to stop run after SETUP phase	2	2
MRESTART	Restart options (0 = no restart), allows splitting runs into smaller segments	0	0
MRESTART	Restart Configuration: Control flag	0	0
NRESPD	Restart Configuration: Number of periods in Restart output cycle	0	0
METFM	Restart Configuration: Meteorological Data Format	1	1
MPRFFM	Restart Configuration: Meteorological Profile Data Format	1	1

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
AVET	Averaging time lateral dispersion parameters (minutes)	60.0	60.0
PGTIME	PG Averaging Time (minutes)	60.0	60.0
INPUT GROUP: 2 -- Technical options			
MGAUSS	Near-field vertical distribution (1 = Gaussian)	1	1
MCTADJ	Terrain adjustments to plume path (3 = Plume path)	3	3
MCTSG	Do we have subgrid hills? (0 = No), allows CTDM-like treatment for subgrid scale hills	0	0
MSLUG	Near-field puff treatment (0 = No slugs)	0	0
MTRANS	Model transitional plume rise? (1 = Yes)	1	1
MTIP	Treat stack tip downwash? (1 = Yes)	1	1
MBDW	Method used to simulate building downwash	1	1
MSHEAR	Treat vertical wind shear? (0 = No)	0	0
MSPLIT	Allow puffs to split? (0 = No)	0	0
MCHEM	MESOPUFF-II Chemistry? (1 = Yes)	1	0
MAQCHEM	Aqueous phase transformation flag	0	0
MWET	Model wet deposition? (1 = Yes)	1	1
MDRY	Dry deposition modeled	1	1
MTILT	Gravitational settling (plume tilt) modeled ?	0	0
MDISP	Method used to calculate dispersion coefficients	3	3
MTURBVW	Sigma-v/theta/w measurements used?	3	3
MDISP2	Backup coefficients (Only if MDISP = 1 or 5)	3	3
MTAULY	Method used for Lagrangian timescale for Sigma-y	0	0
MTAUADV	Method used for Advective-Decay timescale for Turbulence	0	0

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
MCTURB	Method used to compute turbulence sigma-v & sigma-w using micrometeorological variables	1	1
MROUGH	Adjust PG for surface roughness? (0 = No)	0	0
MPARTL	Model partial plume penetration? (0 = No)	1	1
MTINV	Elevated inversion strength (0 = compute from data)	0	0
MPDF	Use PDF for convective dispersion? (0 = No)	0	0
MSGTIBL	Use TIBL module? (0 = No) allows treatment of subgrid scale coastal areas	0	0
MBCON	Boundary conditions (concentration) modeled	0	0
MSOURCE	Individual Source Contributions Saved	0	0
MFOG	Configure for FOG Model output	0	0
MREG	Regulatory default checks? (1 = Yes)	1	0
INPUT GROUP: 3a, 3b -- Species list **Subgroup (3a)**			
CSPEC	Names of species modeled	No default	PTV, PTP1, PTP25, LAWV, LAWP1, LAWP25, HLWV, HLWP1, HLWP25

SPECIES NAME (Limit: 12 Characters in length)		MODELED (0=NO, 1=YES)	EMITTED (0=NO, 1=YES)	DEPOSITED (0=NO, 1=COMPUTED-GAS 2=COMPUTED-PARTICLE 3=USER-SPECIFIED)	NUMBER (0=NONE, 1=1st CGRUP, 2=2nd CGRUP, 3= etc.)
PTFV	=	1,	1,	1,	0
LAWV	=	1,	1,	1,	0
HLWV	=	1,	1,	1,	0
EMFV	=	1,	1,	1,	0
LABV	=	1,	1,	1,	0
PTFP1	=	1,	1,	2,	0
LAWP1	=	1,	1,	2,	0
HLWP1	=	1,	1,	2,	0
EMFP1	=	1,	1,	2,	0
LABP1	=	1,	1,	2,	0

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
PTFP25 =	1, 1,	2,	0
LAWP25 =	1, 1,	2,	0
HLWP25 =	1, 1,	2,	0
EMFP25 =	1, 1,	2,	0
LABP25 =	1, 1,	2,	0
INPUT GROUP: 4 -- Map Projection and Grid control parameters			
PMAP	Map projection	UTM	UTM
FEAST	False Easting and Northing (km) at the projection origin	0.0	0
FNORTH	UTM zone (1 to 60)	0.0	0
IUTMZN	Hemisphere for UTM projection	No default	11
UTMHEM	Latitude and Longitude (decimal degrees) of projection origin	N	N
RLAT0	Latitude and Longitude (decimal degrees) of projection origin	No default	46.085913N
RLON0		No default	120.130371W
XLAT1	Matching parallel(s) of latitude (decimal degrees) for projection	No default	30N
XLAT2		No default	60N
DATUM	Datum-region for output coordinates	WGS-84	WGS-84
NX	Number of east-west grids of input meteorology	No default	100
NY	Number of north-south grids of input meteorology	No default	100
NZ	Number of vertical layers of input meteorology	No default	9
DGRIDKM	Meteorology grid spacing (km)	No default	1
ZFACE	Vertical cell face heights of input meteorology	No default	0, 20, 40, 80, 160, 320, 670, 1400, 2600, 4000
XORIGKM	Southwest corner (east-west) of input meteorology	No default	257.988
YORIGIM	Southwest corner (north-south) of input meteorology	No default	5108.358
IBCOMP	Southwest X-index of computational domain	No default	1
JBCOMP	Southwest Y-index of computational domain	No default	1

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
IECOMP	Northeast X-index of computational domain	No default	100
JECOMP	Northeast Y-index of computational domain	No default	100
LSAMP	Use gridded receptors? (T = Yes)	F	F
IBSAMP	Southwest X-index of receptor grid	No default	1
JBSAMP	Southwest Y-index of receptor grid	No default	1
IESAMP	Northeast X-index of receptor grid	No default	100
JESAMP	Northeast Y-index of receptor grid	No default	100
INPUT GROUP: 5 -- Output Options			
MESHDN	Gridded receptor spacing = DGRIDKM/MESHDN	1	1
ICON	Concentrations	1	1
IDRY	Dry deposition	1	1
IWET	Wet deposition	1	1
IT2D	2D Temperature	0	0
IRHO	2D Density	0	0
IVIS	Output RH for visibility calculations (1 = Yes)	1	1
LCOMPRS	Use compression option in output	T	T
IQAPLOT	Create a standard series of output files	1	1
IMFLX	Mass flux across specified boundaries for selected species reported hourly	0	0
IMBAL	Mass balance for each species reported hourly	0	0
ICPRT	Print concentrations? (0 = No)	0	0
IDPRT	Print dry deposition fluxes (0 = No)	0	0
IWPRT	Print wet deposition fluxes (0 = No)	0	0
ICFRQ	Concentration print interval (1 = hourly)	1	1
IDFRQ	Dry deposition flux print interval (1 = hourly)	1	1
IWFRQ	Wet deposition flux print interval (1 = hourly)	1	1

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
IPRTU	Print output units (1 = g/m**3; g/m**2/s)	1	1
IMESG	Status messages to screen? (1 = Yes)	2	2
Output	Species (or group for combined species) list for output options	No default	PRINT, SAVE

SPECIES /GROUP	- CONCENTRATIONS - PRINTED?	SAVED?	- DRY FLUXES - PRINTED?	SAVED?	- WET FLUXES - PRINTED?	SAVED?	- MASS FLUX - SAVED?
PTFV =	0,	1,	0,	1,	0,	1,	0
LAWV =	0,	1,	0,	1,	0,	1,	0
HLWV =	0,	1,	0,	1,	0,	1,	0
EMFV =	0,	1,	0,	1,	0,	1,	0
LABV =	0,	1,	0,	1,	0,	1,	0
PTFP1 =	0,	1,	0,	1,	0,	1,	0
LAWP1 =	0,	1,	0,	1,	0,	1,	0
HLWP1 =	0,	1,	0,	1,	0,	1,	0
EMFP1 =	0,	1,	0,	1,	0,	1,	0
LABP1 =	0,	1,	0,	1,	0,	1,	0
PTFP25 =	0,	1,	0,	1,	0,	1,	0
LAWP25 =	0,	1,	0,	1,	0,	1,	0
HLWP25 =	0,	1,	0,	1,	0,	1,	0
EMFP25 =	0,	1,	0,	1,	0,	1,	0
LABP25 =	0,	1,	0,	1,	0,	1,	0

LDEBUG	Turn on debug tracking? (F = No)	F	F
IPFDEB	First puff to track	1	1
NPFDEB	Number of Puffs to Track	1	1000
NN1	Met. period to start output	1	1
NN2	Met. period to end output	10	hours in the year
INPUT GROUP: 6a, 6b, & 6c -- Subgrid scale complex terrain inputs **Subgroup (6a)**			
NHILL	Number of terrain features	0	0
NCTREC	Number of special complex terrain receptors	0	0
MHILL	Terrain and CTSG Receptor data for CTSG hills input in CTDM format	No default	2
XHILL2M	Factor to convert horizontal dimensions to meters	1.0	1.

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
ZHILL2M	Factor to convert vertical dimensions to meters	1.0	1.
XCTDMKM	X-origin of CTDM system relative to CALPUFF coordinate system, in Kilometers	No default	0.0E00
YCTDMKM	Y-origin of CTDM system relative to CALPUFF coordinate system, in Kilometers	No default	0.0E00
INPUT GROUP: 6a, 6b, & 6c -- Subgrid scale complex terrain inputs Subgroup (6b)			
HILL XC YC THETAH ZGRID RELIEF EXPO 1 EXPO 2 SCALE 1 SCALE 2 AMAX1 AMAX2	XC, YC = Coordinates of center of hill THETAH = Orientation of major axis of hill (clockwise from North) ZGRID = Height of the 0 of the grid above mean sea level RELIEF = Height of the crest of the hill above the grid elevation EXPO 1 = Hill-shape exponent for the major axis EXPO 2 = Hill-shape exponent for the major axis SCALE 1 = Horizontal length scale	No default	not used
INPUT GROUP: 6a, 6b, & 6c -- Subgrid scale complex terrain inputs Subgroup (6c)			
BMAX XRCT YRCT ZRCT XHH	along the major axis SCALE 2 = Horizontal length scale along the minor axis AMAX = Maximum allowed axis length for the major axis BMAX = Maximum allowed axis length for the major axis XRCT, YRCT = Coordinates of the complex terrain receptors ZRCT = Height of the ground (MSL) at the complex terrain Receptor XHH = Hill number associated with each complex terrain receptor	No default	not used

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
INPUT GROUP: 7 -- Chemical parameters for dry deposition of gases			

SPECIES NAME	DIFFUSIVITY (cm**2/s)	ALPHA STAR	REACTIVITY	MESOPHYLL RESISTANCE (s/cm)	HENRY'S LAW COEF. (dimensionless)
PTFV =	0.1509,	1,	8,	0,	0.04
LAWV =	0.1509,	1,	8,	0,	0.04
HLWV =	0.1509,	1,	8,	0,	0.04
EMFV =	0.1509,	1,	8,	0,	0.04
LAWV =	0.1509,	1,	8,	0,	0.04

INPUT GROUP: 8 -- Size parameters for dry deposition of particles

SPECIES NAME	GEOMETRIC MASS MEAN DIAMETER (microns)	GEOMETRIC STANDARD DEVIATION (microns)
PTFP1 =	1,	0
LAWP1 =	1,	0
HLWP1 =	1,	0
EMFP1 =	1,	0
LABP1 =	1,	0
PTFP25 =	2.5,	0
LAWP25 =	2.5,	0
HLWP25 =	2.5,	0
EMFP25 =	2.5,	0
LABP25 =	2.5,	0

INPUT GROUP: 9 -- Miscellaneous dry deposition parameters			
RCUTR	Reference cuticle resistance (s/cm)	30	30.0
RGR	Reference ground resistance (s/cm)	10	10.0
REACTR	Reference reactivity	8	8.0
NINT	Number of particle-size intervals	9	9
IVEG	Vegetative state (1 = active and unstressed)	1	1

INPUT GROUP: 10 -- Wet Deposition Parameters

Pollutant	Liquid Precip.	Frozen Precip.
PTFV =	0.00017,	0.00006
LAWV =	0.00017,	0.00006
HLWV =	0.00017,	0.00006

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
EMFV =	0.00017,	0.00006	
LABV =	0.00017,	0.00006	
PTFP1 =	0.00005,	0.000017	
LAWP1 =	0.00005,	0.000017	
HLWP1 =	0.00005,	0.000017	
EMFP1 =	0.00005,	0.000017	
LABP1 =	0.00005,	0.000017	
PTFP25 =	0.00005,	0.000017	
LAWP25 =	0.00005,	0.000017	
HLWP25 =	0.00005,	0.000017	
EMFP25 =	0.00005,	0.000017	
PABp25 =	0.00005,	0.000017	
INPUT GROUP: 11 -- Chemistry Parameters			
MOZ	Ozone background? (1 = read from ozone.dat)	1	0
BCKO3	Ozone default (ppb) (Use only for missing data)	12*80	80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00
BCKNH3	Ammonia background (ppb)	12*10	10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00
RNITE1	Nighttime SO2 loss rate (%/hr)	0.2	0.2
RNITE2	Nighttime NOx loss rate (%/hr)	2	2
RNITE3	Nighttime HNO3 loss rate (%/hr)	2	2
MH2O2	H2O2 data input option	1	1
BCKH2O2	Monthly H2O2 concentrations	12*1.	1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00
varies (multiple variables)	Data for SECONDARY ORGANIC AEROSOL (SOA) Option (used only if MCHEM = 4)	varies	not used
INPUT GROUP: 12 -- Misc. Dispersion and Computational Parameters			
SYTDEP	Horizontal size (m) to switch to time dependence	550	5.5E02
MHFTSE	Use Heffter for vertical dispersion? (0 = No)	0	0
JSUP	PG Stability class above mixed layer	5	5
CONK1	Stable dispersion constant (Eq 2.7-3)	0.01	0.01

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
CONK2	Neutral dispersion constant (Eq 2.7-4)	0.1	0.1
TBD	Transition for downwash algorithms (0.5 = ISC)	0.5	0.5
IURB1	Beginning urban land use type	10	10
IURB2	Ending urban land use type	19	19
ILANDUIN	Land use type (20 = Unirrigated agricultural land)	20	20
ZOIN	Roughness length (m)	0.25	0.25
XLAIIN	Leaf area index	3.0	3.0
ELEVIN	Met. Station elevation (m above MSL)	0.0	0.0
XLATIN	Met. Station North latitude (degrees)	-999.	-999.
XLONIN	Met. Station West longitude (degrees)	-999.	-999.
ANEMHT	Anemometer height of ISC meteorological data (m)	10	10
ISIGMAV	Lateral turbulence (Not used with ISC meteorology)	1	1
IMIXCTDM	Mixing heights (Not used with ISC meteorology)	0	0
XMXLEN	Maximum slug length in units of DGRIDKM	1.0	1.
XSAMLEN	Maximum puff travel distance per sampling step (units of DGRIDKM)	1.0	1.
MXNEW	Maximum number of puffs per hour	99	99
MXSAM	Maximum sampling steps per hour	99	99
NCOUNT	Number of iterations used when computing the transport wind for a sampling step that includes gradual rise	2	2
SYMIN	Minimum sigma y for a new puff/slug	1.0	1.
SZMIN	Minimum sigma z for a new puff/slug	1.0	1.

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
SVMIN	Default minimum turbulence velocities sigma-v and sigma-w for each stability class over land and over water (m/s)	Land: .50, .50, .50, .50, .50, .50, Water: .37, .37, .37, .37, .37, .37	Land: 0.500, 0.500, 0.500, 0.500, 0.500, 0.500, Water (not used): 0.500, 0.500, 0.500, 0.500, 0.500, 0.500
SWMIN		Land: .20, .12, .08, .06, .03, .016, Water: .20, .12, .08, .06, .03, .016	Land: 0.200, 0.120, 0.080, 0.060, 0.030, 0.016, Water (not used): 0.200, 0.120, 0.080, 0.060, 0.030, 0.016
CDIV	Divergence criterion for dw/dz across puff used to initiate adjustment for horizontal convergence (1/s)	0.0,0.0	0., 0.
WSCALM	Minimum wind speed (m/s) allowed for non-calm conditions. Also used as minimum speed returned when using power-law extrapolation toward surface	0.5	0.5
XMAXZI	Maximum mixing height (m)	3000	3000
XMINZI	Minimum mixing height (m)	50	50.0
WSCAT	Default wind speed classes - 5 upper bounds (m/s) are entered	1.54, 3.09, 5.14, 8.23, 10.8 (10.8+)	1.54, 3.09, 5.14, 8.23, 10.80
PLX0	Default wind speed profile power-law exponents for stabilities 1-6	.07, .07, .10, .15, .35, .55	0.07, 0.07, 0.10, 0.15, 0.35, 0.55
PTG0	Default potential temperature gradient for stable classes E, F (degK/m)	0.020, 0.035	0.020, 0.035
PPC	Default plume path coefficients for each stability class	.50, .50, .50, .50, .35, .35	0.50, 0.50, 0.50, 0.50, 0.35, 0.35
SL2PF	Slug-to-puff transition criterion factor equal to sigma-y/length of slug	10.	10.0
NSPLIT	Number of puffs that result every time a puff is split	3	3
IRESPLIT	Time(s) of a day when split puffs are eligible to be split once again	Hour 17 = 1	0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0
ZISPLIT	Split is allowed only if last hour's mixing height (m) exceeds a minimum value	100.	100.0
ROLDMAX	Split is allowed only if ratio of last hour's mixing height to the maximum mixing height experienced by the puff is less than a maximum value	0.25	0.25

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
NSPLITH	Number of puffs that result every time a puff is split - nsplith=5 means that 1 puff splits into 5	5	5
SYSPLITH	Minimum sigma-y (Grid Cells Units) of puff before it may be split	1.0	1.0
SHSPLITH	Minimum puff elongation rate (SYSPLITH/hr) due to wind shear, before it may be split	2.	2
CNSPLITH	Minimum concentration (g/m^3) of each species in puff before it may be split	1.0E-07	1.0E-07
EPSSLUG	Fractional convergence criterion for numerical SLUG sampling integration	1.0E-04	1.0E-04
EPSAREA	Fractional convergence criterion for numerical AREA source integration	1.0E-06	1.0E-06
DSRISE	Trajectory step-length (m) used for numerical rise integration	1.0	1.0
HTMINBC	Minimum height (m) to which BC puffs are mixed as they are emitted	500.	500.0
RSAMPBC	Search radius (km) about a receptor for sampling nearest BC puff	10.	10.0
MDEPBC	Near-Surface depletion adjustment to concentration profile used when sampling BC puffs	1	1
INPUT GROUP: 13a, 13b, 13c, 13d -- Point source parameters Subgroup (13a)			
NPT1	Number of point sources	No default	5
IPTU	Units used for point source	1	1
NSPT1	Number of source-species combinations with variable emissions scaling factors	0	0
NPT2	Number of point sources with variable emission parameters provided in external file	No default	0

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values

INPUT GROUP: 13a, 13b, 13c, 13d -- Point source parameters
Subgroup (13b)

Source No.	X UTM Coordinate (km)	Y UTM Coordinate (km)	Stack Height (m)	Base Elevation (m)	Stack Diameter (m)	Exit Vel. (m/s)	Exit Temp. (deg. K)	Bldg. Dwash	Emission Rates
---	---	---	---	---	---	---	---	---	---
1 SRCNAM = PTF									
1	X = 307.9682,	5158.3613,	60.96,	206.6544,	2.84,	19,	309.2,	1.,	1, 0, 0, 0, 0
									1, 0, 0, 0, 0
									1, 0, 0, 0, 0
2 SRCNAM = LAW									
2	X = 308.0493,	5158.2515,	60.96,	207.5688,	2,	17,	330.15,	1.,	0, 1, 0, 0, 0
									0, 1, 0, 0, 0
									0, 1, 0, 0, 0
3 SRCNAM = HLW									
3	X = 308.8631,	5158.2171,	60.96,	207.8736,	2.04,	17,	316.15,	1.,	0, 0, 1, 0, 0
									0, 0, 1, 0, 0
									0, 0, 1, 0, 0
4 SRCNAM = EMF									
4	X = 308.1684,	5158.5001,	45.72,	204.5,	0.945,	16,	308.15,	1.,	0, 0, 0, 1, 0
									0, 0, 0, 1, 0
									0, 0, 0, 1, 0
5 SRCNAM = LAB									
5	X = 308.0961,	5158.4391,	35.97,	206.36,	1.52,	18,	308.15,	1.,	0, 0, 0, 0, 1
									0, 0, 0, 0, 1
									0, 0, 0, 0, 1

all sources:
SIGYZI = 0, 0
ZPLTFM = .0
FMFAC = 1

INPUT GROUP: 13a, 13b, 13c, 13d -- Point source parameters
Subgroup (13c)

Source No

Effective building height, width, length and X/Y offset (in meters) every 10 degrees. LENGTH, XBADJ, and YBADJ are only needed for MBDW=2 (PRIME downwash option)

---

1 SRCNAM =	PTF					
1 HEIGHT =	36.27,	36.27,	36.27,	36.27,	36.27,	36.27,
	36.27,	36.27,	36.27,	36.27,	36.27,	36.27,
	36.27,	36.27,	36.27,	36.27,	36.27,	36.27,

Table A-2 CALPUFF Settings

Variable	Description			IWAQM Value or Default Value		WTP Values
	36.27,	36.27,	36.27,	36.27,	36.27,	36.27,
	36.27,	36.27,	36.27,	36.27,	36.27,	36.27,
	36.27,	36.27,	36.27,	36.27,	36.27,	36.27
1 WIDTH =	183.67,	188.02,	186.66,	179.64,	167.15,	149.58,
	127.47,	101.49,	76.08,	99.63,	125.64,	147.83,
	165.53,	178.2,	185.46,	187.08,	183.01,	173.73,
	183.67,	188.02,	186.66,	179.64,	167.15,	149.58,
	127.47,	101.49,	76.08,	99.63,	125.64,	147.83,
	165.53,	178.2,	185.46,	187.08,	183.01,	173.73
END						
2 SRCNAM =	LAW					
2 HEIGHT =	20.73,	20.73,	20.73,	20.73,	20.73,	25.3,
	25.3,	25.3,	25.3,	25.3,	25.3,	36.27,
	36.27,	36.27,	36.27,	36.27,	36.27,	20.73,
	20.73,	20.73,	20.73,	20.73,	20.73,	20.73,
	20.73,	20.73,	20.73,	20.73,	20.73,	20.73,
	20.73,	20.73,	20.73,	20.73,	20.73,	20.73
2 WIDTH =	101.03,	105.11,	105.99,	103.66,	98.17,	115.91,
	106.23,	94.78,	84.57,	94.5,	105.54,	147.83,
	165.53,	178.2,	185.46,	187.08,	183.01,	93.88,
	101.03,	105.11,	105.99,	103.66,	98.17,	89.7,
	78.51,	64.93,	49.38,	64.93,	78.51,	89.7,
	98.17,	103.66,	105.99,	105.11,	101.03,	93.88
END						
3 SRCNAM =	HLW					
3 HEIGHT =	25.3,	25.3,	25.3,	25.3,	36.27,	25.3,
	25.3,	25.3,	25.3,	25.3,	25.3,	25.3,
	25.3,	25.3,	25.3,	36.27,	36.27,	36.27,
	36.27,	36.27,	36.27,	36.27,	36.27,	25.3,
	25.3,	25.3,	25.3,	25.3,	25.3,	25.3,
	25.3,	25.3,	25.3,	25.3,	25.3,	25.3
3 WIDTH =	119.04,	123.99,	125.16,	124.53,	167.15,	115.91,
	106.23,	94.78,	84.57,	94.5,	105.54,	115.28,
	121.52,	124.47,	124.19,	187.08,	183.01,	173.73,
	183.67,	188.02,	186.66,	179.64,	167.15,	115.91,
	106.23,	94.78,	84.57,	94.5,	105.54,	115.28,
	121.52,	124.47,	124.19,	122.52,	118.3,	110.48
END						
4 SRCNAM =	EMF					
4 HEIGHT =	4.27,	4.27,	4.27,	4.27,	36.27,	36.27,
	36.27,	4.27,	4.27,	18.29,	18.29,	18.29,
	18.29,	11.28,	11.28,	11.28,	0,	0,

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
	4.27, 4.27, 4.27, 4.27, 4.27, 4.27,		
	4.27, 4.27, 4.27, 4.27, 4.27, 4.27,		
	4.27, 4.27, 4.27, 0, 0, 0		
4 WIDTH =	38.56, 40.76, 41.73, 41.43, 167.15, 149.58,		
	127.47, 28.3, 22.53, 22.66, 24.82, 26.22,		
	26.83, 58.59, 58.5, 56.64, 0, 0,		
	38.56, 40.76, 41.73, 41.43, 39.87, 37.1,		
	33.2, 28.3, 22.53, 28.3, 33.2, 37.1,		
	39.87, 41.43, 41.73, 0, 0, 0		
END			
5 SRCNAM =	LAB		
5 HEIGHT =	12.19, 12.19, 12.19, 36.27, 36.27, 36.27,		
	36.27, 36.27, 36.27, 12.19, 12.19, 12.19,		
	12.19, 12.19, 12.19, 12.19, 12.19, 18.29,		
	18.29, 12.19, 12.19, 36.27, 12.19, 12.19,		
	12.19, 12.19, 12.19, 12.19, 12.19, 12.19,		
	12.19, 12.19, 12.19, 12.19, 12.19, 12.19		
5 WIDTH =	74.37, 86.73, 96.47, 179.64, 167.15, 149.58,		
	127.47, 101.49, 76.08, 102.15, 104.35, 103.38,		
	99.27, 92.14, 82.21, 73.55, 67.67, 18.13,		
	21.29, 86.73, 96.47, 179.64, 106.93, 107.34,		
	104.5, 98.55, 96.85, 102.15, 104.35, 103.38,		
	99.27, 92.14, 82.21, 73.55, 67.67, 59.74		
END			
INPUT GROUP: 14a, 14b, 14c, 14d -- Area source parameters **Subgroup (14a)**			
NAR1	Number of polygon area sources with parameters specified below in (14d)	No default	0
IARU	Units used for area source emissions below in (14d)	1	1
NSAR1	Number of source-species combinations with variable emissions scaling factors	0	0
NAR2	Number of buoyant polygon area sources with variable location and emission parameters	No default	0

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
INPUT GROUP: 14a, 14b, 14c, 14d -- Area source parameters Subgroup (14b)			
Source No. ---------	Effect. Height (m) ------	Base Elevation (m) ------	Initial Sigma z (m) --------	Emission Rates ---------
not used				
INPUT GROUP: 14a, 14b, 14c, 14d -- Area source parameters Subgroup (14c)			
Source No. ------	Ordered list of X followed by list of Y, grouped by source ----------		
not used			
INPUT GROUP: 14a, 14b, 14c, 14d -- Area source parameters Subgroup (14d)			
AREA SOURCE: VARIABLE EMISSIONS DATA ----------			
not used			
INPUT GROUP: 15a, 15b, 15c -- Line source parameters Subgroup (15a)			
NLN2	Number of buoyant line sources with variable location and emission parameters	No default	0
NLINES	Number of buoyant line sources	No default	0
ILNU	Units used for line source emissions below	1	1
NSLN1	Number of source-species combinations with variable emissions scaling factors	0	0
MXNSEG	Maximum number of segments used to model each line	7	7
NLRISE	Number of distances at which transitional rise is computed	6	6
XL	Average building length	No default	0.
HBL	Average building height	No default	0.
WBL	Average building width	No default	0.
WML	Average line source width	No default	0.

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
DXL	Average separation between buildings	No default	0.
FPRIMEL	Average buoyancy parameter	No default	0.
INPUT GROUP: 15a, 15b, 15c -- Line source parameters Subgroup (15b)			
BUOYANT LINE SOURCE: CONSTANT DATA ---------- Source No. / Beg. X Coordinate (km) / Beg. Y Coordinate (km) / End. X Coordinate (km) / End. Y Coordinate (km) / Release Height (m) / Base Elevation (m) / Emission Rates ------ / ---------- / ---------- / --------- / ---------- / ------- / --------- / --------- not used			
INPUT GROUP: 15a, 15b, 15c -- Line source parameters Subgroup (15c)			
IVARY	Type of emissions variation	0	not used
INPUT GROUP: 16a, 16b, 16c -- Volume source parameters Subgroup (16a)			
NVL1	Number of volume sources with parameters	No default	0
IVLU	Units used for volume source emissions	1	1
NSVL1	Number of source-species combinations with variable emissions scaling factors	0	0
NSVL2	Number of volume sources with variable location and emission parameters	No default	0
INPUT GROUP: 16a, 16b, 16c -- Volume source parameters Subgroup (16b)			
VOLUME SOURCE: CONSTANT DATA ---------- X Coordinate (km) / Y Coordinate (km) / Effect. Height (m) / Base Elevation (m) / Initial Sigma y (m) / Initial Sigma z (m) / Emission Rates ---------- / ---------- / ------ / ------ / -------- / -------- / -------- not used			
INPUT GROUP: 16a, 16b, 16c -- Volume source parameters Subgroup (16c)			
IVARY	Type of emissions variation	0	not used

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
INPUT GROUP: 17a, & 17b -- Non-gridded (discrete) receptor information Subgroup (17a)			
NREC	Number of non-gridded receptors	No default	4890 (the total for all exposure grid nodes)
INPUT GROUP: 17a, & 17b -- Non-gridded (discrete) receptor information Subgroup (17b)			

NON-GRIDDED (DISCRETE) RECEPTOR DATA

Receptor No	X Coordinate (km)	Y Coordinate (km)	Ground Elevation (m)	Height Above Ground (m)
1 X =	311.5080,	5171.952,	122,	0
2 X =	311.6510,	5171.444,	122,	0
3 X =	312.0310,	5171.095,	119,	0
4 X =	312.4280,	5170.754,	122,	0
5 X =	312.9040,	5170.492,	121,	0
6 X =	313.3650,	5170.206,	118,	0
7 X =	313.7460,	5170,	117,	0
8 X =	314.3960,	5169.825,	116,	0
9 X =	314.7610,	5169.444,	116,	0
10 X =	315.0470,	5169.016,	116,	0
11 X =	315.2380,	5168.476,	116,	0
12 X =	315.3170,	5167.936,	116,	0
13 X =	315.3490,	5167.446,	116,	0
14 X =	315.2530,	5166.956,	116,	0
15 X =	315.2590,	5166.456,	116,	0
16 X =	315.3170,	5165.967,	116,	0
17 X =	315.4440,	5165.501,	116,	0
18 X =	315.6340,	5165.204,	116,	0
19 X =	316.0070,	5164.809,	116,	0
20 X =	316.3960,	5164.38,	116,	0
21 X =	316.7770,	5164.025,	116,	0
22 X =	317.1110,	5163.571,	116,	0
23 X =	317.4920,	5163.179,	117,	0
24 X =	317.8410,	5162.794,	116,	0
25 X =	318.1420,	5162.389,	115,	0
26 X =	318.5390,	5162.054,	115,	0
27 X =	318.9360,	5161.428,	113,	0
28 X =	319.4100,	5161.021,	112,	0
29 X =	319.8040,	5160.682,	112,	0
30 X =	320.3330,	5160.269,	112,	0

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
31 X =	320.7730, 5159.971, 112,	0	
32 X =	321.2490, 5159.714, 113,	0	
33 X =	321.6660, 5159.333, 112,	0	
34 X =	322.0030, 5158.897, 112,	0	
35 X =	322.3800, 5158.54, 114,	0	
36 X =	322.6670, 5157.904, 112,	0	
37 X =	322.9040, 5157.58, 112,	0	
38 X =	323.1420, 5157.118, 113,	0	
39 X =	323.4790, 5156.657, 113,	0	
40 X =	323.8530, 5156.281, 112,	0	
41 X =	324.2850, 5156.031, 113,	0	
42 X =	324.7610, 5155.714, 113,	0	
43 X =	325.2380, 5155.38, 112,	0	
44 X =	325.6190, 5155.031, 113,	0	
45 X =	325.8730, 5154.603, 112,	0	
46 X =	326.0310, 5153.968, 112,	0	
47 X =	326.1900, 5153.444, 112,	0	
48 X =	326.3800, 5152.857, 112,	0	
49 X =	326.5870, 5152.317, 113,	0	
50 X =	326.6270, 5151.872, 113,	0	
51 X =	326.6670, 5151.428, 113,	0	
52 X =	326.7460, 5150.952, 113,	0	
53 X =	326.7420, 5150.452, 112,	0	
54 X =	326.4760, 5150.031, 112,	0	
55 X =	326.2690, 5149.571, 112,	0	
56 X =	326.3650, 5149.175, 112,	0	
57 X =	326.4600, 5148.714, 112,	0	
58 X =	326.4760, 5148.206, 112,	0	
59 X =	326.4040, 5147.714, 112,	0	
60 X =	326.3730, 5147.254, 112,	0	
61 X =	326.2380, 5146.73, 112,	0	
62 X =	326.3170, 5146.238, 112,	0	
63 X =	326.3490, 5145.714, 111,	0	
64 X =	326.4280, 5145.286, 112,	0	
65 X =	326.5230, 5144.762, 110,	0	
66 X =	326.4760, 5144.27, 109,	0	
67 X =	326.4120, 5143.746, 109,	0	
68 X =	326.2060, 5142.81, 109,	0	
69 X =	326.0790, 5142.286, 109,	0	
70 X =	325.9680, 5141.825, 109,	0	
71 X =	325.8730, 5141.333, 109,	0	
72 X =	325.8410, 5140.825, 109,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
73 X =	325.9040, 5140.333, 109,	0	
74 X =	325.9360, 5139.794, 111,	0	
75 X =	325.9200, 5139.325, 111,	0	
76 X =	325.8880, 5138.841, 111,	0	
77 X =	325.7780, 5138.333, 109,	0	
78 X =	325.5390, 5137.905, 109,	0	
79 X =	325.5560, 5137.365, 109,	0	
80 X =	325.6980, 5136.873, 109,	0	
81 X =	325.7780, 5136.349, 109,	0	
82 X =	325.8730, 5135.857, 109,	0	
83 X =	326.0000, 5135.397, 109,	0	
84 X =	312.9350, 5161.13, 174,	0	
85 X =	311.9580, 5161.674, 173,	0	
86 X =	312.4580, 5161.652, 177,	0	
87 X =	312.9570, 5161.63, 183,	0	
88 X =	309.4820, 5162.285, 166,	0	
89 X =	309.9820, 5162.262, 172,	0	
90 X =	310.4810, 5162.24, 175,	0	
91 X =	310.9810, 5162.218, 177,	0	
92 X =	311.4810, 5162.196, 180,	0	
93 X =	311.9800, 5162.174, 182,	0	
94 X =	312.4800, 5162.152, 183,	0	
95 X =	308.0060, 5162.851, 154,	0	
96 X =	308.5050, 5162.829, 170,	0	
97 X =	309.0050, 5162.806, 178,	0	
98 X =	309.5050, 5162.784, 182,	0	
99 X =	310.0040, 5162.762, 186,	0	
100 X =	310.5040, 5162.74, 192,	0	
101 X =	311.0030, 5162.718, 201,	0	
102 X =	311.5030, 5162.695, 209,	0	
103 X =	312.0020, 5162.673, 215,	0	
104 X =	306.0300, 5163.439, 171,	0	
105 X =	306.5290, 5163.417, 152,	0	
106 X =	307.0290, 5163.395, 155,	0	
107 X =	307.5280, 5163.373, 166,	0	
108 X =	308.0280, 5163.35, 182,	0	
109 X =	308.5280, 5163.328, 221,	0	
110 X =	309.0270, 5163.306, 213,	0	
111 X =	309.5270, 5163.284, 221,	0	
112 X =	310.0260, 5163.262, 236,	0	
113 X =	310.5260, 5163.239, 242,	0	
114 X =	311.0250, 5163.217, 249,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
115 X =	311.5250, 5163.195, 299,	0	
116 X =	305.0530, 5163.983, 152,	0	
117 X =	305.5520, 5163.961, 179,	0	
118 X =	306.0520, 5163.939, 183,	0	
119 X =	306.5510, 5163.917, 232,	0	
120 X =	307.0510, 5163.894, 288,	0	
121 X =	307.5510, 5163.872, 255,	0	
122 X =	308.0500, 5163.85, 244,	0	
123 X =	308.5500, 5163.828, 227,	0	
124 X =	309.0490, 5163.806, 223,	0	
125 X =	309.5490, 5163.783, 240,	0	
126 X =	310.0480, 5163.761, 244,	0	
127 X =	310.5480, 5163.739, 244,	0	
128 X =	311.0480, 5163.717, 287,	0	
129 X =	304.5750, 5164.505, 165,	0	
130 X =	305.0750, 5164.483, 171,	0	
131 X =	305.5740, 5164.46, 244,	0	
132 X =	306.0740, 5164.438, 244,	0	
133 X =	306.5740, 5164.416, 253,	0	
134 X =	307.0730, 5164.394, 248,	0	
135 X =	307.5730, 5164.372, 238,	0	
136 X =	308.0720, 5164.35, 243,	0	
137 X =	306.9810, 5159.69, 185.77,	0	
138 X =	306.9780, 5159.63, 184.2,	0	
139 X =	306.9760, 5159.57, 184.44,	0	
140 X =	306.9730, 5159.51, 186.9,	0	
141 X =	306.9700, 5159.45, 189,	0	
142 X =	306.9680, 5159.39, 190,	0	
143 X =	306.9650, 5159.33, 190.33,	0	
144 X =	306.9620, 5159.27, 191,	0	
145 X =	306.9600, 5159.21, 192.33,	0	
146 X =	306.9570, 5159.151, 194.13,	0	
147 X =	306.9540, 5159.091, 195.5,	0	
148 X =	306.9520, 5159.031, 196.27,	0	
149 X =	306.9490, 5158.971, 198.67,	0	
150 X =	306.9460, 5158.911, 201.6,	0	
151 X =	306.9440, 5158.851, 204.3,	0	
152 X =	306.9410, 5158.791, 206.19,	0	
153 X =	306.9380, 5158.731, 207.55,	0	
154 X =	306.9360, 5158.671, 209.04,	0	
155 X =	306.9330, 5158.611, 210.83,	0	
156 X =	306.9300, 5158.551, 214.3,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
157 X =	306.9280, 5158.491, 216.3,	0	
158 X =	306.9250, 5158.431, 217,	0	
159 X =	306.9220, 5158.371, 217,	0	
160 X =	306.9190, 5158.311, 216.89,	0	
161 X =	306.9170, 5158.251, 216.57,	0	
162 X =	306.9140, 5158.191, 216,	0	
163 X =	306.9110, 5158.132, 215.27,	0	
164 X =	306.9090, 5158.072, 215.27,	0	
165 X =	306.9060, 5158.012, 217.27,	0	
166 X =	306.9030, 5157.952, 219.53,	0	
167 X =	306.9010, 5157.892, 222,	0	
168 X =	306.8980, 5157.832, 221,	0	
169 X =	306.8950, 5157.772, 220,	0	
170 X =	306.8930, 5157.712, 219,	0	
171 X =	306.8900, 5157.652, 220,	0	
172 X =	306.8870, 5157.592, 221.15,	0	
173 X =	306.8850, 5157.532, 222.13,	0	
174 X =	306.8820, 5157.472, 226.09,	0	
175 X =	306.8790, 5157.412, 231.61,	0	
176 X =	306.8770, 5157.352, 236.8,	0	
177 X =	306.8740, 5157.292, 238.2,	0	
178 X =	307.0410, 5159.687, 183.56,	0	
179 X =	307.0380, 5159.627, 181.63,	0	
180 X =	307.0360, 5159.567, 181.6,	0	
181 X =	307.0330, 5159.508, 184.37,	0	
182 X =	307.0300, 5159.448, 187.2,	0	
183 X =	307.0280, 5159.388, 188.4,	0	
184 X =	307.0250, 5159.328, 189.33,	0	
185 X =	307.0220, 5159.268, 189.53,	0	
186 X =	307.0200, 5159.208, 189.4,	0	
187 X =	307.0170, 5159.148, 189.7,	0	
188 X =	307.0140, 5159.088, 191.8,	0	
189 X =	307.0120, 5159.028, 193.83,	0	
190 X =	307.0090, 5158.968, 196.17,	0	
191 X =	307.0060, 5158.908, 200.27,	0	
192 X =	307.0030, 5158.848, 203.23,	0	
193 X =	307.0010, 5158.788, 204.78,	0	
194 X =	306.9980, 5158.728, 206.11,	0	
195 X =	306.9950, 5158.668, 207.4,	0	
196 X =	306.9930, 5158.608, 209.4,	0	
197 X =	306.9900, 5158.548, 213.4,	0	
198 X =	306.9870, 5158.489, 215.8,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
199 X =	306.9850, 5158.429, 217,	0	
200 X =	306.9820, 5158.369, 217,	0	
201 X =	306.9790, 5158.309, 217,	0	
202 X =	306.9770, 5158.249, 216.63,	0	
203 X =	306.9740, 5158.189, 214.36,	0	
204 X =	306.9710, 5158.129, 212.9,	0	
205 X =	306.9690, 5158.069, 212.58,	0	
206 X =	306.9660, 5158.009, 215.84,	0	
207 X =	306.9630, 5157.949, 218.63,	0	
208 X =	306.9610, 5157.889, 221.37,	0	
209 X =	306.9580, 5157.829, 221,	0	
210 X =	306.9550, 5157.769, 219.69,	0	
211 X =	306.9530, 5157.709, 219,	0	
212 X =	306.9500, 5157.649, 219.58,	0	
213 X =	306.9470, 5157.589, 221.16,	0	
214 X =	306.9450, 5157.529, 222.37,	0	
215 X =	306.9420, 5157.47, 224.73,	0	
216 X =	306.9390, 5157.41, 227.97,	0	
217 X =	306.9370, 5157.35, 231.41,	0	
218 X =	306.9340, 5157.289, 232.9,	0	
219 X =	307.1010, 5159.685, 182.5,	0	
220 X =	307.0980, 5159.625, 180.3,	0	
221 X =	307.0960, 5159.565, 180,	0	
222 X =	307.0930, 5159.505, 183.72,	0	
223 X =	307.0900, 5159.445, 187.33,	0	
224 X =	307.0880, 5159.385, 188.63,	0	
225 X =	307.0850, 5159.325, 189,	0	
226 X =	307.0820, 5159.265, 188.5,	0	
227 X =	307.0790, 5159.205, 188.5,	0	
228 X =	307.0770, 5159.145, 189,	0	
229 X =	307.0740, 5159.085, 190.1,	0	
230 X =	307.0710, 5159.025, 191.5,	0	
231 X =	307.0690, 5158.965, 194.37,	0	
232 X =	307.0660, 5158.905, 198.97,	0	
233 X =	307.0630, 5158.845, 203.07,	0	
234 X =	307.0610, 5158.786, 204.8,	0	
235 X =	307.0580, 5158.726, 206.61,	0	
236 X =	307.0550, 5158.666, 207.56,	0	
237 X =	307.0530, 5158.606, 209.57,	0	
238 X =	307.0500, 5158.546, 210.93,	0	
239 X =	307.0470, 5158.486, 215.03,	0	
240 X =	307.0450, 5158.426, 217,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
241 X =	307.0420, 5158.366, 217,	0	
242 X =	307.0390, 5158.306, 217,	0	
243 X =	307.0370, 5158.246, 216.33,	0	
244 X =	307.0340, 5158.186, 214.22,	0	
245 X =	307.0310, 5158.126, 211.63,	0	
246 X =	307.0290, 5158.066, 210.99,	0	
247 X =	307.0260, 5158.006, 214.44,	0	
248 X =	307.0230, 5157.946, 218.09,	0	
249 X =	307.0210, 5157.886, 221,	0	
250 X =	307.0180, 5157.826, 220.04,	0	
251 X =	307.0150, 5157.767, 218.57,	0	
252 X =	307.0130, 5157.707, 216.8,	0	
253 X =	307.0100, 5157.647, 217.77,	0	
254 X =	307.0070, 5157.587, 220.11,	0	
255 X =	307.0050, 5157.527, 222.43,	0	
256 X =	307.0020, 5157.467, 223,	0	
257 X =	306.9990, 5157.407, 223.43,	0	
258 X =	306.9970, 5157.347, 224,	0	
259 X =	306.9940, 5157.287, 224,	0	
260 X =	307.1610, 5159.682, 183.28,	0	
261 X =	307.1580, 5159.622, 182,	0	
262 X =	307.1550, 5159.562, 182.7,	0	
263 X =	307.1530, 5159.502, 185.63,	0	
264 X =	307.1500, 5159.442, 189.2,	0	
265 X =	307.1470, 5159.382, 189.09,	0	
266 X =	307.1450, 5159.322, 188.23,	0	
267 X =	307.1420, 5159.262, 187.93,	0	
268 X =	307.1390, 5159.202, 187.03,	0	
269 X =	307.1370, 5159.143, 188.1,	0	
270 X =	307.1340, 5159.083, 189.11,	0	
271 X =	307.1310, 5159.023, 190.17,	0	
272 X =	307.1290, 5158.963, 193.5,	0	
273 X =	307.1260, 5158.903, 197.4,	0	
274 X =	307.1230, 5158.843, 201.45,	0	
275 X =	307.1210, 5158.783, 204.41,	0	
276 X =	307.1180, 5158.723, 207.72,	0	
277 X =	307.1150, 5158.663, 209.83,	0	
278 X =	307.1130, 5158.603, 212.16,	0	
279 X =	307.1100, 5158.543, 211.57,	0	
280 X =	307.1070, 5158.483, 214.52,	0	
281 X =	307.1050, 5158.423, 215.09,	0	
282 X =	307.1020, 5158.363, 216,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
283 X =	307.0990, 5158.303, 216.57,	0	
284 X =	307.0970, 5158.243, 216.43,	0	
285 X =	307.0940, 5158.183, 215.43,	0	
286 X =	307.0910, 5158.124, 214.8,	0	
287 X =	307.0890, 5158.064, 214.53,	0	
288 X =	307.0860, 5158.004, 216.43,	0	
289 X =	307.0830, 5157.944, 218.43,	0	
290 X =	307.0810, 5157.884, 219.97,	0	
291 X =	307.0780, 5157.824, 218.53,	0	
292 X =	307.0750, 5157.764, 217.08,	0	
293 X =	307.0730, 5157.704, 215.47,	0	
294 X =	307.0700, 5157.644, 217.07,	0	
295 X =	307.0670, 5157.584, 219.53,	0	
296 X =	307.0650, 5157.524, 222.3,	0	
297 X =	307.0620, 5157.464, 223,	0	
298 X =	307.0590, 5157.404, 223.53,	0	
299 X =	307.0570, 5157.344, 224,	0	
300 X =	307.0540, 5157.284, 224,	0	
301 X =	307.2210, 5159.679, 185.21,	0	
302 X =	307.2180, 5159.619, 184.18,	0	
303 X =	307.2150, 5159.559, 184.55,	0	
304 X =	307.2130, 5159.499, 187.53,	0	
305 X =	307.2100, 5159.44, 189.67,	0	
306 X =	307.2070, 5159.38, 189.26,	0	
307 X =	307.2050, 5159.32, 187.33,	0	
308 X =	307.2020, 5159.26, 185.33,	0	
309 X =	307.1990, 5159.2, 184.71,	0	
310 X =	307.1970, 5159.14, 186.77,	0	
311 X =	307.1940, 5159.08, 187.73,	0	
312 X =	307.1910, 5159.02, 189.67,	0	
313 X =	307.1890, 5158.96, 191.91,	0	
314 X =	307.1860, 5158.9, 195.8,	0	
315 X =	307.1830, 5158.84, 199.47,	0	
316 X =	307.1810, 5158.78, 203.97,	0	
317 X =	307.1780, 5158.72, 208.33,	0	
318 X =	307.1750, 5158.66, 211.78,	0	
319 X =	307.1730, 5158.6, 213.67,	0	
320 X =	307.1700, 5158.54, 212.67,	0	
321 X =	307.1670, 5158.48, 213.1,	0	
322 X =	307.1650, 5158.421, 214.17,	0	
323 X =	307.1620, 5158.361, 214.73,	0	
324 X =	307.1590, 5158.301, 215.77,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
325 X =	307.1570, 5158.241, 216,	0	
326 X =	307.1540, 5158.181, 215,	0	
327 X =	307.1510, 5158.121, 214.37,	0	
328 X =	307.1490, 5158.061, 214.63,	0	
329 X =	307.1460, 5158.001, 215.63,	0	
330 X =	307.1430, 5157.941, 217.63,	0	
331 X =	307.1410, 5157.881, 219,	0	
332 X =	307.1380, 5157.821, 217.41,	0	
333 X =	307.1350, 5157.761, 215.53,	0	
334 X =	307.1330, 5157.701, 214.6,	0	
335 X =	307.1300, 5157.641, 216.6,	0	
336 X =	307.1270, 5157.581, 219.07,	0	
337 X =	307.1240, 5157.521, 221.8,	0	
338 X =	307.1220, 5157.462, 223,	0	
339 X =	307.1190, 5157.402, 224.18,	0	
340 X =	307.1160, 5157.342, 225.12,	0	
341 X =	307.1140, 5157.281, 225.13,	0	
342 X =	307.2810, 5159.677, 185.23,	0	
343 X =	307.2780, 5159.617, 184.23,	0	
344 X =	307.2750, 5159.557, 184.77,	0	
345 X =	307.2730, 5159.497, 186.77,	0	
346 X =	307.2700, 5159.437, 188.92,	0	
347 X =	307.2670, 5159.377, 188.05,	0	
348 X =	307.2650, 5159.317, 186.9,	0	
349 X =	307.2620, 5159.257, 185.15,	0	
350 X =	307.2590, 5159.197, 184.77,	0	
351 X =	307.2570, 5159.137, 185.02,	0	
352 X =	307.2540, 5159.077, 186.97,	0	
353 X =	307.2510, 5159.017, 188.77,	0	
354 X =	307.2490, 5158.957, 191.53,	0	
355 X =	307.2460, 5158.897, 194.12,	0	
356 X =	307.2430, 5158.837, 198.53,	0	
357 X =	307.2410, 5158.778, 202.83,	0	
358 X =	307.2380, 5158.718, 207.74,	0	
359 X =	307.2350, 5158.658, 211.18,	0	
360 X =	307.2330, 5158.598, 212.95,	0	
361 X =	307.2300, 5158.538, 212,	0	
362 X =	307.2270, 5158.478, 212.1,	0	
363 X =	307.2250, 5158.418, 212.9,	0	
364 X =	307.2220, 5158.358, 214.2,	0	
365 X =	307.2190, 5158.298, 215.27,	0	
366 X =	307.2170, 5158.238, 216,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
367 X =	307.2140, 5158.178, 215,	0	
368 X =	307.2110, 5158.118, 214.27,	0	
369 X =	307.2080, 5158.058, 214.73,	0	
370 X =	307.2060, 5157.998, 215.73,	0	
371 X =	307.2030, 5157.938, 217.66,	0	
372 X =	307.2000, 5157.878, 219,	0	
373 X =	307.1980, 5157.818, 217.27,	0	
374 X =	307.1950, 5157.759, 216,	0	
375 X =	307.1920, 5157.699, 214.3,	0	
376 X =	307.1900, 5157.639, 216.4,	0	
377 X =	307.1870, 5157.579, 218.7,	0	
378 X =	307.1840, 5157.519, 221.4,	0	
379 X =	307.1820, 5157.459, 223.7,	0	
380 X =	307.1790, 5157.399, 226,	0	
381 X =	307.1760, 5157.339, 228.66,	0	
382 X =	307.1740, 5157.279, 229.08,	0	
383 X =	307.3410, 5159.674, 184.13,	0	
384 X =	307.3380, 5159.614, 183.48,	0	
385 X =	307.3350, 5159.554, 183.87,	0	
386 X =	307.3330, 5159.494, 186.79,	0	
387 X =	307.3300, 5159.434, 188.78,	0	
388 X =	307.3270, 5159.374, 187.13,	0	
389 X =	307.3250, 5159.314, 184.27,	0	
390 X =	307.3220, 5159.254, 183,	0	
391 X =	307.3190, 5159.194, 183.03,	0	
392 X =	307.3170, 5159.134, 184.1,	0	
393 X =	307.3140, 5159.075, 185.2,	0	
394 X =	307.3110, 5159.015, 186.18,	0	
395 X =	307.3090, 5158.955, 189.56,	0	
396 X =	307.3060, 5158.895, 193.67,	0	
397 X =	307.3030, 5158.835, 197.67,	0	
398 X =	307.3010, 5158.775, 200.77,	0	
399 X =	307.2980, 5158.715, 204.18,	0	
400 X =	307.2950, 5158.655, 206.5,	0	
401 X =	307.2920, 5158.595, 208.64,	0	
402 X =	307.2900, 5158.535, 207.83,	0	
403 X =	307.2870, 5158.475, 209.05,	0	
404 X =	307.2840, 5158.415, 211.23,	0	
405 X =	307.2820, 5158.355, 212.49,	0	
406 X =	307.2790, 5158.295, 214.26,	0	
407 X =	307.2760, 5158.235, 215.47,	0	
408 X =	307.2740, 5158.175, 215,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
409 X =	307.2710, 5158.115, 214.11,	0	
410 X =	307.2680, 5158.056, 214,	0	
411 X =	307.2660, 5157.996, 215.8,	0	
412 X =	307.2630, 5157.936, 216.8,	0	
413 X =	307.2600, 5157.876, 218,	0	
414 X =	307.2580, 5157.816, 217,	0	
415 X =	307.2550, 5157.756, 215.2,	0	
416 X =	307.2520, 5157.696, 214.2,	0	
417 X =	307.2500, 5157.636, 216.07,	0	
418 X =	307.2470, 5157.576, 218.8,	0	
419 X =	307.2440, 5157.516, 221.23,	0	
420 X =	307.2420, 5157.456, 223.4,	0	
421 X =	307.2390, 5157.396, 226.5,	0	
422 X =	307.2360, 5157.336, 229.24,	0	
423 X =	307.2340, 5157.276, 228.93,	0	
424 X =	307.4010, 5159.671, 184,	0	
425 X =	307.3980, 5159.611, 183,	0	
426 X =	307.3950, 5159.551, 183.97,	0	
427 X =	307.3930, 5159.491, 186.95,	0	
428 X =	307.3900, 5159.432, 188.93,	0	
429 X =	307.3870, 5159.372, 187.12,	0	
430 X =	307.3850, 5159.312, 185.07,	0	
431 X =	307.3820, 5159.252, 183,	0	
432 X =	307.3790, 5159.192, 183,	0	
433 X =	307.3770, 5159.132, 183.84,	0	
434 X =	307.3740, 5159.072, 184.93,	0	
435 X =	307.3710, 5159.012, 185.98,	0	
436 X =	307.3680, 5158.952, 189.87,	0	
437 X =	307.3660, 5158.892, 194.8,	0	
438 X =	307.3630, 5158.832, 198.46,	0	
439 X =	307.3600, 5158.772, 199.93,	0	
440 X =	307.3580, 5158.712, 201.67,	0	
441 X =	307.3550, 5158.652, 202.83,	0	
442 X =	307.3520, 5158.592, 204.87,	0	
443 X =	307.3500, 5158.532, 203.93,	0	
444 X =	307.3470, 5158.472, 205.94,	0	
445 X =	307.3440, 5158.413, 207.82,	0	
446 X =	307.3420, 5158.353, 210.17,	0	
447 X =	307.3390, 5158.293, 213.17,	0	
448 X =	307.3360, 5158.233, 214.47,	0	
449 X =	307.3340, 5158.173, 213.59,	0	
450 X =	307.3310, 5158.113, 213.63,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
451 X =	307.3280, 5158.053, 213.73,	0	
452 X =	307.3260, 5157.993, 214.8,	0	
453 X =	307.3230, 5157.933, 215.99,	0	
454 X =	307.3200, 5157.873, 217,	0	
455 X =	307.3180, 5157.813, 216.1,	0	
456 X =	307.3150, 5157.753, 215.1,	0	
457 X =	307.3120, 5157.693, 214.1,	0	
458 X =	307.3100, 5157.633, 215.9,	0	
459 X =	307.3070, 5157.573, 217.33,	0	
460 X =	307.3040, 5157.513, 219.43,	0	
461 X =	307.3020, 5157.453, 220.56,	0	
462 X =	307.2990, 5157.394, 222.31,	0	
463 X =	307.2960, 5157.334, 223.49,	0	
464 X =	307.2940, 5157.273, 223.75,	0	
465 X =	307.4610, 5159.669, 183.97,	0	
466 X =	307.4580, 5159.609, 183,	0	
467 X =	307.4550, 5159.549, 184.03,	0	
468 X =	307.4520, 5159.489, 187.03,	0	
469 X =	307.4500, 5159.429, 188.97,	0	
470 X =	307.4470, 5159.369, 186.97,	0	
471 X =	307.4440, 5159.309, 184.93,	0	
472 X =	307.4420, 5159.249, 183,	0	
473 X =	307.4390, 5159.189, 183,	0	
474 X =	307.4360, 5159.129, 184,	0	
475 X =	307.4340, 5159.069, 184.2,	0	
476 X =	307.4310, 5159.009, 185.33,	0	
477 X =	307.4280, 5158.949, 189.07,	0	
478 X =	307.4260, 5158.889, 194.1,	0	
479 X =	307.4230, 5158.829, 198.02,	0	
480 X =	307.4200, 5158.769, 199.03,	0	
481 X =	307.4180, 5158.71, 200,	0	
482 X =	307.4150, 5158.65, 202,	0	
483 X =	307.4120, 5158.59, 203,	0	
484 X =	307.4100, 5158.53, 203,	0	
485 X =	307.4070, 5158.47, 204,	0	
486 X =	307.4040, 5158.41, 206,	0	
487 X =	307.4020, 5158.35, 208.27,	0	
488 X =	307.3990, 5158.29, 210.37,	0	
489 X =	307.3960, 5158.23, 211.47,	0	
490 X =	307.3940, 5158.17, 211.07,	0	
491 X =	307.3910, 5158.11, 210.27,	0	
492 X =	307.3880, 5158.05, 211.2,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
493 X =	307.3860, 5157.99, 213.4,	0	
494 X =	307.3830, 5157.93, 214.9,	0	
495 X =	307.3800, 5157.87, 217,	0	
496 X =	307.3780, 5157.81, 216,	0	
497 X =	307.3750, 5157.751, 215.01,	0	
498 X =	307.3720, 5157.691, 214.01,	0	
499 X =	307.3700, 5157.631, 214.98,	0	
500 X =	307.3670, 5157.571, 215.98,	0	
501 X =	307.3640, 5157.511, 217.5,	0	
502 X =	307.3620, 5157.451, 218.57,	0	
503 X =	307.3590, 5157.391, 219.67,	0	
504 X =	307.3560, 5157.331, 220.79,	0	
505 X =	307.3540, 5157.271, 220.9,	0	
506 X =	307.5200, 5159.666, 183.87,	0	
507 X =	307.5180, 5159.606, 183,	0	
508 X =	307.5150, 5159.546, 184.13,	0	
509 X =	307.5120, 5159.486, 187.08,	0	
510 X =	307.5100, 5159.426, 188.87,	0	
511 X =	307.5070, 5159.366, 186.63,	0	
512 X =	307.5040, 5159.306, 183.62,	0	
513 X =	307.5020, 5159.246, 182.12,	0	
514 X =	307.4990, 5159.186, 183,	0	
515 X =	307.4960, 5159.126, 183.02,	0	
516 X =	307.4940, 5159.067, 183.28,	0	
517 X =	307.4910, 5159.007, 184.13,	0	
518 X =	307.4880, 5158.947, 188.24,	0	
519 X =	307.4860, 5158.887, 193.72,	0	
520 X =	307.4830, 5158.827, 198,	0	
521 X =	307.4800, 5158.767, 199.07,	0	
522 X =	307.4780, 5158.707, 200.1,	0	
523 X =	307.4750, 5158.647, 202,	0	
524 X =	307.4720, 5158.587, 203,	0	
525 X =	307.4700, 5158.527, 202,	0	
526 X =	307.4670, 5158.467, 203.01,	0	
527 X =	307.4640, 5158.407, 204.3,	0	
528 X =	307.4620, 5158.347, 207.1,	0	
529 X =	307.4590, 5158.287, 209.1,	0	
530 X =	307.4560, 5158.227, 210,	0	
531 X =	307.4540, 5158.167, 210.05,	0	
532 X =	307.4510, 5158.107, 210.37,	0	
533 X =	307.4480, 5158.048, 210.58,	0	
534 X =	307.4460, 5157.988, 212.27,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
535 X =	307.4430, 5157.928, 214.07,	0	
536 X =	307.4400, 5157.868, 215,	0	
537 X =	307.4380, 5157.808, 215,	0	
538 X =	307.4350, 5157.748, 214.16,	0	
539 X =	307.4320, 5157.688, 214,	0	
540 X =	307.4300, 5157.628, 215.04,	0	
541 X =	307.4270, 5157.568, 216.04,	0	
542 X =	307.4240, 5157.508, 217.47,	0	
543 X =	307.4220, 5157.448, 217.44,	0	
544 X =	307.4190, 5157.388, 217.7,	0	
545 X =	307.4160, 5157.328, 217.8,	0	
546 X =	307.4130, 5157.268, 217.97,	0	
547 X =	307.5800, 5159.663, 183.26,	0	
548 X =	307.5780, 5159.603, 183,	0	
549 X =	307.5750, 5159.543, 184.23,	0	
550 X =	307.5720, 5159.483, 185.83,	0	
551 X =	307.5700, 5159.423, 187.43,	0	
552 X =	307.5670, 5159.364, 185.57,	0	
553 X =	307.5640, 5159.304, 182.8,	0	
554 X =	307.5620, 5159.244, 181.81,	0	
555 X =	307.5590, 5159.184, 182,	0	
556 X =	307.5560, 5159.124, 182.2,	0	
557 X =	307.5540, 5159.064, 182.36,	0	
558 X =	307.5510, 5159.004, 183.2,	0	
559 X =	307.5480, 5158.944, 187.6,	0	
560 X =	307.5460, 5158.884, 192.97,	0	
561 X =	307.5430, 5158.824, 196.68,	0	
562 X =	307.5400, 5158.764, 197.87,	0	
563 X =	307.5380, 5158.704, 198.93,	0	
564 X =	307.5350, 5158.644, 201.03,	0	
565 X =	307.5320, 5158.584, 202.95,	0	
566 X =	307.5300, 5158.524, 202,	0	
567 X =	307.5270, 5158.464, 203,	0	
568 X =	307.5240, 5158.404, 204.2,	0	
569 X =	307.5220, 5158.345, 206.17,	0	
570 X =	307.5190, 5158.285, 207.53,	0	
571 X =	307.5160, 5158.225, 209.08,	0	
572 X =	307.5140, 5158.165, 209.61,	0	
573 X =	307.5110, 5158.105, 210.69,	0	
574 X =	307.5080, 5158.045, 211.12,	0	
575 X =	307.5060, 5157.985, 212.13,	0	
576 X =	307.5030, 5157.925, 213.15,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
577 X =	307.5000, 5157.865, 214,	0	
578 X =	307.4970, 5157.805, 214.1,	0	
579 X =	307.4950, 5157.745, 214,	0	
580 X =	307.4920, 5157.685, 214,	0	
581 X =	307.4890, 5157.625, 215,	0	
582 X =	307.4870, 5157.565, 216,	0	
583 X =	307.4840, 5157.505, 217,	0	
584 X =	307.4810, 5157.445, 215.94,	0	
585 X =	307.4790, 5157.386, 215.57,	0	
586 X =	307.4760, 5157.326, 214.47,	0	
587 X =	307.4730, 5157.265, 214.82,	0	
588 X =	307.6400, 5159.661, 183,	0	
589 X =	307.6380, 5159.601, 183,	0	
590 X =	307.6350, 5159.541, 184.3,	0	
591 X =	307.6320, 5159.481, 185.58,	0	
592 X =	307.6300, 5159.421, 186.37,	0	
593 X =	307.6270, 5159.361, 184.54,	0	
594 X =	307.6240, 5159.301, 182.7,	0	
595 X =	307.6220, 5159.241, 182,	0	
596 X =	307.6190, 5159.181, 182.29,	0	
597 X =	307.6160, 5159.121, 182.74,	0	
598 X =	307.6140, 5159.061, 182,	0	
599 X =	307.6110, 5159.001, 182.3,	0	
600 X =	307.6080, 5158.941, 186.9,	0	
601 X =	307.6060, 5158.881, 192.23,	0	
602 X =	307.6030, 5158.821, 196,	0	
603 X =	307.6000, 5158.761, 196.3,	0	
604 X =	307.5980, 5158.702, 197.27,	0	
605 X =	307.5950, 5158.642, 199.53,	0	
606 X =	307.5920, 5158.582, 202.27,	0	
607 X =	307.5900, 5158.522, 202,	0	
608 X =	307.5870, 5158.462, 203,	0	
609 X =	307.5840, 5158.402, 204.05,	0	
610 X =	307.5820, 5158.342, 205.46,	0	
611 X =	307.5790, 5158.282, 206.63,	0	
612 X =	307.5760, 5158.222, 207.73,	0	
613 X =	307.5730, 5158.162, 208.83,	0	
614 X =	307.5710, 5158.102, 209.9,	0	
615 X =	307.5680, 5158.042, 211,	0	
616 X =	307.5650, 5157.982, 212.1,	0	
617 X =	307.5630, 5157.922, 213.17,	0	
618 X =	307.5600, 5157.862, 214,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
619 X =	307.5570, 5157.802, 213,	0	
620 X =	307.5550, 5157.742, 213,	0	
621 X =	307.5520, 5157.683, 212.44,	0	
622 X =	307.5490, 5157.623, 213.51,	0	
623 X =	307.5470, 5157.563, 214.57,	0	
624 X =	307.5440, 5157.503, 216,	0	
625 X =	307.5410, 5157.443, 215,	0	
626 X =	307.5390, 5157.383, 213.77,	0	
627 X =	307.5360, 5157.323, 212.77,	0	
628 X =	307.5330, 5157.263, 213.23,	0	
629 X =	307.7000, 5159.658, 183,	0	
630 X =	307.6980, 5159.598, 183,	0	
631 X =	307.6950, 5159.538, 183.9,	0	
632 X =	307.6920, 5159.478, 185.76,	0	
633 X =	307.6900, 5159.418, 185.6,	0	
634 X =	307.6870, 5159.358, 184.6,	0	
635 X =	307.6840, 5159.298, 182.6,	0	
636 X =	307.6820, 5159.238, 182,	0	
637 X =	307.6790, 5159.178, 182,	0	
638 X =	307.6760, 5159.118, 181.6,	0	
639 X =	307.6740, 5159.058, 181,	0	
640 X =	307.6710, 5158.999, 181.67,	0	
641 X =	307.6680, 5158.939, 184.73,	0	
642 X =	307.6660, 5158.879, 189.77,	0	
643 X =	307.6630, 5158.819, 192.09,	0	
644 X =	307.6600, 5158.759, 194.37,	0	
645 X =	307.6570, 5158.699, 196.85,	0	
646 X =	307.6550, 5158.639, 199.37,	0	
647 X =	307.6520, 5158.579, 202.37,	0	
648 X =	307.6490, 5158.519, 202.35,	0	
649 X =	307.6470, 5158.459, 203.33,	0	
650 X =	307.6330, 5158.159, 207,	0	
651 X =	307.6310, 5158.099, 207.77,	0	
652 X =	307.6280, 5158.04, 208.82,	0	
653 X =	307.6250, 5157.98, 210.17,	0	
654 X =	307.6230, 5157.92, 211.3,	0	
655 X =	307.6200, 5157.86, 213,	0	
656 X =	307.6170, 5157.8, 212.7,	0	
657 X =	307.6150, 5157.74, 212,	0	
658 X =	307.6120, 5157.68, 212,	0	
659 X =	307.6090, 5157.62, 213,	0	
660 X =	307.6070, 5157.56, 213.43,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
661 X =	307.6040, 5157.5, 214.53,	0	
662 X =	307.6010, 5157.44, 213.88,	0	
663 X =	307.5990, 5157.38, 213,	0	
664 X =	307.5960, 5157.32, 212,	0	
665 X =	307.5930, 5157.26, 213.67,	0	
666 X =	307.7600, 5159.655, 182.33,	0	
667 X =	307.7580, 5159.595, 182.4,	0	
668 X =	307.7550, 5159.535, 183.25,	0	
669 X =	307.7520, 5159.475, 185.1,	0	
670 X =	307.7500, 5159.415, 185.33,	0	
671 X =	307.7470, 5159.356, 184.41,	0	
672 X =	307.7440, 5159.296, 182.4,	0	
673 X =	307.7420, 5159.236, 181.5,	0	
674 X =	307.7390, 5159.176, 181.55,	0	
675 X =	307.7360, 5159.116, 180.6,	0	
676 X =	307.7330, 5159.056, 180.59,	0	
677 X =	307.7310, 5158.996, 181.47,	0	
678 X =	307.7280, 5158.936, 184.93,	0	
679 X =	307.7250, 5158.876, 188.93,	0	
680 X =	307.7230, 5158.816, 192.24,	0	
681 X =	307.7200, 5158.756, 194.29,	0	
682 X =	307.7170, 5158.696, 196.47,	0	
683 X =	307.7150, 5158.636, 199.47,	0	
684 X =	307.7120, 5158.576, 201.9,	0	
685 X =	307.7090, 5158.516, 201.03,	0	
686 X =	307.6930, 5158.157, 207,	0	
687 X =	307.6910, 5158.097, 207.27,	0	
688 X =	307.6880, 5158.037, 208.32,	0	
689 X =	307.6850, 5157.977, 208.91,	0	
690 X =	307.6830, 5157.917, 209.94,	0	
691 X =	307.6800, 5157.857, 210.43,	0	
692 X =	307.6770, 5157.797, 211.1,	0	
693 X =	307.6750, 5157.737, 211.53,	0	
694 X =	307.6720, 5157.677, 212,	0	
695 X =	307.6690, 5157.617, 212.16,	0	
696 X =	307.6670, 5157.557, 213,	0	
697 X =	307.6640, 5157.497, 213,	0	
698 X =	307.6610, 5157.437, 213,	0	
699 X =	307.6590, 5157.377, 212.4,	0	
700 X =	307.6560, 5157.318, 212,	0	
701 X =	307.6530, 5157.257, 213.43,	0	
702 X =	307.8200, 5159.653, 182,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
703 X =	307.8170, 5159.593, 182,	0	
704 X =	307.8150, 5159.533, 183,	0	
705 X =	307.8120, 5159.473, 184.57,	0	
706 X =	307.8090, 5159.413, 185,	0	
707 X =	307.8070, 5159.353, 183.3,	0	
708 X =	307.8040, 5159.293, 181.43,	0	
709 X =	307.8010, 5159.233, 179.98,	0	
710 X =	307.7990, 5159.173, 180,	0	
711 X =	307.7960, 5159.113, 178.57,	0	
712 X =	307.7930, 5159.053, 179,	0	
713 X =	307.7910, 5158.993, 179.7,	0	
714 X =	307.7880, 5158.933, 184.36,	0	
715 X =	307.7850, 5158.873, 188.42,	0	
716 X =	307.7830, 5158.813, 192.38,	0	
717 X =	307.7800, 5158.753, 194.57,	0	
718 X =	307.7770, 5158.693, 196.57,	0	
719 X =	307.7750, 5158.634, 199.53,	0	
720 X =	307.7720, 5158.574, 202.5,	0	
721 X =	307.7690, 5158.514, 200.03,	0	
722 X =	307.7510, 5158.094, 205.63,	0	
723 X =	307.7480, 5158.034, 206.27,	0	
724 X =	307.7450, 5157.974, 207.44,	0	
725 X =	307.7430, 5157.914, 208.53,	0	
726 X =	307.7400, 5157.854, 209,	0	
727 X =	307.7370, 5157.794, 210.05,	0	
728 X =	307.7350, 5157.734, 210.61,	0	
729 X =	307.7320, 5157.675, 211,	0	
730 X =	307.7290, 5157.615, 211.82,	0	
731 X =	307.7270, 5157.555, 212.28,	0	
732 X =	307.7240, 5157.495, 213,	0	
733 X =	307.7210, 5157.435, 213,	0	
734 X =	307.7190, 5157.375, 212.15,	0	
735 X =	307.7160, 5157.315, 212,	0	
736 X =	307.7130, 5157.255, 213.45,	0	
737 X =	307.8800, 5159.65, 182,	0	
738 X =	307.8770, 5159.59, 182,	0	
739 X =	307.8750, 5159.53, 183,	0	
740 X =	307.8720, 5159.47, 184.67,	0	
741 X =	307.8690, 5159.41, 185,	0	
742 X =	307.8670, 5159.35, 182.67,	0	
743 X =	307.8640, 5159.29, 181.29,	0	
744 X =	307.8610, 5159.23, 179.33,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
745 X =	307.8590, 5159.17, 179.33,	0	
746 X =	307.8560, 5159.11, 179,	0	
747 X =	307.8530, 5159.05, 179,	0	
748 X =	307.8510, 5158.991, 179.63,	0	
749 X =	307.8480, 5158.931, 183.52,	0	
750 X =	307.8450, 5158.871, 188.27,	0	
751 X =	307.8430, 5158.811, 191.99,	0	
752 X =	307.8400, 5158.751, 194.3,	0	
753 X =	307.8370, 5158.691, 196.63,	0	
754 X =	307.8350, 5158.631, 200.1,	0	
755 X =	307.8110, 5158.091, 205,	0	
756 X =	307.8080, 5158.031, 205.63,	0	
757 X =	307.8050, 5157.972, 206.6,	0	
758 X =	307.8030, 5157.912, 208,	0	
759 X =	307.8000, 5157.852, 209,	0	
760 X =	307.7970, 5157.792, 210.06,	0	
761 X =	307.7950, 5157.732, 211,	0	
762 X =	307.7920, 5157.672, 212,	0	
763 X =	307.7890, 5157.612, 212,	0	
764 X =	307.7860, 5157.552, 213,	0	
765 X =	307.7840, 5157.492, 213,	0	
766 X =	307.7810, 5157.432, 213,	0	
767 X =	307.7780, 5157.372, 212.29,	0	
768 X =	307.7760, 5157.312, 212,	0	
769 X =	307.7730, 5157.252, 212.6,	0	
770 X =	307.9400, 5159.647, 182,	0	
771 X =	307.9370, 5159.587, 182,	0	
772 X =	307.9350, 5159.527, 182.77,	0	
773 X =	307.9320, 5159.467, 184,	0	
774 X =	307.9290, 5159.407, 185,	0	
775 X =	307.9270, 5159.347, 183.18,	0	
776 X =	307.9240, 5159.288, 180.27,	0	
777 X =	307.9210, 5159.228, 179,	0	
778 X =	307.9190, 5159.168, 179,	0	
779 X =	307.9160, 5159.108, 178.36,	0	
780 X =	307.9130, 5159.048, 178.8,	0	
781 X =	307.9110, 5158.988, 179.73,	0	
782 X =	307.9080, 5158.928, 183.03,	0	
783 X =	307.9050, 5158.868, 187.97,	0	
784 X =	307.9030, 5158.808, 190.57,	0	
785 X =	307.9000, 5158.748, 193.22,	0	
786 X =	307.8680, 5158.029, 205.7,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
787 X =	307.8650, 5157.969, 206.7,	0	
788 X =	307.8620, 5157.909, 208,	0	
789 X =	307.8600, 5157.849, 209,	0	
790 X =	307.8570, 5157.789, 210,	0	
791 X =	307.8540, 5157.729, 210.7,	0	
792 X =	307.8520, 5157.669, 211,	0	
793 X =	307.8490, 5157.609, 211.89,	0	
794 X =	307.8460, 5157.549, 212.37,	0	
795 X =	307.8440, 5157.489, 213,	0	
796 X =	307.8410, 5157.429, 212.3,	0	
797 X =	307.8380, 5157.369, 211.22,	0	
798 X =	307.8360, 5157.31, 210.67,	0	
799 X =	307.8330, 5157.249, 211.5,	0	
800 X =	308.0000, 5159.645, 182,	0	
801 X =	307.9970, 5159.585, 182,	0	
802 X =	307.9950, 5159.525, 182.83,	0	
803 X =	307.9920, 5159.465, 184,	0	
804 X =	307.9890, 5159.405, 184.75,	0	
805 X =	307.9870, 5159.345, 182.17,	0	
806 X =	307.9840, 5159.285, 180.17,	0	
807 X =	307.9810, 5159.225, 179.13,	0	
808 X =	307.9790, 5159.165, 178.17,	0	
809 X =	307.9760, 5159.105, 178,	0	
810 X =	307.9730, 5159.045, 178.83,	0	
811 X =	307.9710, 5158.985, 179.95,	0	
812 X =	307.9680, 5158.925, 182.83,	0	
813 X =	307.9650, 5158.865, 187.17,	0	
814 X =	307.9630, 5158.805, 189.83,	0	
815 X =	307.9280, 5158.026, 205.8,	0	
816 X =	307.9250, 5157.966, 206.8,	0	
817 X =	307.9220, 5157.906, 208,	0	
818 X =	307.9200, 5157.846, 209,	0	
819 X =	307.9170, 5157.786, 210,	0	
820 X =	307.9140, 5157.726, 210.16,	0	
821 X =	307.9120, 5157.666, 211,	0	
822 X =	307.9090, 5157.607, 212,	0	
823 X =	307.9060, 5157.547, 213.77,	0	
824 X =	307.9040, 5157.487, 214.77,	0	
825 X =	307.9010, 5157.427, 213.23,	0	
826 X =	307.8980, 5157.367, 211.23,	0	
827 X =	307.8960, 5157.307, 208.43,	0	
828 X =	307.8930, 5157.247, 209.77,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
829 X =	308.0600, 5159.642, 182.93,	0	
830 X =	308.0570, 5159.582, 182,	0	
831 X =	308.0550, 5159.522, 182,	0	
832 X =	308.0520, 5159.462, 183,	0	
833 X =	308.0490, 5159.402, 183.7,	0	
834 X =	308.0470, 5159.342, 182.07,	0	
835 X =	308.0440, 5159.282, 180.07,	0	
836 X =	308.0410, 5159.222, 178.1,	0	
837 X =	308.0390, 5159.162, 178,	0	
838 X =	308.0360, 5159.102, 177.88,	0	
839 X =	308.0330, 5159.042, 178.93,	0	
840 X =	308.0310, 5158.982, 180,	0	
841 X =	308.0280, 5158.923, 182.84,	0	
842 X =	308.0250, 5158.863, 185.9,	0	
843 X =	307.9880, 5158.023, 205.9,	0	
844 X =	307.9850, 5157.964, 206.87,	0	
845 X =	307.9820, 5157.904, 208,	0	
846 X =	307.9800, 5157.844, 209,	0	
847 X =	307.9770, 5157.784, 210,	0	
848 X =	307.9740, 5157.724, 210,	0	
849 X =	307.9720, 5157.664, 211,	0	
850 X =	307.9690, 5157.604, 212,	0	
851 X =	307.9660, 5157.544, 213.4,	0	
852 X =	307.9640, 5157.484, 214.46,	0	
853 X =	307.9610, 5157.424, 213.13,	0	
854 X =	307.9580, 5157.364, 211.13,	0	
855 X =	307.9560, 5157.304, 209.13,	0	
856 X =	307.9530, 5157.244, 209,	0	
857 X =	308.1200, 5159.639, 183,	0	
858 X =	308.1170, 5159.579, 182,	0	
859 X =	308.1150, 5159.519, 182.02,	0	
860 X =	308.1120, 5159.459, 182.99,	0	
861 X =	308.1090, 5159.399, 182.99,	0	
862 X =	308.1060, 5159.339, 181.77,	0	
863 X =	308.1040, 5159.28, 180,	0	
864 X =	308.1010, 5159.22, 179,	0	
865 X =	308.0980, 5159.16, 178,	0	
866 X =	308.0960, 5159.1, 178,	0	
867 X =	308.0930, 5159.04, 179,	0	
868 X =	308.0900, 5158.98, 180,	0	
869 X =	308.0880, 5158.92, 184,	0	
870 X =	308.0850, 5158.86, 187,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
871 X =	308.0450, 5157.961, 206.97,	0	
872 X =	308.0420, 5157.901, 208,	0	
873 X =	308.0400, 5157.841, 209,	0	
874 X =	308.0370, 5157.781, 210,	0	
875 X =	308.0340, 5157.721, 210.8,	0	
876 X =	308.0320, 5157.661, 211.71,	0	
877 X =	308.0290, 5157.601, 211.99,	0	
878 X =	308.0260, 5157.541, 212.45,	0	
879 X =	308.0240, 5157.481, 212.53,	0	
880 X =	308.0210, 5157.421, 211.67,	0	
881 X =	308.0180, 5157.361, 210.74,	0	
882 X =	308.0160, 5157.301, 209.03,	0	
883 X =	308.0130, 5157.241, 209,	0	
884 X =	308.1800, 5159.636, 183,	0	
885 X =	308.1770, 5159.577, 181.94,	0	
886 X =	308.1740, 5159.517, 181.58,	0	
887 X =	308.1720, 5159.457, 182,	0	
888 X =	308.1690, 5159.397, 182.63,	0	
889 X =	308.1660, 5159.337, 180.98,	0	
890 X =	308.1640, 5159.277, 179.91,	0	
891 X =	308.1610, 5159.217, 179,	0	
892 X =	308.1580, 5159.157, 178.1,	0	
893 X =	308.1560, 5159.097, 177.91,	0	
894 X =	308.1530, 5159.037, 179.1,	0	
895 X =	308.1500, 5158.977, 180.2,	0	
896 X =	308.1480, 5158.917, 183.56,	0	
897 X =	308.1450, 5158.857, 187.05,	0	
898 X =	308.1050, 5157.958, 206.06,	0	
899 X =	308.1020, 5157.898, 208,	0	
900 X =	308.1000, 5157.838, 209,	0	
901 X =	308.0970, 5157.778, 210.01,	0	
902 X =	308.0940, 5157.718, 210.27,	0	
903 X =	308.0920, 5157.658, 211.27,	0	
904 X =	308.0890, 5157.599, 211.39,	0	
905 X =	308.0860, 5157.539, 212,	0	
906 X =	308.0840, 5157.479, 212,	0	
907 X =	308.0810, 5157.419, 211,	0	
908 X =	308.0780, 5157.359, 210,	0	
909 X =	308.0750, 5157.299, 209,	0	
910 X =	308.0730, 5157.239, 209,	0	
911 X =	308.2400, 5159.634, 183,	0	
912 X =	308.2370, 5159.574, 181.8,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
913 X =	308.2340, 5159.514, 181,	0	
914 X =	308.2320, 5159.454, 181.52,	0	
915 X =	308.2290, 5159.394, 181.56,	0	
916 X =	308.2260, 5159.334, 180.64,	0	
917 X =	308.2240, 5159.274, 178.8,	0	
918 X =	308.2210, 5159.214, 178.97,	0	
919 X =	308.2180, 5159.154, 178.25,	0	
920 X =	308.2160, 5159.094, 178,	0	
921 X =	308.2130, 5159.034, 179.05,	0	
922 X =	308.2100, 5158.974, 180.27,	0	
923 X =	308.2080, 5158.915, 182.73,	0	
924 X =	308.2050, 5158.855, 186.17,	0	
925 X =	308.1620, 5157.896, 205,	0	
926 X =	308.1600, 5157.836, 206.13,	0	
927 X =	308.1570, 5157.776, 207.32,	0	
928 X =	308.1540, 5157.716, 209.31,	0	
929 X =	308.1510, 5157.656, 210.3,	0	
930 X =	308.1490, 5157.596, 211.05,	0	
931 X =	308.1460, 5157.536, 211.54,	0	
932 X =	308.1430, 5157.476, 212,	0	
933 X =	308.1410, 5157.416, 211,	0	
934 X =	308.1380, 5157.356, 210,	0	
935 X =	308.1350, 5157.296, 209.17,	0	
936 X =	308.1330, 5157.236, 209.22,	0	
937 X =	308.3000, 5159.631, 182.7,	0	
938 X =	308.2970, 5159.571, 181.7,	0	
939 X =	308.2940, 5159.511, 181,	0	
940 X =	308.2920, 5159.451, 181.7,	0	
941 X =	308.2890, 5159.391, 181.49,	0	
942 X =	308.2860, 5159.331, 179.7,	0	
943 X =	308.2840, 5159.271, 177.7,	0	
944 X =	308.2810, 5159.212, 177.27,	0	
945 X =	308.2780, 5159.152, 178.27,	0	
946 X =	308.2760, 5159.092, 178.23,	0	
947 X =	308.2730, 5159.032, 178.62,	0	
948 X =	308.2700, 5158.972, 179.36,	0	
949 X =	308.2680, 5158.912, 181.77,	0	
950 X =	308.2650, 5158.852, 184.77,	0	
951 X =	308.2220, 5157.893, 205,	0	
952 X =	308.2190, 5157.833, 205.23,	0	
953 X =	308.2170, 5157.773, 207,	0	
954 X =	308.2140, 5157.713, 208,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
955 X =	308.2110, 5157.653, 209.23,	0	
956 X =	308.2090, 5157.593, 210,	0	
957 X =	308.2060, 5157.533, 211,	0	
958 X =	308.2030, 5157.473, 212,	0	
959 X =	308.2010, 5157.413, 212,	0	
960 X =	308.1980, 5157.353, 212,	0	
961 X =	308.1950, 5157.293, 212,	0	
962 X =	308.1930, 5157.233, 212,	0	
963 X =	308.3600, 5159.628, 182.6,	0	
964 X =	308.3570, 5159.569, 181.63,	0	
965 X =	308.3540, 5159.509, 181,	0	
966 X =	308.3520, 5159.449, 181,	0	
967 X =	308.3490, 5159.389, 180.63,	0	
968 X =	308.3460, 5159.329, 178.83,	0	
969 X =	308.3440, 5159.269, 177.77,	0	
970 X =	308.3410, 5159.209, 177.67,	0	
971 X =	308.3380, 5159.149, 178.02,	0	
972 X =	308.3360, 5159.089, 178,	0	
973 X =	308.3330, 5159.029, 177.87,	0	
974 X =	308.3300, 5158.969, 178.37,	0	
975 X =	308.3280, 5158.909, 180.51,	0	
976 X =	308.3250, 5158.849, 182.87,	0	
977 X =	308.2820, 5157.89, 205,	0	
978 X =	308.2790, 5157.83, 205.33,	0	
979 X =	308.2770, 5157.77, 207,	0	
980 X =	308.2740, 5157.71, 208,	0	
981 X =	308.2710, 5157.65, 209.1,	0	
982 X =	308.2690, 5157.59, 210,	0	
983 X =	308.2660, 5157.531, 211,	0	
984 X =	308.2630, 5157.471, 212,	0	
985 X =	308.2610, 5157.411, 212,	0	
986 X =	308.2580, 5157.351, 211.73,	0	
987 X =	308.2550, 5157.291, 211.83,	0	
988 X =	308.2530, 5157.23, 211.93,	0	
989 X =	308.4200, 5159.626, 183.53,	0	
990 X =	308.4170, 5159.566, 182.53,	0	
991 X =	308.4140, 5159.506, 181.53,	0	
992 X =	308.4120, 5159.446, 181,	0	
993 X =	308.4090, 5159.386, 180.51,	0	
994 X =	308.4060, 5159.326, 179.63,	0	
995 X =	308.4040, 5159.266, 178.6,	0	
996 X =	308.4010, 5159.206, 177.48,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
997 X =	308.3980, 5159.146, 177,	0	
998 X =	308.3950, 5159.086, 178,	0	
999 X =	308.3930, 5159.026, 179.47,	0	
1000 X =	308.3900, 5158.966, 180,	0	
1001 X =	308.3870, 5158.906, 181,	0	
1002 X =	308.3850, 5158.847, 181,	0	
1003 X =	308.3420, 5157.888, 208,	0	
1004 X =	308.3390, 5157.828, 208,	0	
1005 X =	308.3370, 5157.768, 208,	0	
1006 X =	308.3340, 5157.708, 208.4,	0	
1007 X =	308.3310, 5157.648, 209,	0	
1008 X =	308.3290, 5157.588, 210,	0	
1009 X =	308.3260, 5157.528, 211,	0	
1010 X =	308.3230, 5157.468, 212,	0	
1011 X =	308.3210, 5157.408, 212,	0	
1012 X =	308.3180, 5157.348, 211,	0	
1013 X =	308.3150, 5157.288, 211,	0	
1014 X =	308.3130, 5157.228, 212,	0	
1015 X =	308.4800, 5159.623, 182.48,	0	
1016 X =	308.4770, 5159.563, 181.62,	0	
1017 X =	308.4740, 5159.503, 180.74,	0	
1018 X =	308.4710, 5159.443, 180.63,	0	
1019 X =	308.4690, 5159.383, 180,	0	
1020 X =	308.4660, 5159.323, 179.8,	0	
1021 X =	308.4630, 5159.263, 178.9,	0	
1022 X =	308.4610, 5159.204, 178,	0	
1023 X =	308.4580, 5159.144, 178,	0	
1024 X =	308.4550, 5159.084, 178,	0	
1025 X =	308.4530, 5159.024, 178.23,	0	
1026 X =	308.4500, 5158.964, 178.33,	0	
1027 X =	308.4470, 5158.904, 178.43,	0	
1028 X =	308.4450, 5158.844, 179.27,	0	
1029 X =	308.4020, 5157.885, 208,	0	
1030 X =	308.3990, 5157.825, 208,	0	
1031 X =	308.3970, 5157.765, 208,	0	
1032 X =	308.3940, 5157.705, 208.5,	0	
1033 X =	308.3910, 5157.645, 209,	0	
1034 X =	308.3890, 5157.585, 209.5,	0	
1035 X =	308.3860, 5157.525, 211,	0	
1036 X =	308.3830, 5157.465, 212,	0	
1037 X =	308.3810, 5157.405, 213,	0	
1038 X =	308.3780, 5157.345, 213,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
1039	X = 308.3750, 5157.285, 214,	0	
1040	X = 308.3730, 5157.225, 214.05,	0	
1041	X = 308.5390, 5159.62, 180,	0	
1042	X = 308.5370, 5159.56, 179.43,	0	
1043	X = 308.5340, 5159.501, 179.7,	0	
1044	X = 308.5310, 5159.441, 179.23,	0	
1045	X = 308.5290, 5159.381, 179,	0	
1046	X = 308.5260, 5159.321, 178.8,	0	
1047	X = 308.5230, 5159.261, 178,	0	
1048	X = 308.5210, 5159.201, 178,	0	
1049	X = 308.5180, 5159.141, 178,	0	
1050	X = 308.5150, 5159.081, 178,	0	
1051	X = 308.5130, 5159.021, 178,	0	
1052	X = 308.5100, 5158.961, 177.37,	0	
1053	X = 308.5070, 5158.901, 177.79,	0	
1054	X = 308.5050, 5158.841, 178,	0	
1055	X = 308.5020, 5158.781, 180,	0	
1056	X = 308.4990, 5158.721, 182.27,	0	
1057	X = 308.4970, 5158.661, 185.27,	0	
1058	X = 308.4940, 5158.601, 188.63,	0	
1059	X = 308.4910, 5158.542, 190.6,	0	
1060	X = 308.4890, 5158.482, 192.63,	0	
1061	X = 308.4860, 5158.422, 194.6,	0	
1062	X = 308.4830, 5158.362, 197.2,	0	
1063	X = 308.4810, 5158.302, 201.2,	0	
1064	X = 308.4780, 5158.242, 205.2,	0	
1065	X = 308.4620, 5157.882, 208.04,	0	
1066	X = 308.4590, 5157.822, 208,	0	
1067	X = 308.4570, 5157.762, 208.9,	0	
1068	X = 308.4540, 5157.702, 208.92,	0	
1069	X = 308.4510, 5157.642, 209,	0	
1070	X = 308.4490, 5157.582, 209.6,	0	
1071	X = 308.4460, 5157.523, 211,	0	
1072	X = 308.4430, 5157.463, 212,	0	
1073	X = 308.4400, 5157.403, 213,	0	
1074	X = 308.4380, 5157.343, 214,	0	
1075	X = 308.4350, 5157.283, 214.57,	0	
1076	X = 308.4320, 5157.222, 215,	0	
1077	X = 308.5990, 5159.618, 179,	0	
1078	X = 308.5970, 5159.558, 178.43,	0	
1079	X = 308.5940, 5159.498, 179,	0	
1080	X = 308.5910, 5159.438, 179,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
1081 X =	308.5890, 5159.378, 179,	0	
1082 X =	308.5860, 5159.318, 178,	0	
1083 X =	308.5830, 5159.258, 178,	0	
1084 X =	308.5810, 5159.198, 178,	0	
1085 X =	308.5780, 5159.138, 178,	0	
1086 X =	308.5750, 5159.078, 178,	0	
1087 X =	308.5730, 5159.018, 177,	0	
1088 X =	308.5700, 5158.958, 177,	0	
1089 X =	308.5670, 5158.898, 176.85,	0	
1090 X =	308.5650, 5158.839, 177.35,	0	
1091 X =	308.5620, 5158.779, 179.3,	0	
1092 X =	308.5590, 5158.719, 181.4,	0	
1093 X =	308.5570, 5158.659, 185.03,	0	
1094 X =	308.5540, 5158.599, 188.66,	0	
1095 X =	308.5510, 5158.539, 190.7,	0	
1096 X =	308.5490, 5158.479, 192.7,	0	
1097 X =	308.5460, 5158.419, 194.7,	0	
1098 X =	308.5430, 5158.359, 197.4,	0	
1099 X =	308.5410, 5158.299, 201.4,	0	
1100 X =	308.5380, 5158.239, 205.4,	0	
1101 X =	308.5350, 5158.179, 208.7,	0	
1102 X =	308.5330, 5158.119, 208,	0	
1103 X =	308.5300, 5158.059, 207,	0	
1104 X =	308.5270, 5157.999, 206,	0	
1105 X =	308.5250, 5157.939, 207,	0	
1106 X =	308.5220, 5157.879, 208.7,	0	
1107 X =	308.5190, 5157.82, 209.67,	0	
1108 X =	308.5160, 5157.76, 209.42,	0	
1109 X =	308.5140, 5157.7, 209.07,	0	
1110 X =	308.5110, 5157.64, 208.53,	0	
1111 X =	308.5080, 5157.58, 209.07,	0	
1112 X =	308.5060, 5157.52, 210.67,	0	
1113 X =	308.5030, 5157.46, 211.86,	0	
1114 X =	308.5000, 5157.4, 213,	0	
1115 X =	308.4980, 5157.34, 214,	0	
1116 X =	308.4950, 5157.28, 214.67,	0	
1117 X =	308.4920, 5157.22, 215,	0	
1118 X =	308.6590, 5159.615, 178,	0	
1119 X =	308.6570, 5159.555, 178,	0	
1120 X =	308.6540, 5159.495, 178.53,	0	
1121 X =	308.6510, 5159.435, 178.94,	0	
1122 X =	308.6490, 5159.375, 179,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
1123 X =	308.6460, 5159.315, 178.03,	0	
1124 X =	308.6430, 5159.255, 178,	0	
1125 X =	308.6410, 5159.195, 178,	0	
1126 X =	308.6380, 5159.136, 178,	0	
1127 X =	308.6350, 5159.076, 177.03,	0	
1128 X =	308.6330, 5159.016, 176.2,	0	
1129 X =	308.6300, 5158.956, 175.47,	0	
1130 X =	308.6270, 5158.896, 175.09,	0	
1131 X =	308.6250, 5158.836, 175.9,	0	
1132 X =	308.6220, 5158.776, 177.72,	0	
1133 X =	308.6190, 5158.716, 180.36,	0	
1134 X =	308.6170, 5158.656, 184.17,	0	
1135 X =	308.6140, 5158.596, 188.47,	0	
1136 X =	308.6110, 5158.536, 190.8,	0	
1137 X =	308.6090, 5158.476, 192.03,	0	
1138 X =	308.6060, 5158.416, 193.93,	0	
1139 X =	308.6030, 5158.356, 195.83,	0	
1140 X =	308.6000, 5158.296, 199.93,	0	
1141 X =	308.5980, 5158.236, 204.48,	0	
1142 X =	308.5950, 5158.177, 207.77,	0	
1143 X =	308.5920, 5158.117, 207.23,	0	
1144 X =	308.5900, 5158.057, 207,	0	
1145 X =	308.5870, 5157.997, 206,	0	
1146 X =	308.5840, 5157.937, 207,	0	
1147 X =	308.5820, 5157.877, 208.77,	0	
1148 X =	308.5790, 5157.817, 209.77,	0	
1149 X =	308.5760, 5157.757, 209.23,	0	
1150 X =	308.5740, 5157.697, 209,	0	
1151 X =	308.5710, 5157.637, 208.23,	0	
1152 X =	308.5680, 5157.577, 208.77,	0	
1153 X =	308.5660, 5157.517, 210.77,	0	
1154 X =	308.5630, 5157.457, 211.77,	0	
1155 X =	308.5600, 5157.397, 213,	0	
1156 X =	308.5580, 5157.337, 213.94,	0	
1157 X =	308.5550, 5157.277, 214.64,	0	
1158 X =	308.5520, 5157.217, 214.93,	0	
1159 X =	308.7190, 5159.612, 177,	0	
1160 X =	308.7170, 5159.552, 177,	0	
1161 X =	308.7140, 5159.493, 178,	0	
1162 X =	308.7110, 5159.433, 178,	0	
1163 X =	308.7090, 5159.373, 179,	0	
1164 X =	308.7060, 5159.313, 178.1,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
1165 X =	308.7030, 5159.253, 178,	0	
1166 X =	308.7010, 5159.193, 178,	0	
1167 X =	308.6980, 5159.133, 178,	0	
1168 X =	308.6950, 5159.073, 177.83,	0	
1169 X =	308.6930, 5159.013, 176.87,	0	
1170 X =	308.6900, 5158.953, 175.57,	0	
1171 X =	308.6870, 5158.893, 174,	0	
1172 X =	308.6840, 5158.833, 175.9,	0	
1173 X =	308.6820, 5158.773, 177.5,	0	
1174 X =	308.6790, 5158.713, 180.5,	0	
1175 X =	308.6760, 5158.653, 183.78,	0	
1176 X =	308.6740, 5158.593, 187.8,	0	
1177 X =	308.6710, 5158.533, 190.9,	0	
1178 X =	308.6680, 5158.474, 191.87,	0	
1179 X =	308.6660, 5158.414, 193,	0	
1180 X =	308.6630, 5158.354, 195.73,	0	
1181 X =	308.6600, 5158.294, 199.73,	0	
1182 X =	308.6580, 5158.234, 203.73,	0	
1183 X =	308.6550, 5158.174, 207.87,	0	
1184 X =	308.6520, 5158.114, 207.13,	0	
1185 X =	308.6500, 5158.054, 207,	0	
1186 X =	308.6470, 5157.994, 206,	0	
1187 X =	308.6440, 5157.934, 207,	0	
1188 X =	308.6420, 5157.874, 208,	0	
1189 X =	308.6390, 5157.814, 209.87,	0	
1190 X =	308.6360, 5157.754, 209.13,	0	
1191 X =	308.6340, 5157.694, 208.31,	0	
1192 X =	308.6310, 5157.634, 207.43,	0	
1193 X =	308.6280, 5157.574, 208.27,	0	
1194 X =	308.6260, 5157.514, 209.93,	0	
1195 X =	308.6230, 5157.455, 211.83,	0	
1196 X =	308.6200, 5157.395, 213,	0	
1197 X =	308.6180, 5157.335, 213,	0	
1198 X =	308.6150, 5157.275, 212.14,	0	
1199 X =	308.6120, 5157.214, 212,	0	
1200 X =	308.7790, 5159.61, 177,	0	
1201 X =	308.7770, 5159.55, 177,	0	
1202 X =	308.7740, 5159.49, 178,	0	
1203 X =	308.7710, 5159.43, 178,	0	
1204 X =	308.7690, 5159.37, 179,	0	
1205 X =	308.7660, 5159.31, 178,	0	
1206 X =	308.7630, 5159.25, 178,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
1207 X =	308.7600, 5159.19, 178,	0	
1208 X =	308.7580, 5159.13, 178,	0	
1209 X =	308.7550, 5159.07, 178,	0	
1210 X =	308.7520, 5159.01, 178,	0	
1211 X =	308.7500, 5158.95, 174,	0	
1212 X =	308.7470, 5158.89, 174,	0	
1213 X =	308.7440, 5158.831, 175.95,	0	
1214 X =	308.7420, 5158.771, 176.97,	0	
1215 X =	308.7390, 5158.711, 178.96,	0	
1216 X =	308.7360, 5158.651, 183.89,	0	
1217 X =	308.7340, 5158.591, 187.93,	0	
1218 X =	308.7310, 5158.531, 190.97,	0	
1219 X =	308.7280, 5158.471, 192.9,	0	
1220 X =	308.7260, 5158.411, 194.83,	0	
1221 X =	308.7230, 5158.351, 197.47,	0	
1222 X =	308.7200, 5158.291, 200.62,	0	
1223 X =	308.7180, 5158.231, 204.92,	0	
1224 X =	308.7150, 5158.171, 207.97,	0	
1225 X =	308.7120, 5158.111, 207.03,	0	
1226 X =	308.7100, 5158.051, 207,	0	
1227 X =	308.7070, 5157.991, 206,	0	
1228 X =	308.7040, 5157.931, 207,	0	
1229 X =	308.7020, 5157.871, 208,	0	
1230 X =	308.6990, 5157.812, 209.93,	0	
1231 X =	308.6960, 5157.752, 209.07,	0	
1232 X =	308.6940, 5157.692, 208.07,	0	
1233 X =	308.6910, 5157.632, 207.02,	0	
1234 X =	308.6880, 5157.572, 207.33,	0	
1235 X =	308.6860, 5157.512, 209.4,	0	
1236 X =	308.6830, 5157.452, 211.9,	0	
1237 X =	308.6800, 5157.392, 213,	0	
1238 X =	308.6780, 5157.332, 212,	0	
1239 X =	308.6750, 5157.272, 211.06,	0	
1240 X =	308.6720, 5157.212, 210.93,	0	
1241 X =	308.8390, 5159.607, 176.37,	0	
1242 X =	308.8360, 5159.547, 177.05,	0	
1243 X =	308.8340, 5159.487, 178,	0	
1244 X =	308.8310, 5159.427, 178.1,	0	
1245 X =	308.8280, 5159.367, 179,	0	
1246 X =	308.8260, 5159.307, 178,	0	
1247 X =	308.8230, 5159.247, 178,	0	
1248 X =	308.8200, 5159.187, 178,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
1249 X =	308.8180, 5159.128, 178,	0	
1250 X =	308.8150, 5159.068, 178,	0	
1251 X =	308.8120, 5159.008, 177.93,	0	
1252 X =	308.8100, 5158.948, 174,	0	
1253 X =	308.8070, 5158.888, 174,	0	
1254 X =	308.8040, 5158.828, 175.13,	0	
1255 X =	308.8020, 5158.768, 176.07,	0	
1256 X =	308.7990, 5158.708, 178.79,	0	
1257 X =	308.7960, 5158.648, 184.13,	0	
1258 X =	308.7940, 5158.588, 188.13,	0	
1259 X =	308.7910, 5158.528, 191.07,	0	
1260 X =	308.7880, 5158.468, 194.07,	0	
1261 X =	308.7860, 5158.408, 196.08,	0	
1262 X =	308.7830, 5158.348, 199.08,	0	
1263 X =	308.7800, 5158.288, 202.13,	0	
1264 X =	308.7780, 5158.228, 205.13,	0	
1265 X =	308.7750, 5158.168, 207.97,	0	
1266 X =	308.7720, 5158.109, 207,	0	
1267 X =	308.7700, 5158.049, 206,	0	
1268 X =	308.7670, 5157.989, 205.03,	0	
1269 X =	308.7640, 5157.929, 206.87,	0	
1270 X =	308.7620, 5157.869, 208.03,	0	
1271 X =	308.7590, 5157.809, 210,	0	
1272 X =	308.7560, 5157.749, 208.97,	0	
1273 X =	308.7540, 5157.689, 207,	0	
1274 X =	308.7510, 5157.629, 205.97,	0	
1275 X =	308.7480, 5157.569, 206.05,	0	
1276 X =	308.7460, 5157.509, 208.52,	0	
1277 X =	308.7430, 5157.449, 211.05,	0	
1278 X =	308.7400, 5157.389, 212.63,	0	
1279 X =	308.7380, 5157.329, 210.72,	0	
1280 X =	308.7350, 5157.269, 209.64,	0	
1281 X =	308.7320, 5157.209, 208.9,	0	
1282 X =	308.8990, 5159.604, 173.86,	0	
1283 X =	308.8960, 5159.544, 175.57,	0	
1284 X =	308.8940, 5159.484, 177.63,	0	
1285 X =	308.8910, 5159.425, 178.11,	0	
1286 X =	308.8880, 5159.365, 179,	0	
1287 X =	308.8860, 5159.305, 178,	0	
1288 X =	308.8830, 5159.245, 178.25,	0	
1289 X =	308.8800, 5159.185, 179,	0	
1290 X =	308.8780, 5159.125, 178.93,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
1291 X =	308.8750, 5159.065, 179,	0	
1292 X =	308.8720, 5159.005, 177.83,	0	
1293 X =	308.8700, 5158.945, 174,	0	
1294 X =	308.8670, 5158.885, 174,	0	
1295 X =	308.8640, 5158.825, 174,	0	
1296 X =	308.8620, 5158.765, 174.33,	0	
1297 X =	308.8590, 5158.705, 177.28,	0	
1298 X =	308.8560, 5158.645, 183.17,	0	
1299 X =	308.8540, 5158.585, 188.22,	0	
1300 X =	308.8510, 5158.525, 191.17,	0	
1301 X =	308.8480, 5158.466, 194.13,	0	
1302 X =	308.8460, 5158.406, 196.13,	0	
1303 X =	308.8430, 5158.346, 199.27,	0	
1304 X =	308.8400, 5158.286, 202.27,	0	
1305 X =	308.8380, 5158.226, 206.13,	0	
1306 X =	308.8350, 5158.166, 208.87,	0	
1307 X =	308.8320, 5158.106, 207.87,	0	
1308 X =	308.8300, 5158.046, 206,	0	
1309 X =	308.8270, 5157.986, 205.13,	0	
1310 X =	308.8240, 5157.926, 206.13,	0	
1311 X =	308.8220, 5157.866, 208.13,	0	
1312 X =	308.8190, 5157.806, 209.13,	0	
1313 X =	308.8160, 5157.746, 208.87,	0	
1314 X =	308.8140, 5157.686, 207,	0	
1315 X =	308.8110, 5157.626, 205.87,	0	
1316 X =	308.8080, 5157.566, 206.05,	0	
1317 X =	308.8050, 5157.506, 207.57,	0	
1318 X =	308.8030, 5157.447, 209.23,	0	
1319 X =	308.8000, 5157.387, 210.23,	0	
1320 X =	308.7970, 5157.327, 208.67,	0	
1321 X =	308.7950, 5157.267, 206.98,	0	
1322 X =	308.7920, 5157.206, 206.26,	0	
1323 X =	308.9590, 5159.602, 171,	0	
1324 X =	308.9560, 5159.542, 173.73,	0	
1325 X =	308.9540, 5159.482, 176.53,	0	
1326 X =	308.9510, 5159.422, 178,	0	
1327 X =	308.9480, 5159.362, 178.27,	0	
1328 X =	308.9460, 5159.302, 178.27,	0	
1329 X =	308.9430, 5159.242, 179,	0	
1330 X =	308.9400, 5159.182, 179.27,	0	
1331 X =	308.9380, 5159.122, 179.73,	0	
1332 X =	308.9350, 5159.062, 178.73,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
1333 X =	308.9320, 5159.002, 177.2,	0	
1334 X =	308.9300, 5158.942, 175.33,	0	
1335 X =	308.9270, 5158.882, 174.17,	0	
1336 X =	308.9240, 5158.822, 173.53,	0	
1337 X =	308.9220, 5158.763, 173.6,	0	
1338 X =	308.9190, 5158.703, 175.17,	0	
1339 X =	308.9160, 5158.643, 181.5,	0	
1340 X =	308.9140, 5158.583, 187.57,	0	
1341 X =	308.9110, 5158.523, 191.23,	0	
1342 X =	308.9080, 5158.463, 193.52,	0	
1343 X =	308.9060, 5158.403, 196.23,	0	
1344 X =	308.9030, 5158.343, 198.47,	0	
1345 X =	308.9000, 5158.283, 201.13,	0	
1346 X =	308.8980, 5158.223, 204.13,	0	
1347 X =	308.8950, 5158.163, 206.5,	0	
1348 X =	308.8920, 5158.103, 205.97,	0	
1349 X =	308.8890, 5158.043, 205.24,	0	
1350 X =	308.8870, 5157.983, 204.82,	0	
1351 X =	308.8840, 5157.923, 206.1,	0	
1352 X =	308.8810, 5157.863, 207.23,	0	
1353 X =	308.8790, 5157.803, 209.23,	0	
1354 X =	308.8760, 5157.744, 208.8,	0	
1355 X =	308.8730, 5157.684, 207,	0	
1356 X =	308.8710, 5157.624, 205.8,	0	
1357 X =	308.8680, 5157.564, 205.52,	0	
1358 X =	308.8650, 5157.504, 206.6,	0	
1359 X =	308.8630, 5157.444, 207.65,	0	
1360 X =	308.8600, 5157.384, 207.93,	0	
1361 X =	308.8570, 5157.324, 206.95,	0	
1362 X =	308.8550, 5157.264, 205.67,	0	
1363 X =	308.8520, 5157.204, 205.13,	0	
1364 X =	309.0190, 5159.599, 167.87,	0	
1365 X =	309.0160, 5159.539, 171,	0	
1366 X =	309.0140, 5159.479, 173.9,	0	
1367 X =	309.0110, 5159.419, 176.63,	0	
1368 X =	309.0080, 5159.359, 177.27,	0	
1369 X =	309.0060, 5159.299, 178,	0	
1370 X =	309.0030, 5159.239, 178.94,	0	
1371 X =	309.0000, 5159.179, 179,	0	
1372 X =	308.9980, 5159.12, 178.69,	0	
1373 X =	308.9950, 5159.06, 177.11,	0	
1374 X =	308.9920, 5159, 175.67,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
1375 X =	308.9900, 5158.94, 173.78,	0	
1376 X =	308.9870, 5158.88, 172.1,	0	
1377 X =	308.9840, 5158.82, 170.53,	0	
1378 X =	308.9820, 5158.76, 170.6,	0	
1379 X =	308.9790, 5158.7, 172.57,	0	
1380 X =	308.9760, 5158.64, 179.73,	0	
1381 X =	308.9740, 5158.58, 187,	0	
1382 X =	308.9710, 5158.52, 190.32,	0	
1383 X =	308.9680, 5158.46, 191.09,	0	
1384 X =	308.9650, 5158.4, 191.56,	0	
1385 X =	308.9630, 5158.34, 192.34,	0	
1386 X =	308.9600, 5158.28, 195,	0	
1387 X =	308.9570, 5158.22, 197.69,	0	
1388 X =	308.9550, 5158.16, 200,	0	
1389 X =	308.9520, 5158.101, 200.8,	0	
1390 X =	308.9490, 5158.041, 202.19,	0	
1391 X =	308.9470, 5157.981, 202.6,	0	
1392 X =	308.9440, 5157.921, 203.99,	0	
1393 X =	308.9410, 5157.861, 205.19,	0	
1394 X =	308.9390, 5157.801, 206.11,	0	
1395 X =	308.9360, 5157.741, 206.1,	0	
1396 X =	308.9330, 5157.681, 205.47,	0	
1397 X =	308.9310, 5157.621, 205.21,	0	
1398 X =	308.9280, 5157.561, 205.3,	0	
1399 X =	308.9250, 5157.501, 206.3,	0	
1400 X =	308.9230, 5157.441, 207.3,	0	
1401 X =	308.9200, 5157.381, 207.7,	0	
1402 X =	308.9170, 5157.321, 206.54,	0	
1403 X =	308.9150, 5157.261, 204.95,	0	
1404 X =	308.9120, 5157.201, 204.23,	0	
1405 X =	309.0790, 5159.596, 165,	0	
1406 X =	309.0760, 5159.536, 167.4,	0	
1407 X =	309.0740, 5159.476, 169.78,	0	
1408 X =	309.0710, 5159.417, 172.7,	0	
1409 X =	309.0680, 5159.357, 175.02,	0	
1410 X =	309.0660, 5159.297, 176.8,	0	
1411 X =	309.0630, 5159.237, 177.84,	0	
1412 X =	309.0600, 5159.177, 177,	0	
1413 X =	309.0580, 5159.117, 176.66,	0	
1414 X =	309.0550, 5159.057, 176.17,	0	
1415 X =	309.0520, 5158.997, 174.83,	0	
1416 X =	309.0490, 5158.937, 173.57,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
1417 X =	309.0470, 5158.877, 171.57,	0	
1418 X =	309.0440, 5158.817, 169.8,	0	
1419 X =	309.0410, 5158.757, 169.43,	0	
1420 X =	309.0390, 5158.697, 171.26,	0	
1421 X =	309.0360, 5158.637, 177.27,	0	
1422 X =	309.0330, 5158.577, 186.59,	0	
1423 X =	309.0310, 5158.517, 189.5,	0	
1424 X =	309.0280, 5158.457, 187.66,	0	
1425 X =	309.0250, 5158.398, 186.1,	0	
1426 X =	309.0230, 5158.338, 186.1,	0	
1427 X =	309.0200, 5158.278, 188.4,	0	
1428 X =	309.0170, 5158.218, 190.7,	0	
1429 X =	309.0150, 5158.158, 192.9,	0	
1430 X =	309.0120, 5158.098, 194.04,	0	
1431 X =	309.0090, 5158.038, 195.38,	0	
1432 X =	309.0070, 5157.978, 196.3,	0	
1433 X =	309.0040, 5157.918, 196.6,	0	
1434 X =	309.0010, 5157.858, 197.32,	0	
1435 X =	308.9990, 5157.798, 198.13,	0	
1436 X =	308.9960, 5157.738, 199.75,	0	
1437 X =	308.9930, 5157.678, 201.87,	0	
1438 X =	308.9910, 5157.618, 203.7,	0	
1439 X =	308.9880, 5157.558, 205.16,	0	
1440 X =	308.9850, 5157.498, 205.9,	0	
1441 X =	308.9830, 5157.438, 206.57,	0	
1442 X =	308.9800, 5157.379, 206.3,	0	
1443 X =	308.9770, 5157.319, 205.25,	0	
1444 X =	308.9750, 5157.259, 203.47,	0	
1445 X =	308.9720, 5157.198, 201.93,	0	
1446 X =	309.1390, 5159.594, 162.27,	0	
1447 X =	309.1360, 5159.534, 164,	0	
1448 X =	309.1340, 5159.474, 166.07,	0	
1449 X =	309.1310, 5159.414, 168.8,	0	
1450 X =	309.1280, 5159.354, 171,	0	
1451 X =	309.1250, 5159.294, 173.5,	0	
1452 X =	309.1230, 5159.234, 174.28,	0	
1453 X =	309.1200, 5159.174, 174,	0	
1454 X =	309.1170, 5159.114, 174.68,	0	
1455 X =	309.1150, 5159.054, 175,	0	
1456 X =	309.1120, 5158.994, 174.12,	0	
1457 X =	309.1090, 5158.934, 173.47,	0	
1458 X =	309.1070, 5158.874, 171.47,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
1459 X =	309.1040, 5158.814, 169.47,	0	
1460 X =	309.1010, 5158.755, 168,	0	
1461 X =	309.0990, 5158.695, 169.5,	0	
1462 X =	309.0960, 5158.635, 175.5,	0	
1463 X =	309.0930, 5158.575, 183.5,	0	
1464 X =	309.0910, 5158.515, 185.47,	0	
1465 X =	309.0880, 5158.455, 183.63,	0	
1466 X =	309.0850, 5158.395, 181.83,	0	
1467 X =	309.0830, 5158.335, 181.58,	0	
1468 X =	309.0800, 5158.275, 183.33,	0	
1469 X =	309.0770, 5158.215, 184.8,	0	
1470 X =	309.0750, 5158.155, 186.5,	0	
1471 X =	309.0720, 5158.095, 187.4,	0	
1472 X =	309.0690, 5158.035, 187.8,	0	
1473 X =	309.0670, 5157.975, 188.3,	0	
1474 X =	309.0640, 5157.915, 189.53,	0	
1475 X =	309.0610, 5157.855, 189.92,	0	
1476 X =	309.0590, 5157.795, 191.13,	0	
1477 X =	309.0560, 5157.736, 193.4,	0	
1478 X =	309.0530, 5157.676, 197.04,	0	
1479 X =	309.0510, 5157.616, 200.07,	0	
1480 X =	309.0480, 5157.556, 202.08,	0	
1481 X =	309.0450, 5157.496, 203,	0	
1482 X =	309.0430, 5157.436, 203.4,	0	
1483 X =	309.0400, 5157.376, 203.69,	0	
1484 X =	309.0370, 5157.316, 203.18,	0	
1485 X =	309.0350, 5157.256, 201.83,	0	
1486 X =	309.0320, 5157.196, 200.53,	0	
1487 X =	309.1990, 5159.591, 158.37,	0	
1488 X =	309.1960, 5159.531, 160.57,	0	
1489 X =	309.1930, 5159.471, 162.61,	0	
1490 X =	309.1910, 5159.411, 165.3,	0	
1491 X =	309.1880, 5159.351, 167.54,	0	
1492 X =	309.1850, 5159.291, 169.67,	0	
1493 X =	309.1830, 5159.231, 169.8,	0	
1494 X =	309.1800, 5159.171, 170,	0	
1495 X =	309.1770, 5159.111, 171.16,	0	
1496 X =	309.1750, 5159.052, 172.77,	0	
1497 X =	309.1720, 5158.992, 174,	0	
1498 X =	309.1690, 5158.932, 174,	0	
1499 X =	309.1670, 5158.872, 171.4,	0	
1500 X =	309.1640, 5158.812, 169.4,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
1501 X =	309.1610, 5158.752, 167.4,	0	
1502 X =	309.1590, 5158.692, 169.02,	0	
1503 X =	309.1560, 5158.632, 175.48,	0	
1504 X =	309.1530, 5158.572, 182.96,	0	
1505 X =	309.1510, 5158.512, 183.73,	0	
1506 X =	309.1480, 5158.452, 180.91,	0	
1507 X =	309.1450, 5158.392, 177.23,	0	
1508 X =	309.1430, 5158.332, 175.84,	0	
1509 X =	309.1400, 5158.272, 177.6,	0	
1510 X =	309.1370, 5158.212, 179.64,	0	
1511 X =	309.1350, 5158.152, 181,	0	
1512 X =	309.1320, 5158.092, 181.6,	0	
1513 X =	309.1290, 5158.033, 182.1,	0	
1514 X =	309.1270, 5157.973, 182.53,	0	
1515 X =	309.1240, 5157.913, 183.36,	0	
1516 X =	309.1210, 5157.853, 184.5,	0	
1517 X =	309.1190, 5157.793, 185.68,	0	
1518 X =	309.1160, 5157.733, 188.59,	0	
1519 X =	309.1130, 5157.673, 192.4,	0	
1520 X =	309.1110, 5157.613, 195.64,	0	
1521 X =	309.1080, 5157.553, 197.6,	0	
1522 X =	309.1050, 5157.493, 198.5,	0	
1523 X =	309.1030, 5157.433, 198.95,	0	
1524 X =	309.1000, 5157.373, 199.52,	0	
1525 X =	309.0970, 5157.313, 199.77,	0	
1526 X =	309.0940, 5157.253, 200.49,	0	
1527 X =	309.0920, 5157.193, 200.43,	0	
1528 X =	309.2590, 5159.588, 153.47,	0	
1529 X =	309.2560, 5159.528, 155.67,	0	
1530 X =	309.2530, 5159.468, 158.43,	0	
1531 X =	309.2510, 5159.409, 160.97,	0	
1532 X =	309.2480, 5159.349, 163.17,	0	
1533 X =	309.2450, 5159.289, 165.33,	0	
1534 X =	309.2430, 5159.229, 164.9,	0	
1535 X =	309.2400, 5159.169, 166,	0	
1536 X =	309.2370, 5159.109, 167.9,	0	
1537 X =	309.2350, 5159.049, 170.03,	0	
1538 X =	309.2320, 5158.989, 172.05,	0	
1539 X =	309.2290, 5158.929, 173.55,	0	
1540 X =	309.2270, 5158.869, 171.3,	0	
1541 X =	309.2240, 5158.809, 169.3,	0	
1542 X =	309.2210, 5158.749, 166.74,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
1543 X =	309.2190, 5158.689, 167.4,	0	
1544 X =	309.2160, 5158.629, 172.94,	0	
1545 X =	309.2130, 5158.569, 179.3,	0	
1546 X =	309.2110, 5158.509, 179.57,	0	
1547 X =	309.2080, 5158.449, 175.73,	0	
1548 X =	309.2050, 5158.39, 172.17,	0	
1549 X =	309.2030, 5158.33, 170.37,	0	
1550 X =	309.2000, 5158.27, 172.67,	0	
1551 X =	309.1970, 5158.21, 174.97,	0	
1552 X =	309.1950, 5158.15, 176.83,	0	
1553 X =	309.1920, 5158.09, 176.8,	0	
1554 X =	309.1890, 5158.03, 176.8,	0	
1555 X =	309.1870, 5157.97, 176.4,	0	
1556 X =	309.1840, 5157.91, 178.13,	0	
1557 X =	309.1810, 5157.85, 179.53,	0	
1558 X =	309.1780, 5157.79, 180.82,	0	
1559 X =	309.1760, 5157.73, 181.49,	0	
1560 X =	309.1730, 5157.67, 182.32,	0	
1561 X =	309.1700, 5157.61, 182.56,	0	
1562 X =	309.1680, 5157.55, 184.67,	0	
1563 X =	309.1650, 5157.49, 188.83,	0	
1564 X =	309.1620, 5157.43, 193.13,	0	
1565 X =	309.1600, 5157.371, 196.09,	0	
1566 X =	309.1570, 5157.311, 197.02,	0	
1567 X =	309.1540, 5157.251, 197.6,	0	
1568 X =	309.1520, 5157.19, 198.04,	0	
1569 X =	309.3190, 5159.586, 151.29,	0	
1570 X =	309.3160, 5159.526, 153.27,	0	
1571 X =	309.3130, 5159.466, 155.37,	0	
1572 X =	309.3110, 5159.406, 158.36,	0	
1573 X =	309.3080, 5159.346, 160.53,	0	
1574 X =	309.3050, 5159.286, 162.5,	0	
1575 X =	309.3030, 5159.226, 162.8,	0	
1576 X =	309.3000, 5159.166, 163.8,	0	
1577 X =	309.2970, 5159.106, 164.9,	0	
1578 X =	309.2950, 5159.046, 167.97,	0	
1579 X =	309.2920, 5158.986, 170.8,	0	
1580 X =	309.2890, 5158.926, 172.8,	0	
1581 X =	309.2870, 5158.866, 171.2,	0	
1582 X =	309.2840, 5158.806, 169.2,	0	
1583 X =	309.2810, 5158.746, 166.2,	0	
1584 X =	309.2790, 5158.687, 165.93,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
1585 X =	309.2760, 5158.627, 172.17,	0	
1586 X =	309.2730, 5158.567, 177.36,	0	
1587 X =	309.2710, 5158.507, 177.4,	0	
1588 X =	309.2680, 5158.447, 173.53,	0	
1589 X =	309.2650, 5158.387, 169.63,	0	
1590 X =	309.2630, 5158.327, 168,	0	
1591 X =	309.2600, 5158.267, 169.43,	0	
1592 X =	309.2570, 5158.207, 171.2,	0	
1593 X =	309.2540, 5158.147, 172.53,	0	
1594 X =	309.2520, 5158.087, 171.74,	0	
1595 X =	309.2490, 5158.027, 170.47,	0	
1596 X =	309.2460, 5157.967, 169.65,	0	
1597 X =	309.2440, 5157.907, 170.84,	0	
1598 X =	309.2410, 5157.847, 172.73,	0	
1599 X =	309.2380, 5157.787, 174.92,	0	
1600 X =	309.2360, 5157.727, 174.6,	0	
1601 X =	309.2330, 5157.668, 173.97,	0	
1602 X =	309.2300, 5157.608, 174,	0	
1603 X =	309.2280, 5157.548, 176.51,	0	
1604 X =	309.2250, 5157.488, 182.7,	0	
1605 X =	309.2220, 5157.428, 188.96,	0	
1606 X =	309.2200, 5157.368, 192.67,	0	
1607 X =	309.2170, 5157.308, 191.8,	0	
1608 X =	309.2140, 5157.248, 190.87,	0	
1609 X =	309.2120, 5157.188, 190.05,	0	
1610 X =	309.3790, 5159.583, 150.9,	0	
1611 X =	309.3760, 5159.523, 151.95,	0	
1612 X =	309.3730, 5159.463, 154.8,	0	
1613 X =	309.3710, 5159.403, 156.53,	0	
1614 X =	309.3680, 5159.343, 158.63,	0	
1615 X =	309.3650, 5159.283, 159.83,	0	
1616 X =	309.3630, 5159.223, 160.8,	0	
1617 X =	309.3600, 5159.163, 161.9,	0	
1618 X =	309.3570, 5159.103, 163,	0	
1619 X =	309.3550, 5159.044, 167.01,	0	
1620 X =	309.3520, 5158.984, 170.13,	0	
1621 X =	309.3490, 5158.924, 172.87,	0	
1622 X =	309.3470, 5158.864, 171.13,	0	
1623 X =	309.3440, 5158.804, 168.67,	0	
1624 X =	309.3410, 5158.744, 166.45,	0	
1625 X =	309.3380, 5158.684, 165.9,	0	
1626 X =	309.3360, 5158.624, 170.19,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
1627 X =	309.3330, 5158.564, 173.75,	0	
1628 X =	309.3300, 5158.504, 173.27,	0	
1629 X =	309.3280, 5158.444, 168.59,	0	
1630 X =	309.3250, 5158.384, 164.77,	0	
1631 X =	309.3220, 5158.324, 162.93,	0	
1632 X =	309.3200, 5158.264, 165.78,	0	
1633 X =	309.3170, 5158.204, 168.73,	0	
1634 X =	309.3140, 5158.144, 170.94,	0	
1635 X =	309.3120, 5158.084, 169.13,	0	
1636 X =	309.3090, 5158.025, 168.17,	0	
1637 X =	309.3060, 5157.965, 167.17,	0	
1638 X =	309.3040, 5157.905, 168.83,	0	
1639 X =	309.3010, 5157.845, 170.8,	0	
1640 X =	309.2980, 5157.785, 172.84,	0	
1641 X =	309.2960, 5157.725, 172.28,	0	
1642 X =	309.2930, 5157.665, 170.59,	0	
1643 X =	309.2900, 5157.605, 169.5,	0	
1644 X =	309.2880, 5157.545, 172.3,	0	
1645 X =	309.2850, 5157.485, 178.5,	0	
1646 X =	309.2820, 5157.425, 185.7,	0	
1647 X =	309.2800, 5157.365, 189.06,	0	
1648 X =	309.2770, 5157.305, 186.47,	0	
1649 X =	309.2740, 5157.245, 183.8,	0	
1650 X =	309.2720, 5157.185, 181.89,	0	
1651 X =	309.3780, 5159.583, 150.9,	0	
1652 X =	309.3750, 5159.523, 151.95,	0	
1653 X =	309.3730, 5159.463, 154.8,	0	
1654 X =	309.3700, 5159.403, 156.57,	0	
1655 X =	309.3670, 5159.343, 158.67,	0	
1656 X =	309.3650, 5159.283, 159.83,	0	
1657 X =	309.3620, 5159.223, 160.83,	0	
1658 X =	309.3590, 5159.163, 161.9,	0	
1659 X =	309.3570, 5159.103, 163,	0	
1660 X =	309.3540, 5159.044, 167.04,	0	
1661 X =	309.3510, 5158.984, 170.17,	0	
1662 X =	309.3490, 5158.924, 172.87,	0	
1663 X =	309.3460, 5158.864, 171.13,	0	
1664 X =	309.3430, 5158.804, 168.64,	0	
1665 X =	309.3410, 5158.744, 166.45,	0	
1666 X =	309.3380, 5158.684, 165.9,	0	
1667 X =	309.3350, 5158.624, 170.21,	0	
1668 X =	309.3330, 5158.564, 173.75,	0	

Table A-2 CALPUFF Settings

Variable	Description			IWAQM Value or Default Value	WTP Values
1669 X =	309.3300,	5158.504,	173.27,	0	
1670 X =	309.3270,	5158.444,	168.69,	0	
1671 X =	309.3250,	5158.384,	164.77,	0	
1672 X =	309.3220,	5158.324,	162.93,	0	
1673 X =	309.3190,	5158.264,	165.88,	0	
1674 X =	309.3160,	5158.204,	168.8,	0	
1675 X =	309.3140,	5158.144,	170.94,	0	
1676 X =	309.3110,	5158.084,	169.13,	0	
1677 X =	309.3080,	5158.025,	168.17,	0	
1678 X =	309.3060,	5157.965,	167.17,	0	
1679 X =	309.3030,	5157.905,	168.83,	0	
1680 X =	309.3000,	5157.845,	170.83,	0	
1681 X =	309.2980,	5157.785,	172.84,	0	
1682 X =	309.2950,	5157.725,	172.31,	0	
1683 X =	309.2920,	5157.665,	170.66,	0	
1684 X =	309.2900,	5157.605,	169.5,	0	
1685 X =	309.2870,	5157.545,	172.37,	0	
1686 X =	309.2840,	5157.485,	178.57,	0	
1687 X =	309.2820,	5157.425,	185.7,	0	
1688 X =	309.2790,	5157.365,	189.15,	0	
1689 X =	309.2760,	5157.305,	186.57,	0	
1690 X =	309.2740,	5157.245,	183.8,	0	
1691 X =	309.2720,	5157.185,	181.89,	0	
1692 X =	0.0000,	0,	0,	0	
1693 X =	0.0000,	0,	0,	0	
1694 X =	0.0000,	0,	0,	0	
1695 X =	0.0000,	0,	0,	0	
1696 X =	0.0000,	0,	0,	0	
1697 X =	0.0000,	0,	0,	0	
1698 X =	0.0000,	0,	0,	0	
1699 X =	0.0000,	0,	0,	0	
1700 X =	0.0000,	0,	0,	0	
1701 X =	0.0000,	0,	0,	0	
1702 X =	303.7950,	5138.657,	551,	0	
1703 X =	307.7920,	5138.48,	302,	0	
1704 X =	308.7910,	5138.436,	268,	0	
1705 X =	309.7900,	5138.391,	235,	0	
1706 X =	310.7890,	5138.347,	202,	0	
1707 X =	300.8420,	5139.789,	869,	0	
1708 X =	301.8410,	5139.745,	807,	0	
1709 X =	302.8400,	5139.701,	643,	0	
1710 X =	303.8390,	5139.656,	508,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
1711 X =	304.8390, 5139.612, 411,	0	
1712 X =	305.8380, 5139.568, 358,	0	
1713 X =	306.8370, 5139.523, 325,	0	
1714 X =	307.8360, 5139.479, 296,	0	
1715 X =	308.8350, 5139.435, 264,	0	
1716 X =	309.8340, 5139.391, 232,	0	
1717 X =	310.8340, 5139.346, 200,	0	
1718 X =	299.8870, 5140.832, 957,	0	
1719 X =	300.8860, 5140.788, 912,	0	
1720 X =	301.8850, 5140.744, 709,	0	
1721 X =	302.8850, 5140.7, 545,	0	
1722 X =	303.8840, 5140.655, 451,	0	
1723 X =	304.8830, 5140.611, 382,	0	
1724 X =	305.8820, 5140.567, 342,	0	
1725 X =	306.8810, 5140.523, 313,	0	
1726 X =	307.8800, 5140.478, 284,	0	
1727 X =	308.8800, 5140.434, 252,	0	
1728 X =	309.8790, 5140.39, 221,	0	
1729 X =	310.8780, 5140.346, 189,	0	
1730 X =	311.8770, 5140.301, 163,	0	
1731 X =	299.9310, 5141.832, 922,	0	
1732 X =	300.9300, 5141.787, 730,	0	
1733 X =	301.9300, 5141.743, 571,	0	
1734 X =	302.9290, 5141.699, 472,	0	
1735 X =	303.9280, 5141.655, 400,	0	
1736 X =	304.9270, 5141.61, 352,	0	
1737 X =	305.9260, 5141.566, 322,	0	
1738 X =	306.9250, 5141.522, 295,	0	
1739 X =	307.9250, 5141.477, 266,	0	
1740 X =	308.9240, 5141.433, 236,	0	
1741 X =	309.9230, 5141.389, 204,	0	
1742 X =	310.9220, 5141.345, 175,	0	
1743 X =	297.9770, 5142.919, 976,	0	
1744 X =	298.9760, 5142.875, 929,	0	
1745 X =	299.9760, 5142.831, 743,	0	
1746 X =	300.9750, 5142.787, 571,	0	
1747 X =	301.9740, 5142.742, 475,	0	
1748 X =	302.9730, 5142.698, 403,	0	
1749 X =	303.9720, 5142.654, 355,	0	
1750 X =	304.9710, 5142.609, 323,	0	
1751 X =	305.9710, 5142.565, 298,	0	
1752 X =	306.9700, 5142.521, 271,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
1753 X =	307.9690, 5142.477, 241,	0	
1754 X =	308.9680, 5142.432, 210,	0	
1755 X =	309.9670, 5142.388, 180,	0	
1756 X =	310.9660, 5142.344, 160,	0	
1757 X =	297.0220, 5143.963, 932,	0	
1758 X =	298.0210, 5143.919, 850,	0	
1759 X =	299.0210, 5143.874, 682,	0	
1760 X =	300.0200, 5143.83, 551,	0	
1761 X =	301.0190, 5143.786, 456,	0	
1762 X =	302.0180, 5143.741, 396,	0	
1763 X =	303.0170, 5143.697, 351,	0	
1764 X =	304.0170, 5143.653, 320,	0	
1765 X =	305.0160, 5143.609, 294,	0	
1766 X =	306.0150, 5143.564, 266,	0	
1767 X =	307.0140, 5143.52, 239,	0	
1768 X =	308.0130, 5143.476, 210,	0	
1769 X =	309.0120, 5143.431, 181,	0	
1770 X =	310.0120, 5143.387, 161,	0	
1771 X =	288.0730, 5145.361, 854,	0	
1772 X =	289.0730, 5145.316, 780,	0	
1773 X =	290.0720, 5145.272, 690,	0	
1774 X =	291.0710, 5145.228, 657,	0	
1775 X =	292.0700, 5145.184, 691,	0	
1776 X =	293.0700, 5145.139, 760,	0	
1777 X =	294.0690, 5145.095, 798,	0	
1778 X =	295.0680, 5145.051, 789,	0	
1779 X =	296.0670, 5145.006, 784,	0	
1780 X =	297.0670, 5144.962, 734,	0	
1781 X =	298.0660, 5144.918, 616,	0	
1782 X =	299.0650, 5144.874, 511,	0	
1783 X =	300.0640, 5144.829, 437,	0	
1784 X =	301.0630, 5144.785, 377,	0	
1785 X =	302.0620, 5144.741, 337,	0	
1786 X =	303.0620, 5144.696, 311,	0	
1787 X =	304.0610, 5144.652, 285,	0	
1788 X =	305.0600, 5144.608, 259,	0	
1789 X =	306.0590, 5144.564, 232,	0	
1790 X =	307.0580, 5144.519, 205,	0	
1791 X =	308.0570, 5144.475, 181,	0	
1792 X =	309.0570, 5144.431, 161,	0	
1793 X =	287.1180, 5146.404, 775,	0	
1794 X =	288.1180, 5146.36, 757,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
1795 X =	289.1170, 5146.316, 681,	0	
1796 X =	290.1160, 5146.271, 593,	0	
1797 X =	291.1150, 5146.227, 561,	0	
1798 X =	292.1150, 5146.183, 588,	0	
1799 X =	293.1140, 5146.139, 647,	0	
1800 X =	294.1130, 5146.094, 657,	0	
1801 X =	295.1120, 5146.05, 640,	0	
1802 X =	296.1120, 5146.006, 608,	0	
1803 X =	297.1110, 5145.961, 531,	0	
1804 X =	298.1100, 5145.917, 455,	0	
1805 X =	299.1090, 5145.873, 398,	0	
1806 X =	300.1080, 5145.828, 354,	0	
1807 X =	301.1080, 5145.784, 319,	0	
1808 X =	302.1070, 5145.74, 293,	0	
1809 X =	303.1060, 5145.696, 271,	0	
1810 X =	304.1050, 5145.651, 246,	0	
1811 X =	305.1040, 5145.607, 222,	0	
1812 X =	306.1030, 5145.563, 198,	0	
1813 X =	307.1030, 5145.518, 178,	0	
1814 X =	308.1020, 5145.474, 162,	0	
1815 X =	287.1630, 5147.404, 641,	0	
1816 X =	288.1620, 5147.359, 629,	0	
1817 X =	289.1610, 5147.315, 598,	0	
1818 X =	290.1610, 5147.271, 543,	0	
1819 X =	291.1600, 5147.226, 512,	0	
1820 X =	292.1590, 5147.182, 544,	0	
1821 X =	293.1580, 5147.138, 594,	0	
1822 X =	294.1570, 5147.093, 586,	0	
1823 X =	295.1570, 5147.049, 549,	0	
1824 X =	296.1560, 5147.005, 506,	0	
1825 X =	297.1550, 5146.961, 433,	0	
1826 X =	298.1540, 5146.916, 362,	0	
1827 X =	299.1540, 5146.872, 316,	0	
1828 X =	300.1530, 5146.828, 290,	0	
1829 X =	301.1520, 5146.783, 269,	0	
1830 X =	302.1510, 5146.739, 246,	0	
1831 X =	303.1500, 5146.695, 226,	0	
1832 X =	304.1490, 5146.65, 207,	0	
1833 X =	305.1490, 5146.606, 190,	0	
1834 X =	306.1480, 5146.562, 177,	0	
1835 X =	307.1470, 5146.518, 166,	0	
1836 X =	286.2080, 5148.447, 577,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
1837 X =	287.2070, 5148.403, 517,	0	
1838 X =	288.2060, 5148.359, 519,	0	
1839 X =	289.2060, 5148.314, 529,	0	
1840 X =	290.2050, 5148.27, 493,	0	
1841 X =	291.2040, 5148.226, 470,	0	
1842 X =	292.2030, 5148.181, 491,	0	
1843 X =	293.2030, 5148.137, 508,	0	
1844 X =	294.2020, 5148.093, 517,	0	
1845 X =	295.2010, 5148.048, 483,	0	
1846 X =	296.2000, 5148.004, 391,	0	
1847 X =	297.1990, 5147.96, 324,	0	
1848 X =	298.1990, 5147.915, 289,	0	
1849 X =	299.1980, 5147.871, 265,	0	
1850 X =	300.1970, 5147.827, 243,	0	
1851 X =	301.1960, 5147.783, 224,	0	
1852 X =	302.1950, 5147.738, 205,	0	
1853 X =	303.1950, 5147.694, 193,	0	
1854 X =	304.1940, 5147.65, 187,	0	
1855 X =	305.1930, 5147.605, 180,	0	
1856 X =	306.1920, 5147.561, 172,	0	
1857 X =	307.1910, 5147.517, 164,	0	
1858 X =	308.1900, 5147.472, 157,	0	
1859 X =	286.2520, 5149.446, 452,	0	
1860 X =	287.2510, 5149.402, 418,	0	
1861 X =	288.2510, 5149.358, 412,	0	
1862 X =	289.2500, 5149.313, 420,	0	
1863 X =	290.2490, 5149.269, 404,	0	
1864 X =	291.2480, 5149.225, 404,	0	
1865 X =	292.2480, 5149.181, 387,	0	
1866 X =	293.2470, 5149.136, 358,	0	
1867 X =	294.2460, 5149.092, 355,	0	
1868 X =	295.2450, 5149.048, 326,	0	
1869 X =	296.2450, 5149.003, 300,	0	
1870 X =	297.2440, 5148.959, 274,	0	
1871 X =	298.2430, 5148.915, 247,	0	
1872 X =	299.2420, 5148.87, 228,	0	
1873 X =	300.2410, 5148.826, 213,	0	
1874 X =	301.2410, 5148.782, 196,	0	
1875 X =	302.2400, 5148.737, 187,	0	
1876 X =	303.2390, 5148.693, 185,	0	
1877 X =	304.2380, 5148.649, 184,	0	
1878 X =	305.2370, 5148.604, 181,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
1879 X =	306.2360, 5148.56, 175,	0	
1880 X =	307.2360, 5148.516, 167,	0	
1881 X =	308.2350, 5148.472, 159,	0	
1882 X =	309.2340, 5148.427, 154,	0	
1883 X =	286.2960, 5150.446, 372,	0	
1884 X =	287.2960, 5150.401, 362,	0	
1885 X =	288.2950, 5150.357, 352,	0	
1886 X =	289.2940, 5150.313, 341,	0	
1887 X =	290.2930, 5150.268, 327,	0	
1888 X =	291.2930, 5150.224, 325,	0	
1889 X =	292.2920, 5150.18, 302,	0	
1890 X =	293.2910, 5150.135, 271,	0	
1891 X =	294.2900, 5150.091, 250,	0	
1892 X =	295.2900, 5150.047, 242,	0	
1893 X =	296.2890, 5150.002, 245,	0	
1894 X =	297.2880, 5149.958, 234,	0	
1895 X =	298.2870, 5149.914, 218,	0	
1896 X =	299.2860, 5149.87, 202,	0	
1897 X =	300.2860, 5149.825, 190,	0	
1898 X =	301.2850, 5149.781, 185,	0	
1899 X =	302.2840, 5149.737, 184,	0	
1900 X =	303.2830, 5149.692, 184,	0	
1901 X =	304.2820, 5149.648, 184,	0	
1902 X =	305.2820, 5149.604, 182,	0	
1903 X =	306.2810, 5149.559, 178,	0	
1904 X =	307.2800, 5149.515, 170,	0	
1905 X =	308.2790, 5149.471, 162,	0	
1906 X =	309.2780, 5149.426, 155,	0	
1907 X =	310.2770, 5149.382, 153,	0	
1908 X =	311.2760, 5149.338, 153,	0	
1909 X =	286.3410, 5151.445, 326,	0	
1910 X =	287.3400, 5151.401, 321,	0	
1911 X =	288.3390, 5151.356, 316,	0	
1912 X =	289.3390, 5151.312, 303,	0	
1913 X =	290.3380, 5151.268, 286,	0	
1914 X =	291.3370, 5151.223, 277,	0	
1915 X =	292.3360, 5151.179, 262,	0	
1916 X =	293.3350, 5151.135, 240,	0	
1917 X =	294.3350, 5151.09, 220,	0	
1918 X =	295.3340, 5151.046, 212,	0	
1919 X =	296.3330, 5151.002, 209,	0	
1920 X =	297.3320, 5150.957, 202,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
1921 X =	298.3320, 5150.913, 190,	0	
1922 X =	299.3310, 5150.869, 185,	0	
1923 X =	300.3300, 5150.824, 184,	0	
1924 X =	301.3290, 5150.78, 184,	0	
1925 X =	302.3280, 5150.736, 184,	0	
1926 X =	303.3280, 5150.691, 184,	0	
1927 X =	304.3270, 5150.647, 184,	0	
1928 X =	305.3260, 5150.603, 183,	0	
1929 X =	306.3250, 5150.558, 181,	0	
1930 X =	307.3240, 5150.514, 173,	0	
1931 X =	308.3230, 5150.47, 166,	0	
1932 X =	309.3220, 5150.426, 155,	0	
1933 X =	310.3220, 5150.381, 153,	0	
1934 X =	311.3210, 5150.337, 153,	0	
1935 X =	312.3200, 5150.293, 153,	0	
1936 X =	313.3190, 5150.248, 157,	0	
1937 X =	286.3850, 5152.444, 304,	0	
1938 X =	287.3840, 5152.4, 290,	0	
1939 X =	288.3840, 5152.356, 280,	0	
1940 X =	289.3830, 5152.311, 271,	0	
1941 X =	290.3820, 5152.267, 259,	0	
1942 X =	291.3810, 5152.223, 254,	0	
1943 X =	292.3810, 5152.178, 241,	0	
1944 X =	293.3800, 5152.134, 225,	0	
1945 X =	294.3790, 5152.09, 211,	0	
1946 X =	295.3780, 5152.045, 201,	0	
1947 X =	296.3770, 5152.001, 192,	0	
1948 X =	297.3770, 5151.957, 186,	0	
1949 X =	298.3760, 5151.912, 184,	0	
1950 X =	299.3750, 5151.868, 184,	0	
1951 X =	300.3740, 5151.824, 184,	0	
1952 X =	301.3730, 5151.779, 184,	0	
1953 X =	302.3730, 5151.735, 184,	0	
1954 X =	303.3720, 5151.691, 184,	0	
1955 X =	304.3710, 5151.646, 184,	0	
1956 X =	305.3700, 5151.602, 190,	0	
1957 X =	306.3690, 5151.558, 185,	0	
1958 X =	307.3680, 5151.513, 177,	0	
1959 X =	308.3680, 5151.469, 169,	0	
1960 X =	309.3670, 5151.425, 155,	0	
1961 X =	310.3660, 5151.38, 153,	0	
1962 X =	311.3650, 5151.336, 153,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
1963 X =	312.3640, 5151.292, 153,	0	
1964 X =	313.3630, 5151.247, 156,	0	
1965 X =	314.3620, 5151.203, 160,	0	
1966 X =	315.3620, 5151.159, 162,	0	
1967 X =	316.3610, 5151.114, 160,	0	
1968 X =	317.3600, 5151.07, 154,	0	
1969 X =	318.3590, 5151.026, 153,	0	
1970 X =	319.3580, 5150.981, 153,	0	
1971 X =	320.3570, 5150.937, 151,	0	
1972 X =	321.3560, 5150.893, 147,	0	
1973 X =	322.3550, 5150.848, 141,	0	
1974 X =	323.3540, 5150.804, 134,	0	
1975 X =	324.3540, 5150.76, 128,	0	
1976 X =	286.4290, 5153.443, 302,	0	
1977 X =	287.4290, 5153.399, 290,	0	
1978 X =	288.4280, 5153.355, 278,	0	
1979 X =	289.4270, 5153.31, 277,	0	
1980 X =	290.4260, 5153.266, 275,	0	
1981 X =	291.4260, 5153.222, 260,	0	
1982 X =	292.4250, 5153.177, 227,	0	
1983 X =	293.4240, 5153.133, 214,	0	
1984 X =	294.4230, 5153.089, 206,	0	
1985 X =	295.4230, 5153.044, 196,	0	
1986 X =	296.4220, 5153, 187,	0	
1987 X =	297.4210, 5152.956, 184,	0	
1988 X =	298.4200, 5152.911, 184,	0	
1989 X =	299.4190, 5152.867, 184,	0	
1990 X =	300.4190, 5152.823, 185,	0	
1991 X =	301.4180, 5152.778, 185,	0	
1992 X =	302.4170, 5152.734, 185,	0	
1993 X =	303.4160, 5152.69, 185,	0	
1994 X =	304.4150, 5152.645, 186,	0	
1995 X =	305.4140, 5152.601, 188,	0	
1996 X =	306.4140, 5152.557, 185,	0	
1997 X =	307.4130, 5152.512, 180,	0	
1998 X =	308.4120, 5152.468, 172,	0	
1999 X =	309.4110, 5152.424, 156,	0	
2000 X =	310.4100, 5152.379, 153,	0	
2001 X =	311.4090, 5152.335, 153,	0	
2002 X =	312.4090, 5152.291, 153,	0	
2003 X =	313.4080, 5152.247, 154,	0	
2004 X =	314.4070, 5152.202, 156,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
2005 X =	315.4060, 5152.158, 158,	0	
2006 X =	316.4050, 5152.114, 158,	0	
2007 X =	317.4040, 5152.069, 153,	0	
2008 X =	318.4030, 5152.025, 153,	0	
2009 X =	319.4020, 5151.981, 153,	0	
2010 X =	320.4010, 5151.936, 151,	0	
2011 X =	321.4010, 5151.892, 149,	0	
2012 X =	322.4000, 5151.848, 144,	0	
2013 X =	323.3990, 5151.803, 136,	0	
2014 X =	324.3980, 5151.759, 129,	0	
2015 X =	286.4740, 5154.443, 305,	0	
2016 X =	287.4730, 5154.398, 302,	0	
2017 X =	288.4720, 5154.354, 301,	0	
2018 X =	289.4720, 5154.31, 311,	0	
2019 X =	290.4710, 5154.265, 329,	0	
2020 X =	291.4700, 5154.221, 299,	0	
2021 X =	292.4690, 5154.177, 225,	0	
2022 X =	293.4680, 5154.132, 213,	0	
2023 X =	294.4680, 5154.088, 205,	0	
2024 X =	295.4670, 5154.044, 197,	0	
2025 X =	296.4660, 5153.999, 191,	0	
2026 X =	297.4650, 5153.955, 187,	0	
2027 X =	298.4650, 5153.911, 187,	0	
2028 X =	299.4640, 5153.866, 187,	0	
2029 X =	300.4630, 5153.822, 192,	0	
2030 X =	301.4620, 5153.778, 193,	0	
2031 X =	302.4610, 5153.733, 194,	0	
2032 X =	303.4600, 5153.689, 194,	0	
2033 X =	304.4600, 5153.645, 194,	0	
2034 X =	305.4590, 5153.6, 192,	0	
2035 X =	306.4580, 5153.556, 188,	0	
2036 X =	307.4570, 5153.512, 182,	0	
2037 X =	308.4560, 5153.467, 174,	0	
2038 X =	309.4550, 5153.423, 156,	0	
2039 X =	310.4550, 5153.379, 153,	0	
2040 X =	311.4540, 5153.334, 153,	0	
2041 X =	312.4530, 5153.29, 153,	0	
2042 X =	313.4520, 5153.246, 153,	0	
2043 X =	314.4510, 5153.201, 153,	0	
2044 X =	315.4500, 5153.157, 153,	0	
2045 X =	316.4490, 5153.113, 153,	0	
2046 X =	317.4480, 5153.068, 153,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
2047 X =	318.4480, 5153.024, 153,	0	
2048 X =	319.4470, 5152.98, 153,	0	
2049 X =	320.4460, 5152.935, 152,	0	
2050 X =	321.4450, 5152.891, 150,	0	
2051 X =	322.4440, 5152.847, 147,	0	
2052 X =	323.4430, 5152.802, 138,	0	
2053 X =	324.4420, 5152.758, 130,	0	
2054 X =	286.5180, 5155.442, 323,	0	
2055 X =	287.5170, 5155.398, 328,	0	
2056 X =	288.5170, 5155.353, 347,	0	
2057 X =	289.5160, 5155.309, 337,	0	
2058 X =	290.5150, 5155.265, 345,	0	
2059 X =	291.5140, 5155.22, 304,	0	
2060 X =	292.5140, 5155.176, 224,	0	
2061 X =	293.5130, 5155.132, 213,	0	
2062 X =	294.5120, 5155.087, 207,	0	
2063 X =	295.5110, 5155.043, 200,	0	
2064 X =	296.5100, 5154.999, 195,	0	
2065 X =	297.5100, 5154.954, 192,	0	
2066 X =	298.5090, 5154.91, 196,	0	
2067 X =	299.5080, 5154.866, 198,	0	
2068 X =	300.5070, 5154.821, 201,	0	
2069 X =	301.5060, 5154.777, 203,	0	
2070 X =	302.5060, 5154.732, 204,	0	
2071 X =	303.5050, 5154.688, 204,	0	
2072 X =	304.5040, 5154.644, 205,	0	
2073 X =	305.5030, 5154.599, 204,	0	
2074 X =	306.5020, 5154.555, 197,	0	
2075 X =	307.5010, 5154.511, 184,	0	
2076 X =	308.5010, 5154.466, 177,	0	
2077 X =	309.5000, 5154.422, 156,	0	
2078 X =	310.4990, 5154.378, 153,	0	
2079 X =	311.4980, 5154.333, 153,	0	
2080 X =	312.4970, 5154.289, 153,	0	
2081 X =	313.4960, 5154.245, 153,	0	
2082 X =	314.4950, 5154.2, 153,	0	
2083 X =	315.4950, 5154.156, 153,	0	
2084 X =	316.4940, 5154.112, 153,	0	
2085 X =	317.4930, 5154.067, 153,	0	
2086 X =	318.4920, 5154.023, 153,	0	
2087 X =	319.4910, 5153.979, 153,	0	
2088 X =	320.4900, 5153.934, 153,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
2089 X =	321.4890, 5153.89, 152,	0	
2090 X =	322.4880, 5153.846, 148,	0	
2091 X =	323.4870, 5153.801, 137,	0	
2092 X =	324.4860, 5153.757, 128,	0	
2093 X =	286.5620, 5156.441, 376,	0	
2094 X =	287.5620, 5156.397, 368,	0	
2095 X =	288.5610, 5156.353, 391,	0	
2096 X =	289.5600, 5156.308, 352,	0	
2097 X =	290.5590, 5156.264, 316,	0	
2098 X =	291.5590, 5156.219, 264,	0	
2099 X =	292.5580, 5156.175, 216,	0	
2100 X =	293.5570, 5156.131, 213,	0	
2101 X =	294.5560, 5156.086, 208,	0	
2102 X =	295.5560, 5156.042, 203,	0	
2103 X =	296.5550, 5155.998, 200,	0	
2104 X =	297.5540, 5155.953, 198,	0	
2105 X =	298.5530, 5155.909, 201,	0	
2106 X =	299.5520, 5155.865, 206,	0	
2107 X =	300.5520, 5155.82, 210,	0	
2108 X =	301.5510, 5155.776, 212,	0	
2109 X =	302.5500, 5155.732, 212,	0	
2110 X =	303.5490, 5155.687, 212,	0	
2111 X =	304.5480, 5155.643, 213,	0	
2112 X =	305.5480, 5155.599, 212,	0	
2113 X =	306.5470, 5155.554, 209,	0	
2114 X =	307.5460, 5155.51, 193,	0	
2115 X =	308.5450, 5155.466, 179,	0	
2116 X =	309.5440, 5155.421, 157,	0	
2117 X =	310.5430, 5155.377, 153,	0	
2118 X =	311.5420, 5155.333, 153,	0	
2119 X =	312.5420, 5155.288, 153,	0	
2120 X =	313.5410, 5155.244, 153,	0	
2121 X =	314.5400, 5155.2, 153,	0	
2122 X =	315.5390, 5155.155, 153,	0	
2123 X =	316.5380, 5155.111, 153,	0	
2124 X =	317.5370, 5155.067, 153,	0	
2125 X =	318.5360, 5155.022, 153,	0	
2126 X =	319.5350, 5154.978, 153,	0	
2127 X =	320.5340, 5154.934, 153,	0	
2128 X =	321.5340, 5154.889, 153,	0	
2129 X =	322.5330, 5154.845, 146,	0	
2130 X =	323.5320, 5154.8, 130,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
2131 X =	324.5310, 5154.756, 123,	0	
2132 X =	325.5300, 5154.712, 117,	0	
2133 X =	286.6070, 5157.44, 382,	0	
2134 X =	287.6060, 5157.396, 358,	0	
2135 X =	288.6050, 5157.352, 354,	0	
2136 X =	289.6050, 5157.307, 315,	0	
2137 X =	290.6040, 5157.263, 270,	0	
2138 X =	291.6030, 5157.219, 231,	0	
2139 X =	292.6020, 5157.174, 214,	0	
2140 X =	293.6020, 5157.13, 213,	0	
2141 X =	294.6010, 5157.086, 210,	0	
2142 X =	309.5880, 5156.42, 159,	0	
2143 X =	310.5880, 5156.376, 153,	0	
2144 X =	316.5820, 5156.11, 153,	0	
2145 X =	317.5820, 5156.066, 153,	0	
2146 X =	318.5810, 5156.021, 153,	0	
2147 X =	319.5800, 5155.977, 153,	0	
2148 X =	320.5790, 5155.933, 153,	0	
2149 X =	321.5780, 5155.888, 150,	0	
2150 X =	322.5770, 5155.844, 136,	0	
2151 X =	323.5760, 5155.8, 122,	0	
2152 X =	324.5750, 5155.755, 118,	0	
2153 X =	286.6510, 5158.44, 352,	0	
2154 X =	287.6500, 5158.395, 318,	0	
2155 X =	288.6500, 5158.351, 300,	0	
2156 X =	289.6490, 5158.307, 279,	0	
2157 X =	290.6480, 5158.262, 247,	0	
2158 X =	291.6470, 5158.218, 220,	0	
2159 X =	292.6470, 5158.174, 214,	0	
2160 X =	293.6460, 5158.129, 213,	0	
2161 X =	294.6450, 5158.085, 211,	0	
2162 X =	309.6330, 5157.42, 160,	0	
2163 X =	310.6320, 5157.375, 153,	0	
2164 X =	316.6270, 5157.109, 153,	0	
2165 X =	317.6260, 5157.065, 153,	0	
2166 X =	318.6250, 5157.02, 153,	0	
2167 X =	319.6240, 5156.976, 151,	0	
2168 X =	320.6230, 5156.932, 148,	0	
2169 X =	321.6220, 5156.887, 138,	0	
2170 X =	322.6210, 5156.843, 123,	0	
2171 X =	323.6200, 5156.799, 116,	0	
2172 X =	286.6960, 5159.439, 322,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
2173 X =	287.6950, 5159.395, 292,	0	
2174 X =	288.6940, 5159.35, 272,	0	
2175 X =	289.6930, 5159.306, 253,	0	
2176 X =	290.6930, 5159.262, 234,	0	
2177 X =	291.6920, 5159.217, 216,	0	
2178 X =	292.6910, 5159.173, 215,	0	
2179 X =	293.6900, 5159.128, 215,	0	
2180 X =	294.6890, 5159.084, 213,	0	
2181 X =	309.6770, 5158.419, 159,	0	
2182 X =	310.6760, 5158.374, 153,	0	
2183 X =	315.6720, 5158.153, 153,	0	
2184 X =	316.6710, 5158.108, 153,	0	
2185 X =	317.6700, 5158.064, 152,	0	
2186 X =	318.6690, 5158.02, 150,	0	
2187 X =	319.6680, 5157.975, 141,	0	
2188 X =	320.6680, 5157.931, 135,	0	
2189 X =	321.6670, 5157.886, 124,	0	
2190 X =	322.6660, 5157.842, 117,	0	
2191 X =	323.6650, 5157.798, 126,	0	
2192 X =	286.7400, 5160.438, 302,	0	
2193 X =	287.7390, 5160.394, 280,	0	
2194 X =	288.7380, 5160.35, 258,	0	
2195 X =	289.7380, 5160.305, 243,	0	
2196 X =	290.7370, 5160.261, 232,	0	
2197 X =	291.7360, 5160.216, 223,	0	
2198 X =	292.7350, 5160.172, 224,	0	
2199 X =	293.7350, 5160.128, 225,	0	
2200 X =	294.7340, 5160.083, 221,	0	
2201 X =	309.7220, 5159.418, 155,	0	
2202 X =	310.7210, 5159.373, 153,	0	
2203 X =	313.7180, 5159.24, 154,	0	
2204 X =	314.7170, 5159.196, 153,	0	
2205 X =	315.7160, 5159.152, 152,	0	
2206 X =	316.7150, 5159.107, 150,	0	
2207 X =	317.7150, 5159.063, 147,	0	
2208 X =	318.7140, 5159.019, 140,	0	
2209 X =	319.7130, 5158.974, 129,	0	
2210 X =	320.7120, 5158.93, 122,	0	
2211 X =	321.7110, 5158.886, 117,	0	
2212 X =	322.7100, 5158.841, 124,	0	
2213 X =	323.7090, 5158.797, 162,	0	
2214 X =	286.7840, 5161.438, 299,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
2215 X =	287.7840, 5161.393, 281,	0	
2216 X =	288.7830, 5161.349, 261,	0	
2217 X =	289.7820, 5161.304, 246,	0	
2218 X =	290.7810, 5161.26, 240,	0	
2219 X =	291.7810, 5161.216, 240,	0	
2220 X =	292.7800, 5161.171, 243,	0	
2221 X =	293.7790, 5161.127, 243,	0	
2222 X =	294.7780, 5161.083, 237,	0	
2223 X =	295.7770, 5161.038, 223,	0	
2224 X =	296.7770, 5160.994, 213,	0	
2225 X =	297.7760, 5160.949, 211,	0	
2226 X =	298.7750, 5160.905, 211,	0	
2227 X =	299.7740, 5160.861, 210,	0	
2228 X =	300.7730, 5160.816, 206,	0	
2229 X =	301.7730, 5160.772, 201,	0	
2230 X =	302.7720, 5160.728, 195,	0	
2231 X =	303.7710, 5160.683, 192,	0	
2232 X =	304.7700, 5160.639, 188,	0	
2233 X =	305.7690, 5160.594, 182,	0	
2234 X =	306.7680, 5160.55, 173,	0	
2235 X =	307.7680, 5160.506, 163,	0	
2236 X =	308.7670, 5160.461, 156,	0	
2237 X =	309.7660, 5160.417, 153,	0	
2238 X =	310.7650, 5160.373, 154,	0	
2239 X =	311.7640, 5160.328, 156,	0	
2240 X =	312.7630, 5160.284, 159,	0	
2241 X =	313.7620, 5160.24, 158,	0	
2242 X =	314.7620, 5160.195, 152,	0	
2243 X =	315.7610, 5160.151, 148,	0	
2244 X =	316.7600, 5160.106, 140,	0	
2245 X =	317.7590, 5160.062, 134,	0	
2246 X =	318.7580, 5160.018, 126,	0	
2247 X =	319.7570, 5159.973, 118,	0	
2248 X =	320.7560, 5159.929, 117,	0	
2249 X =	321.7550, 5159.885, 133,	0	
2250 X =	322.7540, 5159.84, 181,	0	
2251 X =	286.8290, 5162.437, 305,	0	
2252 X =	287.8280, 5162.392, 289,	0	
2253 X =	288.8270, 5162.348, 270,	0	
2254 X =	289.8260, 5162.304, 254,	0	
2255 X =	290.8260, 5162.259, 246,	0	
2256 X =	291.8250, 5162.215, 243,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
2257 X =	292.8240, 5162.171, 240,	0	
2258 X =	293.8230, 5162.126, 234,	0	
2259 X =	294.8230, 5162.082, 223,	0	
2260 X =	295.8220, 5162.037, 211,	0	
2261 X =	296.8210, 5161.993, 203,	0	
2262 X =	297.8200, 5161.949, 197,	0	
2263 X =	298.8190, 5161.904, 194,	0	
2264 X =	299.8190, 5161.86, 191,	0	
2265 X =	300.8180, 5161.816, 187,	0	
2266 X =	301.8170, 5161.771, 185,	0	
2267 X =	302.8160, 5161.727, 181,	0	
2268 X =	303.8150, 5161.682, 177,	0	
2269 X =	304.8140, 5161.638, 173,	0	
2270 X =	305.8140, 5161.594, 166,	0	
2271 X =	306.8130, 5161.549, 160,	0	
2272 X =	307.8120, 5161.505, 155,	0	
2273 X =	308.8110, 5161.461, 154,	0	
2274 X =	309.8100, 5161.416, 158,	0	
2275 X =	310.8090, 5161.372, 162,	0	
2276 X =	311.8090, 5161.327, 168,	0	
2277 X =	312.8080, 5161.283, 171,	0	
2278 X =	313.8070, 5161.239, 163,	0	
2279 X =	314.8060, 5161.194, 146,	0	
2280 X =	315.8050, 5161.15, 137,	0	
2281 X =	316.8040, 5161.106, 128,	0	
2282 X =	317.8030, 5161.061, 122,	0	
2283 X =	318.8020, 5161.017, 117,	0	
2284 X =	319.8010, 5160.972, 122,	0	
2285 X =	320.8010, 5160.928, 150,	0	
2286 X =	285.8740, 5163.48, 362,	0	
2287 X =	286.8730, 5163.436, 325,	0	
2288 X =	287.8720, 5163.392, 301,	0	
2289 X =	288.8720, 5163.347, 286,	0	
2290 X =	289.8710, 5163.303, 269,	0	
2291 X =	290.8700, 5163.259, 249,	0	
2292 X =	291.8690, 5163.214, 236,	0	
2293 X =	292.8680, 5163.17, 224,	0	
2294 X =	293.8680, 5163.125, 211,	0	
2295 X =	294.8670, 5163.081, 198,	0	
2296 X =	295.8660, 5163.037, 189,	0	
2297 X =	296.8650, 5162.992, 185,	0	
2298 X =	297.8650, 5162.948, 184,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
2299 X =	298.8640, 5162.903, 184,	0	
2300 X =	299.8630, 5162.859, 184,	0	
2301 X =	300.8620, 5162.815, 184,	0	
2302 X =	301.8610, 5162.77, 182,	0	
2303 X =	302.8610, 5162.726, 174,	0	
2304 X =	303.8600, 5162.682, 166,	0	
2305 X =	304.8590, 5162.637, 162,	0	
2306 X =	305.8580, 5162.593, 158,	0	
2307 X =	306.8570, 5162.548, 155,	0	
2308 X =	307.8560, 5162.504, 159,	0	
2309 X =	308.8550, 5162.46, 170,	0	
2310 X =	309.8550, 5162.415, 182,	0	
2311 X =	310.8540, 5162.371, 194,	0	
2312 X =	311.8530, 5162.327, 196,	0	
2313 X =	312.8520, 5162.282, 178,	0	
2314 X =	313.8510, 5162.238, 155,	0	
2315 X =	314.8500, 5162.193, 133,	0	
2316 X =	315.8490, 5162.149, 125,	0	
2317 X =	316.8490, 5162.105, 122,	0	
2318 X =	317.8480, 5162.06, 123,	0	
2319 X =	318.8470, 5162.016, 132,	0	
2320 X =	319.8460, 5161.972, 168,	0	
2321 X =	320.8450, 5161.927, 237,	0	
2322 X =	285.9180, 5164.48, 402,	0	
2323 X =	286.9170, 5164.435, 357,	0	
2324 X =	287.9170, 5164.391, 319,	0	
2325 X =	288.9160, 5164.347, 298,	0	
2326 X =	289.9150, 5164.302, 273,	0	
2327 X =	290.9140, 5164.258, 235,	0	
2328 X =	291.9140, 5164.213, 211,	0	
2329 X =	292.9130, 5164.169, 193,	0	
2330 X =	293.9120, 5164.125, 181,	0	
2331 X =	294.9110, 5164.08, 174,	0	
2332 X =	295.9110, 5164.036, 175,	0	
2333 X =	296.9100, 5163.991, 180,	0	
2334 X =	297.9090, 5163.947, 184,	0	
2335 X =	298.9080, 5163.903, 184,	0	
2336 X =	299.9070, 5163.858, 184,	0	
2337 X =	300.9070, 5163.814, 184,	0	
2338 X =	301.9060, 5163.769, 180,	0	
2339 X =	302.9050, 5163.725, 168,	0	
2340 X =	303.9040, 5163.681, 157,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
2341 X =	304.9030, 5163.636, 163,	0	
2342 X =	305.9020, 5163.592, 184,	0	
2343 X =	306.9020, 5163.548, 204,	0	
2344 X =	307.9010, 5163.503, 209,	0	
2345 X =	308.9000, 5163.459, 208,	0	
2346 X =	309.8990, 5163.414, 212,	0	
2347 X =	310.8980, 5163.37, 220,	0	
2348 X =	311.8970, 5163.326, 206,	0	
2349 X =	312.8960, 5163.281, 166,	0	
2350 X =	313.8960, 5163.237, 139,	0	
2351 X =	314.8950, 5163.193, 125,	0	
2352 X =	315.8940, 5163.148, 122,	0	
2353 X =	316.8930, 5163.104, 126,	0	
2354 X =	317.8920, 5163.059, 156,	0	
2355 X =	318.8910, 5163.015, 206,	0	
2356 X =	319.8900, 5162.971, 251,	0	
2357 X =	320.8890, 5162.926, 275,	0	
2358 X =	284.9630, 5165.523, 452,	0	
2359 X =	285.9630, 5165.479, 399,	0	
2360 X =	286.9620, 5165.435, 340,	0	
2361 X =	287.9610, 5165.39, 292,	0	
2362 X =	288.9600, 5165.346, 269,	0	
2363 X =	289.9600, 5165.301, 229,	0	
2364 X =	290.9590, 5165.257, 190,	0	
2365 X =	291.9580, 5165.213, 172,	0	
2366 X =	292.9570, 5165.168, 163,	0	
2367 X =	293.9560, 5165.124, 163,	0	
2368 X =	294.9560, 5165.079, 162,	0	
2369 X =	295.9550, 5165.035, 166,	0	
2370 X =	296.9540, 5164.991, 176,	0	
2371 X =	297.9530, 5164.946, 183,	0	
2372 X =	298.9530, 5164.902, 183,	0	
2373 X =	299.9520, 5164.857, 182,	0	
2374 X =	300.9510, 5164.813, 177,	0	
2375 X =	301.9500, 5164.769, 167,	0	
2376 X =	302.9490, 5164.724, 157,	0	
2377 X =	303.9480, 5164.68, 158,	0	
2378 X =	304.9480, 5164.636, 175,	0	
2379 X =	305.9470, 5164.591, 195,	0	
2380 X =	306.9460, 5164.547, 204,	0	
2381 X =	307.9450, 5164.502, 203,	0	
2382 X =	308.9440, 5164.458, 197,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
2383 X =	309.9430, 5164.414, 194,	0	
2384 X =	310.9430, 5164.369, 192,	0	
2385 X =	311.9420, 5164.325, 174,	0	
2386 X =	312.9410, 5164.28, 146,	0	
2387 X =	313.9400, 5164.236, 129,	0	
2388 X =	314.9390, 5164.192, 122,	0	
2389 X =	315.9380, 5164.147, 124,	0	
2390 X =	316.9370, 5164.103, 159,	0	
2391 X =	317.9360, 5164.059, 227,	0	
2392 X =	318.9360, 5164.014, 269,	0	
2393 X =	319.9350, 5163.97, 275,	0	
2394 X =	320.9340, 5163.925, 275,	0	
2395 X =	285.0080, 5166.523, 273,	0	
2396 X =	286.0070, 5166.478, 255,	0	
2397 X =	287.0060, 5166.434, 227,	0	
2398 X =	288.0050, 5166.389, 205,	0	
2399 X =	289.0050, 5166.345, 193,	0	
2400 X =	290.0040, 5166.301, 166,	0	
2401 X =	291.0030, 5166.256, 150,	0	
2402 X =	292.0020, 5166.212, 148,	0	
2403 X =	293.0020, 5166.167, 148,	0	
2404 X =	294.0010, 5166.123, 149,	0	
2405 X =	295.0000, 5166.079, 150,	0	
2406 X =	295.9990, 5166.034, 153,	0	
2407 X =	296.9990, 5165.99, 163,	0	
2408 X =	297.9980, 5165.945, 172,	0	
2409 X =	298.9970, 5165.901, 174,	0	
2410 X =	299.9960, 5165.857, 171,	0	
2411 X =	300.9950, 5165.812, 166,	0	
2412 X =	301.9940, 5165.768, 159,	0	
2413 X =	302.9940, 5165.723, 154,	0	
2414 X =	303.9930, 5165.679, 155,	0	
2415 X =	304.9920, 5165.635, 161,	0	
2416 X =	305.9910, 5165.59, 168,	0	
2417 X =	306.9900, 5165.546, 173,	0	
2418 X =	307.9890, 5165.502, 172,	0	
2419 X =	308.9890, 5165.457, 166,	0	
2420 X =	309.9880, 5165.413, 159,	0	
2421 X =	310.9870, 5165.368, 152,	0	
2422 X =	311.9860, 5165.324, 143,	0	
2423 X =	312.9850, 5165.28, 131,	0	
2424 X =	313.9840, 5165.235, 124,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
2425 X =	314.9830, 5165.191, 120,	0	
2426 X =	315.9830, 5165.146, 140,	0	
2427 X =	316.9820, 5165.102, 211,	0	
2428 X =	317.9810, 5165.058, 270,	0	
2429 X =	318.9800, 5165.013, 275,	0	
2430 X =	319.9790, 5164.969, 275,	0	
2431 X =	320.9780, 5164.924, 275,	0	
2432 X =	285.0520, 5167.522, 147,	0	
2433 X =	286.0510, 5167.477, 144,	0	
2434 X =	287.0510, 5167.433, 142,	0	
2435 X =	288.0500, 5167.389, 142,	0	
2436 X =	289.0490, 5167.344, 139,	0	
2437 X =	290.0480, 5167.3, 136,	0	
2438 X =	291.0480, 5167.255, 137,	0	
2439 X =	292.0470, 5167.211, 139,	0	
2440 X =	293.0460, 5167.167, 140,	0	
2441 X =	294.0450, 5167.122, 139,	0	
2442 X =	295.0450, 5167.078, 138,	0	
2443 X =	296.0440, 5167.033, 138,	0	
2444 X =	297.0430, 5166.989, 140,	0	
2445 X =	298.0420, 5166.945, 147,	0	
2446 X =	299.0410, 5166.9, 154,	0	
2447 X =	300.0410, 5166.856, 158,	0	
2448 X =	301.0400, 5166.811, 156,	0	
2449 X =	302.0390, 5166.767, 154,	0	
2450 X =	303.0380, 5166.723, 153,	0	
2451 X =	304.0370, 5166.678, 153,	0	
2452 X =	305.0360, 5166.634, 153,	0	
2453 X =	306.0360, 5166.589, 154,	0	
2454 X =	307.0350, 5166.545, 157,	0	
2455 X =	308.0340, 5166.501, 158,	0	
2456 X =	309.0330, 5166.456, 151,	0	
2457 X =	310.0320, 5166.412, 142,	0	
2458 X =	311.0310, 5166.367, 134,	0	
2459 X =	312.0300, 5166.323, 128,	0	
2460 X =	313.0300, 5166.279, 124,	0	
2461 X =	314.0290, 5166.234, 122,	0	
2462 X =	315.0280, 5166.19, 119,	0	
2463 X =	316.0270, 5166.146, 163,	0	
2464 X =	317.0260, 5166.101, 239,	0	
2465 X =	318.0250, 5166.057, 272,	0	
2466 X =	319.0240, 5166.012, 274,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
2467 X =	320.0230, 5165.968, 275,	0	
2468 X =	321.0220, 5165.924, 275,	0	
2469 X =	287.0950, 5168.432, 135,	0	
2470 X =	288.0940, 5168.388, 132,	0	
2471 X =	289.0940, 5168.344, 130,	0	
2472 X =	290.0930, 5168.299, 128,	0	
2473 X =	291.0920, 5168.255, 129,	0	
2474 X =	292.0910, 5168.21, 131,	0	
2475 X =	293.0900, 5168.166, 132,	0	
2476 X =	294.0900, 5168.121, 131,	0	
2477 X =	295.0890, 5168.077, 128,	0	
2478 X =	296.0880, 5168.033, 127,	0	
2479 X =	297.0870, 5167.988, 127,	0	
2480 X =	298.0870, 5167.944, 131,	0	
2481 X =	299.0860, 5167.899, 140,	0	
2482 X =	300.0850, 5167.855, 150,	0	
2483 X =	301.0840, 5167.811, 153,	0	
2484 X =	302.0830, 5167.766, 153,	0	
2485 X =	303.0820, 5167.722, 153,	0	
2486 X =	304.0820, 5167.677, 153,	0	
2487 X =	305.0810, 5167.633, 153,	0	
2488 X =	306.0800, 5167.589, 153,	0	
2489 X =	307.0790, 5167.544, 153,	0	
2490 X =	308.0780, 5167.5, 150,	0	
2491 X =	309.0770, 5167.455, 140,	0	
2492 X =	310.0770, 5167.411, 130,	0	
2493 X =	311.0760, 5167.367, 125,	0	
2494 X =	312.0750, 5167.322, 124,	0	
2495 X =	313.0740, 5167.278, 124,	0	
2496 X =	314.0730, 5167.233, 122,	0	
2497 X =	315.0720, 5167.189, 119,	0	
2498 X =	316.0710, 5167.145, 176,	0	
2499 X =	317.0700, 5167.1, 240,	0	
2500 X =	318.0700, 5167.056, 259,	0	
2501 X =	319.0690, 5167.011, 266,	0	
2502 X =	320.0680, 5166.967, 272,	0	
2503 X =	321.0670, 5166.923, 272,	0	
2504 X =	287.1390, 5169.432, 162,	0	
2505 X =	288.1390, 5169.387, 161,	0	
2506 X =	289.1380, 5169.343, 163,	0	
2507 X =	290.1370, 5169.298, 157,	0	
2508 X =	291.1360, 5169.254, 146,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
2509 X =	292.1360, 5169.21, 135,	0	
2510 X =	293.1350, 5169.165, 130,	0	
2511 X =	294.1340, 5169.121, 129,	0	
2512 X =	295.1330, 5169.076, 127,	0	
2513 X =	296.1330, 5169.032, 126,	0	
2514 X =	297.1320, 5168.987, 124,	0	
2515 X =	298.1310, 5168.943, 122,	0	
2516 X =	299.1300, 5168.899, 124,	0	
2517 X =	300.1290, 5168.854, 136,	0	
2518 X =	301.1290, 5168.81, 147,	0	
2519 X =	302.1280, 5168.765, 152,	0	
2520 X =	303.1270, 5168.721, 153,	0	
2521 X =	304.1260, 5168.677, 153,	0	
2522 X =	305.1250, 5168.632, 153,	0	
2523 X =	306.1240, 5168.588, 153,	0	
2524 X =	307.1240, 5168.543, 150,	0	
2525 X =	308.1230, 5168.499, 143,	0	
2526 X =	309.1220, 5168.455, 132,	0	
2527 X =	310.1210, 5168.41, 125,	0	
2528 X =	311.1200, 5168.366, 123,	0	
2529 X =	312.1190, 5168.321, 124,	0	
2530 X =	313.1180, 5168.277, 124,	0	
2531 X =	314.1180, 5168.233, 122,	0	
2532 X =	315.1170, 5168.188, 120,	0	
2533 X =	316.1160, 5168.144, 180,	0	
2534 X =	317.1150, 5168.099, 232,	0	
2535 X =	318.1140, 5168.055, 242,	0	
2536 X =	319.1130, 5168.011, 245,	0	
2537 X =	320.1120, 5167.966, 253,	0	
2538 X =	321.1110, 5167.922, 253,	0	
2539 X =	288.1830, 5170.386, 203,	0	
2540 X =	289.1820, 5170.342, 211,	0	
2541 X =	290.1820, 5170.298, 211,	0	
2542 X =	291.1810, 5170.253, 200,	0	
2543 X =	292.1800, 5170.209, 181,	0	
2544 X =	293.1790, 5170.164, 161,	0	
2545 X =	294.1790, 5170.12, 149,	0	
2546 X =	295.1780, 5170.075, 146,	0	
2547 X =	296.1770, 5170.031, 144,	0	
2548 X =	297.1760, 5169.987, 138,	0	
2549 X =	298.1750, 5169.942, 130,	0	
2550 X =	299.1750, 5169.898, 124,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
2551 X =	300.1740, 5169.853, 122,	0	
2552 X =	301.1730, 5169.809, 129,	0	
2553 X =	302.1720, 5169.765, 140,	0	
2554 X =	303.1710, 5169.72, 146,	0	
2555 X =	304.1700, 5169.676, 148,	0	
2556 X =	305.1700, 5169.631, 149,	0	
2557 X =	306.1690, 5169.587, 149,	0	
2558 X =	307.1680, 5169.543, 145,	0	
2559 X =	308.1670, 5169.498, 137,	0	
2560 X =	309.1660, 5169.454, 128,	0	
2561 X =	310.1650, 5169.409, 124,	0	
2562 X =	311.1650, 5169.365, 123,	0	
2563 X =	312.1640, 5169.32, 123,	0	
2564 X =	313.1630, 5169.276, 122,	0	
2565 X =	314.1620, 5169.232, 120,	0	
2566 X =	315.1610, 5169.187, 132,	0	
2567 X =	316.1600, 5169.143, 192,	0	
2568 X =	317.1590, 5169.098, 230,	0	
2569 X =	318.1580, 5169.054, 237,	0	
2570 X =	319.1570, 5169.01, 238,	0	
2571 X =	320.1570, 5168.965, 240,	0	
2572 X =	321.1560, 5168.921, 242,	0	
2573 X =	289.2270, 5171.341, 235,	0	
2574 X =	290.2260, 5171.297, 238,	0	
2575 X =	291.2250, 5171.252, 240,	0	
2576 X =	292.2240, 5171.208, 239,	0	
2577 X =	293.2240, 5171.164, 219,	0	
2578 X =	294.2230, 5171.119, 186,	0	
2579 X =	295.2220, 5171.075, 163,	0	
2580 X =	296.2210, 5171.03, 155,	0	
2581 X =	297.2210, 5170.986, 151,	0	
2582 X =	298.2200, 5170.941, 144,	0	
2583 X =	299.2190, 5170.897, 135,	0	
2584 X =	300.2180, 5170.853, 127,	0	
2585 X =	301.2170, 5170.808, 122,	0	
2586 X =	302.2170, 5170.764, 127,	0	
2587 X =	303.2160, 5170.719, 136,	0	
2588 X =	304.2150, 5170.675, 140,	0	
2589 X =	305.2140, 5170.631, 143,	0	
2590 X =	306.2130, 5170.586, 143,	0	
2591 X =	307.2120, 5170.542, 139,	0	
2592 X =	308.2120, 5170.497, 132,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
2593 X =	309.2110, 5170.453, 126,	0	
2594 X =	310.2100, 5170.408, 123,	0	
2595 X =	311.2090, 5170.364, 122,	0	
2596 X =	312.2080, 5170.32, 122,	0	
2597 X =	313.2070, 5170.275, 121,	0	
2598 X =	314.2060, 5170.231, 133,	0	
2599 X =	315.2050, 5170.186, 167,	0	
2600 X =	316.2050, 5170.142, 206,	0	
2601 X =	317.2040, 5170.098, 227,	0	
2602 X =	318.2030, 5170.053, 237,	0	
2603 X =	319.2020, 5170.009, 239,	0	
2604 X =	320.2010, 5169.964, 239,	0	
2605 X =	321.2000, 5169.92, 241,	0	
2606 X =	290.2700, 5172.296, 245,	0	
2607 X =	291.2700, 5172.252, 245,	0	
2608 X =	292.2690, 5172.207, 244,	0	
2609 X =	293.2680, 5172.163, 241,	0	
2610 X =	294.2670, 5172.118, 212,	0	
2611 X =	295.2670, 5172.074, 169,	0	
2612 X =	296.2660, 5172.029, 155,	0	
2613 X =	297.2650, 5171.985, 153,	0	
2614 X =	298.2640, 5171.941, 152,	0	
2615 X =	299.2630, 5171.896, 148,	0	
2616 X =	300.2630, 5171.852, 139,	0	
2617 X =	301.2620, 5171.807, 129,	0	
2618 X =	302.2610, 5171.763, 123,	0	
2619 X =	303.2600, 5171.719, 127,	0	
2620 X =	304.2590, 5171.674, 133,	0	
2621 X =	305.2580, 5171.63, 138,	0	
2622 X =	306.2580, 5171.585, 138,	0	
2623 X =	307.2570, 5171.541, 134,	0	
2624 X =	308.2560, 5171.496, 130,	0	
2625 X =	309.2550, 5171.452, 126,	0	
2626 X =	310.2540, 5171.408, 123,	0	
2627 X =	311.2530, 5171.363, 122,	0	
2628 X =	312.2520, 5171.319, 120,	0	
2629 X =	313.2520, 5171.274, 132,	0	
2630 X =	314.2510, 5171.23, 170,	0	
2631 X =	315.2500, 5171.186, 203,	0	
2632 X =	316.2490, 5171.141, 213,	0	
2633 X =	317.2480, 5171.097, 225,	0	
2634 X =	318.2470, 5171.052, 238,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
2635 X =	319.2460, 5171.008, 240,	0	
2636 X =	320.2450, 5170.963, 241,	0	
2637 X =	291.3140, 5173.251, 244,	0	
2638 X =	292.3130, 5173.206, 237,	0	
2639 X =	293.3130, 5173.162, 226,	0	
2640 X =	294.3120, 5173.118, 206,	0	
2641 X =	295.3110, 5173.073, 172,	0	
2642 X =	296.3100, 5173.029, 156,	0	
2643 X =	297.3090, 5172.984, 153,	0	
2644 X =	298.3090, 5172.94, 153,	0	
2645 X =	299.3080, 5172.895, 155,	0	
2646 X =	300.3070, 5172.851, 150,	0	
2647 X =	301.3060, 5172.807, 139,	0	
2648 X =	302.3050, 5172.762, 128,	0	
2649 X =	303.3050, 5172.718, 123,	0	
2650 X =	304.3040, 5172.673, 127,	0	
2651 X =	305.3030, 5172.629, 132,	0	
2652 X =	306.3020, 5172.584, 134,	0	
2653 X =	307.3010, 5172.54, 131,	0	
2654 X =	308.3000, 5172.496, 129,	0	
2655 X =	309.2990, 5172.451, 127,	0	
2656 X =	310.2990, 5172.407, 125,	0	
2657 X =	311.2980, 5172.362, 122,	0	
2658 X =	312.2970, 5172.318, 119,	0	
2659 X =	313.2960, 5172.273, 154,	0	
2660 X =	314.2950, 5172.229, 189,	0	
2661 X =	315.2940, 5172.185, 206,	0	
2662 X =	316.2930, 5172.14, 215,	0	
2663 X =	317.2920, 5172.096, 227,	0	
2664 X =	318.2920, 5172.051, 240,	0	
2665 X =	319.2910, 5172.007, 243,	0	
2666 X =	320.2900, 5171.963, 245,	0	
2667 X =	291.3590, 5174.25, 240,	0	
2668 X =	292.3580, 5174.206, 221,	0	
2669 X =	293.3570, 5174.161, 210,	0	
2670 X =	294.3560, 5174.117, 199,	0	
2671 X =	295.3550, 5174.072, 186,	0	
2672 X =	296.3550, 5174.028, 164,	0	
2673 X =	297.3540, 5173.983, 155,	0	
2674 X =	298.3530, 5173.939, 153,	0	
2675 X =	299.3520, 5173.895, 153,	0	
2676 X =	300.3510, 5173.85, 153,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
2677 X =	301.3510, 5173.806, 144,	0	
2678 X =	302.3500, 5173.761, 133,	0	
2679 X =	303.3490, 5173.717, 125,	0	
2680 X =	304.3480, 5173.672, 123,	0	
2681 X =	305.3470, 5173.628, 127,	0	
2682 X =	306.3460, 5173.584, 130,	0	
2683 X =	307.3460, 5173.539, 129,	0	
2684 X =	308.3450, 5173.495, 133,	0	
2685 X =	309.3440, 5173.45, 135,	0	
2686 X =	310.3430, 5173.406, 134,	0	
2687 X =	311.3420, 5173.361, 122,	0	
2688 X =	312.3410, 5173.317, 118,	0	
2689 X =	313.3400, 5173.273, 164,	0	
2690 X =	314.3400, 5173.228, 194,	0	
2691 X =	315.3390, 5173.184, 209,	0	
2692 X =	316.3380, 5173.139, 226,	0	
2693 X =	317.3370, 5173.095, 237,	0	
2694 X =	318.3360, 5173.05, 244,	0	
2695 X =	319.3350, 5173.006, 248,	0	
2696 X =	320.3340, 5172.962, 256,	0	
2697 X =	294.4010, 5175.116, 203,	0	
2698 X =	295.4000, 5175.072, 194,	0	
2699 X =	296.3990, 5175.027, 186,	0	
2700 X =	297.3980, 5174.983, 168,	0	
2701 X =	298.3970, 5174.938, 156,	0	
2702 X =	299.3970, 5174.894, 153,	0	
2703 X =	300.3960, 5174.849, 153,	0	
2704 X =	301.3950, 5174.805, 146,	0	
2705 X =	302.3940, 5174.76, 137,	0	
2706 X =	303.3930, 5174.716, 129,	0	
2707 X =	304.3930, 5174.672, 123,	0	
2708 X =	305.3920, 5174.627, 122,	0	
2709 X =	306.3910, 5174.583, 126,	0	
2710 X =	307.3900, 5174.538, 126,	0	
2711 X =	308.3890, 5174.494, 136,	0	
2712 X =	309.3880, 5174.449, 143,	0	
2713 X =	310.3870, 5174.405, 135,	0	
2714 X =	311.3870, 5174.361, 120,	0	
2715 X =	312.3860, 5174.316, 128,	0	
2716 X =	313.3850, 5174.272, 177,	0	
2717 X =	314.3840, 5174.227, 201,	0	
2718 X =	315.3830, 5174.183, 216,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
2719	X = 316.3820, 5174.138, 237,	0	
2720	X = 317.3810, 5174.094, 244,	0	
2721	X = 318.3800, 5174.05, 246,	0	
2722	X = 319.3800, 5174.005, 259,	0	
2723	X = 295.4440, 5176.071, 197,	0	
2724	X = 296.4440, 5176.026, 191,	0	
2725	X = 297.4430, 5175.982, 185,	0	
2726	X = 298.4420, 5175.937, 176,	0	
2727	X = 299.4410, 5175.893, 164,	0	
2728	X = 300.4400, 5175.849, 154,	0	
2729	X = 301.4390, 5175.804, 148,	0	
2730	X = 302.4390, 5175.76, 141,	0	
2731	X = 303.4380, 5175.715, 134,	0	
2732	X = 304.4370, 5175.671, 128,	0	
2733	X = 305.4360, 5175.626, 123,	0	
2734	X = 306.4350, 5175.582, 122,	0	
2735	X = 307.4340, 5175.537, 124,	0	
2736	X = 308.4340, 5175.493, 130,	0	
2737	X = 309.4330, 5175.449, 135,	0	
2738	X = 310.4320, 5175.404, 124,	0	
2739	X = 311.4310, 5175.36, 125,	0	
2740	X = 312.4300, 5175.315, 161,	0	
2741	X = 313.4290, 5175.271, 193,	0	
2742	X = 314.4280, 5175.226, 206,	0	
2743	X = 315.4280, 5175.182, 218,	0	
2744	X = 316.4270, 5175.138, 234,	0	
2745	X = 317.4260, 5175.093, 242,	0	
2746	X = 318.4250, 5175.049, 251,	0	
2747	X = 319.4240, 5175.004, 269,	0	
2748	X = 296.4880, 5177.026, 195,	0	
2749	X = 297.4870, 5176.981, 187,	0	
2750	X = 298.4860, 5176.937, 184,	0	
2751	X = 299.4860, 5176.892, 184,	0	
2752	X = 300.4850, 5176.848, 172,	0	
2753	X = 301.4840, 5176.803, 151,	0	
2754	X = 302.4830, 5176.759, 146,	0	
2755	X = 303.4820, 5176.714, 143,	0	
2756	X = 304.4810, 5176.67, 137,	0	
2757	X = 305.4810, 5176.625, 127,	0	
2758	X = 306.4800, 5176.581, 122,	0	
2759	X = 307.4790, 5176.537, 121,	0	
2760	X = 308.4780, 5176.492, 123,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
2761 X =	309.4770, 5176.448, 125,	0	
2762 X =	310.4760, 5176.403, 130,	0	
2763 X =	311.4750, 5176.359, 156,	0	
2764 X =	312.4750, 5176.314, 190,	0	
2765 X =	313.4740, 5176.27, 198,	0	
2766 X =	314.4730, 5176.226, 207,	0	
2767 X =	315.4720, 5176.181, 214,	0	
2768 X =	316.4710, 5176.137, 223,	0	
2769 X =	317.4700, 5176.092, 235,	0	
2770 X =	318.4690, 5176.048, 257,	0	
2771 X =	319.4680, 5176.003, 273,	0	
2772 X =	298.5310, 5177.936, 188,	0	
2773 X =	299.5300, 5177.891, 186,	0	
2774 X =	300.5290, 5177.847, 184,	0	
2775 X =	301.5280, 5177.802, 169,	0	
2776 X =	302.5280, 5177.758, 157,	0	
2777 X =	303.5270, 5177.714, 164,	0	
2778 X =	304.5260, 5177.669, 162,	0	
2779 X =	305.5250, 5177.625, 158,	0	
2780 X =	306.5240, 5177.58, 150,	0	
2781 X =	307.5230, 5177.536, 130,	0	
2782 X =	308.5230, 5177.491, 134,	0	
2783 X =	309.5220, 5177.447, 159,	0	
2784 X =	310.5210, 5177.402, 170,	0	
2785 X =	311.5200, 5177.358, 190,	0	
2786 X =	312.5190, 5177.314, 198,	0	
2787 X =	313.5180, 5177.269, 202,	0	
2788 X =	314.5170, 5177.225, 206,	0	
2789 X =	315.5160, 5177.18, 211,	0	
2790 X =	316.5160, 5177.136, 216,	0	
2791 X =	317.5150, 5177.091, 223,	0	
2792 X =	318.5140, 5177.047, 238,	0	
2793 X =	319.5130, 5177.002, 259,	0	
2794 X =	299.5740, 5178.891, 200,	0	
2795 X =	300.5740, 5178.846, 196,	0	
2796 X =	301.5730, 5178.802, 192,	0	
2797 X =	302.5720, 5178.757, 188,	0	
2798 X =	303.5710, 5178.713, 189,	0	
2799 X =	304.5700, 5178.668, 190,	0	
2800 X =	305.5700, 5178.624, 191,	0	
2801 X =	306.5690, 5178.579, 184,	0	
2802 X =	307.5680, 5178.535, 172,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
2803 X =	308.5670, 5178.49, 179,	0	
2804 X =	309.5660, 5178.446, 195,	0	
2805 X =	310.5650, 5178.402, 202,	0	
2806 X =	311.5640, 5178.357, 205,	0	
2807 X =	312.5640, 5178.313, 205,	0	
2808 X =	313.5630, 5178.268, 208,	0	
2809 X =	314.5620, 5178.224, 210,	0	
2810 X =	315.5610, 5178.179, 211,	0	
2811 X =	316.5600, 5178.135, 214,	0	
2812 X =	317.5590, 5178.09, 218,	0	
2813 X =	318.5580, 5178.046, 227,	0	
2814 X =	299.6190, 5179.89, 217,	0	
2815 X =	300.6180, 5179.845, 213,	0	
2816 X =	301.6170, 5179.801, 211,	0	
2817 X =	302.6160, 5179.756, 209,	0	
2818 X =	303.6160, 5179.712, 209,	0	
2819 X =	304.6150, 5179.667, 211,	0	
2820 X =	305.6140, 5179.623, 214,	0	
2821 X =	306.6130, 5179.578, 211,	0	
2822 X =	307.6120, 5179.534, 210,	0	
2823 X =	308.6110, 5179.49, 213,	0	
2824 X =	309.6110, 5179.445, 215,	0	
2825 X =	310.6100, 5179.401, 218,	0	
2826 X =	311.6090, 5179.356, 218,	0	
2827 X =	312.6080, 5179.312, 217,	0	
2828 X =	313.6070, 5179.267, 219,	0	
2829 X =	314.6060, 5179.223, 217,	0	
2830 X =	315.6050, 5179.178, 216,	0	
2831 X =	316.6040, 5179.134, 220,	0	
2832 X =	317.6040, 5179.09, 228,	0	
2833 X =	318.6030, 5179.045, 236,	0	
2834 X =	300.6630, 5180.844, 237,	0	
2835 X =	301.6620, 5180.8, 235,	0	
2836 X =	302.6610, 5180.756, 234,	0	
2837 X =	303.6600, 5180.711, 235,	0	
2838 X =	304.6590, 5180.667, 235,	0	
2839 X =	305.6580, 5180.622, 239,	0	
2840 X =	306.6580, 5180.578, 238,	0	
2841 X =	307.6570, 5180.533, 239,	0	
2842 X =	308.6560, 5180.489, 239,	0	
2843 X =	309.6550, 5180.444, 237,	0	
2844 X =	310.6540, 5180.4, 239,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
2845 X =	311.6530, 5180.355, 240,	0	
2846 X =	312.6520, 5180.311, 238,	0	
2847 X =	313.6520, 5180.266, 238,	0	
2848 X =	314.6510, 5180.222, 235,	0	
2849 X =	315.6500, 5180.178, 232,	0	
2850 X =	316.6490, 5180.133, 235,	0	
2851 X =	317.6480, 5180.089, 242,	0	
2852 X =	302.7050, 5181.755, 267,	0	
2853 X =	303.7050, 5181.71, 269,	0	
2854 X =	304.7040, 5181.666, 269,	0	
2855 X =	305.7030, 5181.621, 271,	0	
2856 X =	306.7020, 5181.577, 272,	0	
2857 X =	307.7010, 5181.532, 272,	0	
2858 X =	308.7000, 5181.488, 272,	0	
2859 X =	309.6990, 5181.443, 271,	0	
2860 X =	310.6990, 5181.399, 272,	0	
2861 X =	311.6980, 5181.354, 272,	0	
2862 X =	312.6970, 5181.31, 272,	0	
2863 X =	313.6960, 5181.266, 268,	0	
2864 X =	314.6950, 5181.221, 265,	0	
2865 X =	315.6940, 5181.177, 261,	0	
2866 X =	316.6930, 5181.132, 260,	0	
2867 X =	317.6920, 5181.088, 264,	0	
2868 X =	303.7490, 5182.709, 308,	0	
2869 X =	304.7480, 5182.665, 311,	0	
2870 X =	305.7470, 5182.62, 312,	0	
2871 X =	306.7470, 5182.576, 313,	0	
2872 X =	307.7460, 5182.531, 315,	0	
2873 X =	308.7450, 5182.487, 316,	0	
2874 X =	309.7440, 5182.443, 316,	0	
2875 X =	310.7430, 5182.398, 315,	0	
2876 X =	311.7420, 5182.354, 314,	0	
2877 X =	312.7410, 5182.309, 315,	0	
2878 X =	313.7400, 5182.265, 313,	0	
2879 X =	314.7400, 5182.22, 310,	0	
2880 X =	315.7390, 5182.176, 307,	0	
2881 X =	304.7930, 5183.664, 367,	0	
2882 X =	305.7920, 5183.62, 368,	0	
2883 X =	306.7910, 5183.575, 367,	0	
2884 X =	307.7900, 5183.531, 370,	0	
2885 X =	308.7890, 5183.486, 372,	0	
2886 X =	309.7880, 5183.442, 377,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
2887 X =	310.7880, 5183.397, 385,	0	
2888 X =	311.7870, 5183.353, 382,	0	
2889 X =	312.7860, 5183.308, 377,	0	
2890 X =	313.7850, 5183.264, 388,	0	
2891 X =	314.7840, 5183.219, 390,	0	
2892 X =	306.8350, 5184.574, 447,	0	
2893 X =	307.8350, 5184.53, 449,	0	
2894 X =	308.8340, 5184.485, 457,	0	
2895 X =	309.8330, 5184.441, 471,	0	
2896 X =	310.8320, 5184.396, 489,	0	
2897 X =	311.8310, 5184.352, 477,	0	
2898 X =	312.8300, 5184.307, 470,	0	
2899 X =	313.8290, 5184.263, 487,	0	
2900 X =	318.7380, 5136.994, 144,	0	
2901 X =	319.7370, 5136.95, 139,	0	
2902 X =	320.7360, 5136.905, 131,	0	
2903 X =	321.7350, 5136.861, 125,	0	
2904 X =	322.7340, 5136.817, 123,	0	
2905 X =	323.7330, 5136.773, 123,	0	
2906 X =	306.7930, 5138.524, 336,	0	
2907 X =	315.7850, 5138.126, 133,	0	
2908 X =	316.7840, 5138.082, 139,	0	
2909 X =	317.7830, 5138.037, 147,	0	
2910 X =	318.7820, 5137.993, 150,	0	
2911 X =	319.7810, 5137.949, 144,	0	
2912 X =	320.7800, 5137.905, 134,	0	
2913 X =	321.7800, 5137.86, 126,	0	
2914 X =	322.7790, 5137.816, 123,	0	
2915 X =	323.7780, 5137.772, 122,	0	
2916 X =	313.8310, 5139.214, 153,	0	
2917 X =	314.8300, 5139.169, 148,	0	
2918 X =	315.8290, 5139.125, 141,	0	
2919 X =	316.8280, 5139.081, 145,	0	
2920 X =	317.8270, 5139.036, 151,	0	
2921 X =	318.8270, 5138.992, 152,	0	
2922 X =	319.8260, 5138.948, 145,	0	
2923 X =	320.8250, 5138.904, 135,	0	
2924 X =	321.8240, 5138.859, 127,	0	
2925 X =	322.8230, 5138.815, 123,	0	
2926 X =	323.8220, 5138.771, 122,	0	
2927 X =	312.8760, 5140.257, 153,	0	
2928 X =	313.8750, 5140.213, 153,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
2929 X =	314.8740, 5140.168, 151,	0	
2930 X =	315.8730, 5140.124, 148,	0	
2931 X =	316.8730, 5140.08, 149,	0	
2932 X =	317.8720, 5140.036, 152,	0	
2933 X =	318.8710, 5139.991, 152,	0	
2934 X =	319.8700, 5139.947, 146,	0	
2935 X =	320.8690, 5139.903, 136,	0	
2936 X =	321.8680, 5139.858, 128,	0	
2937 X =	322.8670, 5139.814, 124,	0	
2938 X =	323.8660, 5139.77, 123,	0	
2939 X =	311.9210, 5141.3, 156,	0	
2940 X =	312.9200, 5141.256, 153,	0	
2941 X =	313.9190, 5141.212, 153,	0	
2942 X =	314.9190, 5141.168, 153,	0	
2943 X =	315.9180, 5141.123, 152,	0	
2944 X =	316.9170, 5141.079, 152,	0	
2945 X =	317.9160, 5141.035, 153,	0	
2946 X =	318.9150, 5140.99, 152,	0	
2947 X =	319.9140, 5140.946, 146,	0	
2948 X =	320.9130, 5140.902, 137,	0	
2949 X =	321.9120, 5140.858, 128,	0	
2950 X =	322.9110, 5140.813, 124,	0	
2951 X =	323.9110, 5140.769, 123,	0	
2952 X =	311.9660, 5142.299, 153,	0	
2953 X =	312.9650, 5142.255, 153,	0	
2954 X =	313.9640, 5142.211, 153,	0	
2955 X =	314.9630, 5142.167, 153,	0	
2956 X =	315.9620, 5142.122, 153,	0	
2957 X =	316.9610, 5142.078, 153,	0	
2958 X =	317.9600, 5142.034, 153,	0	
2959 X =	318.9590, 5141.99, 152,	0	
2960 X =	319.9580, 5141.945, 146,	0	
2961 X =	320.9580, 5141.901, 137,	0	
2962 X =	321.9570, 5141.857, 129,	0	
2963 X =	322.9560, 5141.812, 123,	0	
2964 X =	323.9550, 5141.768, 121,	0	
2965 X =	311.0110, 5143.343, 154,	0	
2966 X =	312.0100, 5143.299, 153,	0	
2967 X =	313.0090, 5143.254, 153,	0	
2968 X =	314.0080, 5143.21, 153,	0	
2969 X =	315.0070, 5143.166, 153,	0	
2970 X =	316.0060, 5143.121, 153,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
2971 X =	317.0050, 5143.077, 153,	0	
2972 X =	318.0050, 5143.033, 153,	0	
2973 X =	319.0040, 5142.989, 152,	0	
2974 X =	320.0030, 5142.944, 146,	0	
2975 X =	321.0020, 5142.9, 137,	0	
2976 X =	322.0010, 5142.856, 129,	0	
2977 X =	323.0000, 5142.811, 124,	0	
2978 X =	323.9990, 5142.767, 122,	0	
2979 X =	310.0560, 5144.386, 154,	0	
2980 X =	311.0550, 5144.342, 153,	0	
2981 X =	312.0540, 5144.298, 153,	0	
2982 X =	313.0530, 5144.253, 153,	0	
2983 X =	314.0520, 5144.209, 153,	0	
2984 X =	315.0510, 5144.165, 153,	0	
2985 X =	316.0510, 5144.121, 153,	0	
2986 X =	317.0500, 5144.076, 153,	0	
2987 X =	318.0490, 5144.032, 153,	0	
2988 X =	319.0480, 5143.988, 152,	0	
2989 X =	320.0470, 5143.943, 147,	0	
2990 X =	321.0460, 5143.899, 138,	0	
2991 X =	322.0450, 5143.855, 130,	0	
2992 X =	323.0440, 5143.811, 125,	0	
2993 X =	324.0430, 5143.766, 123,	0	
2994 X =	309.1010, 5145.43, 154,	0	
2995 X =	310.1000, 5145.385, 153,	0	
2996 X =	311.0990, 5145.341, 153,	0	
2997 X =	312.0980, 5145.297, 153,	0	
2998 X =	313.0970, 5145.253, 153,	0	
2999 X =	314.0970, 5145.208, 153,	0	
3000 X =	315.0960, 5145.164, 153,	0	
3001 X =	316.0950, 5145.12, 153,	0	
3002 X =	317.0940, 5145.075, 153,	0	
3003 X =	318.0930, 5145.031, 153,	0	
3004 X =	319.0920, 5144.987, 152,	0	
3005 X =	320.0910, 5144.943, 147,	0	
3006 X =	321.0900, 5144.898, 139,	0	
3007 X =	322.0890, 5144.854, 132,	0	
3008 X =	323.0890, 5144.81, 127,	0	
3009 X =	324.0880, 5144.765, 124,	0	
3010 X =	308.1460, 5146.473, 157,	0	
3011 X =	309.1450, 5146.429, 153,	0	
3012 X =	310.1440, 5146.385, 153,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
3013 X =	311.1440, 5146.34, 153,	0	
3014 X =	312.1430, 5146.296, 153,	0	
3015 X =	313.1420, 5146.252, 153,	0	
3016 X =	314.1410, 5146.207, 153,	0	
3017 X =	315.1400, 5146.163, 153,	0	
3018 X =	316.1390, 5146.119, 153,	0	
3019 X =	317.1380, 5146.075, 153,	0	
3020 X =	318.1370, 5146.03, 153,	0	
3021 X =	319.1360, 5145.986, 152,	0	
3022 X =	320.1360, 5145.942, 147,	0	
3023 X =	321.1350, 5145.897, 140,	0	
3024 X =	322.1340, 5145.853, 134,	0	
3025 X =	323.1330, 5145.809, 128,	0	
3026 X =	324.1320, 5145.764, 124,	0	
3027 X =	309.1900, 5147.428, 154,	0	
3028 X =	310.1890, 5147.384, 153,	0	
3029 X =	311.1880, 5147.339, 153,	0	
3030 X =	312.1870, 5147.295, 153,	0	
3031 X =	313.1860, 5147.251, 153,	0	
3032 X =	314.1850, 5147.207, 153,	0	
3033 X =	315.1840, 5147.162, 153,	0	
3034 X =	316.1830, 5147.118, 153,	0	
3035 X =	317.1830, 5147.074, 153,	0	
3036 X =	318.1820, 5147.029, 153,	0	
3037 X =	319.1810, 5146.985, 152,	0	
3038 X =	320.1800, 5146.941, 148,	0	
3039 X =	321.1790, 5146.896, 141,	0	
3040 X =	322.1780, 5146.852, 135,	0	
3041 X =	323.1770, 5146.808, 130,	0	
3042 X =	324.1760, 5146.764, 125,	0	
3043 X =	310.2330, 5148.383, 153,	0	
3044 X =	311.2320, 5148.339, 153,	0	
3045 X =	312.2310, 5148.294, 153,	0	
3046 X =	313.2300, 5148.25, 154,	0	
3047 X =	314.2300, 5148.206, 154,	0	
3048 X =	315.2290, 5148.161, 153,	0	
3049 X =	316.2280, 5148.117, 153,	0	
3050 X =	317.2270, 5148.073, 153,	0	
3051 X =	318.2260, 5148.028, 153,	0	
3052 X =	319.2250, 5147.984, 153,	0	
3053 X =	320.2240, 5147.94, 149,	0	
3054 X =	321.2230, 5147.896, 142,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
3055 X =	322.2220, 5147.851, 136,	0	
3056 X =	323.2210, 5147.807, 130,	0	
3057 X =	324.2210, 5147.763, 126,	0	
3058 X =	312.2760, 5149.293, 153,	0	
3059 X =	313.2750, 5149.249, 155,	0	
3060 X =	314.2740, 5149.205, 156,	0	
3061 X =	315.2730, 5149.16, 154,	0	
3062 X =	316.2720, 5149.116, 153,	0	
3063 X =	317.2710, 5149.072, 153,	0	
3064 X =	318.2700, 5149.028, 153,	0	
3065 X =	319.2690, 5148.983, 153,	0	
3066 X =	320.2690, 5148.939, 149,	0	
3067 X =	321.2680, 5148.895, 144,	0	
3068 X =	322.2670, 5148.85, 137,	0	
3069 X =	323.2660, 5148.806, 131,	0	
3070 X =	324.2650, 5148.762, 126,	0	
3071 X =	314.3180, 5150.204, 159,	0	
3072 X =	315.3170, 5150.16, 158,	0	
3073 X =	316.3160, 5150.115, 156,	0	
3074 X =	317.3160, 5150.071, 154,	0	
3075 X =	318.3150, 5150.027, 153,	0	
3076 X =	319.3140, 5149.982, 153,	0	
3077 X =	320.3130, 5149.938, 150,	0	
3078 X =	321.3120, 5149.894, 145,	0	
3079 X =	322.3110, 5149.849, 139,	0	
3080 X =	323.3100, 5149.805, 132,	0	
3081 X =	324.3090, 5149.761, 127,	0	
3082 X =	326.0000, 5135.397, 109,	0	
3083 X =	325.8730, 5135.857, 109,	0	
3084 X =	325.7780, 5136.349, 109,	0	
3085 X =	325.7380, 5136.611, 109,	0	
3086 X =	325.6980, 5136.873, 109,	0	
3087 X =	325.6270, 5137.119, 109,	0	
3088 X =	325.5560, 5137.365, 109,	0	
3089 X =	325.5480, 5137.635, 109,	0	
3090 X =	325.5390, 5137.905, 109,	0	
3091 X =	325.7780, 5138.333, 109,	0	
3092 X =	325.8330, 5138.587, 109,	0	
3093 X =	325.8880, 5138.841, 111,	0	
3094 X =	325.9200, 5139.325, 111,	0	
3095 X =	325.9360, 5139.794, 111,	0	
3096 X =	325.9200, 5140.064, 111,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
3097 X =	325.9040, 5140.333, 109,	0	
3098 X =	325.8410, 5140.825, 109,	0	
3099 X =	325.8570, 5141.079, 109,	0	
3100 X =	325.8730, 5141.333, 109,	0	
3101 X =	325.9210, 5141.579, 109,	0	
3102 X =	325.9680, 5141.825, 109,	0	
3103 X =	326.0790, 5142.286, 109,	0	
3104 X =	326.1430, 5142.548, 109,	0	
3105 X =	326.2060, 5142.81, 109,	0	
3106 X =	326.3090, 5143.278, 109,	0	
3107 X =	326.4120, 5143.746, 109,	0	
3108 X =	326.4440, 5144.008, 109,	0	
3109 X =	326.4760, 5144.27, 109,	0	
3110 X =	326.5230, 5144.762, 110,	0	
3111 X =	326.4760, 5145.024, 111,	0	
3112 X =	326.4280, 5145.286, 112,	0	
3113 X =	326.3490, 5145.714, 111,	0	
3114 X =	326.3330, 5145.976, 112,	0	
3115 X =	326.3170, 5146.238, 112,	0	
3116 X =	326.2380, 5146.73, 112,	0	
3117 X =	326.3060, 5146.992, 112,	0	
3118 X =	326.3730, 5147.254, 112,	0	
3119 X =	326.4040, 5147.714, 112,	0	
3120 X =	326.4760, 5148.206, 112,	0	
3121 X =	326.4680, 5148.46, 112,	0	
3122 X =	326.4600, 5148.714, 112,	0	
3123 X =	326.3650, 5149.175, 112,	0	
3124 X =	326.2690, 5149.571, 112,	0	
3125 X =	326.3730, 5149.801, 112,	0	
3126 X =	326.4760, 5150.031, 112,	0	
3127 X =	326.7420, 5150.452, 112,	0	
3128 X =	326.7460, 5150.952, 113,	0	
3129 X =	326.6670, 5151.428, 113,	0	
3130 X =	326.6270, 5151.872, 113,	0	
3131 X =	326.5870, 5152.317, 113,	0	
3132 X =	326.4840, 5152.587, 112,	0	
3133 X =	326.3800, 5152.857, 112,	0	
3134 X =	326.2850, 5153.151, 112,	0	
3135 X =	326.1900, 5153.444, 112,	0	
3136 X =	326.1110, 5153.706, 112,	0	
3137 X =	326.0310, 5153.968, 112,	0	
3138 X =	326.3970, 5153.86, 113,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
3139 X =	326.7630, 5153.752, 125,	0	
3140 X =	326.7670, 5154.008, 145,	0	
3141 X =	326.7710, 5154.263, 161,	0	
3142 X =	326.7900, 5154.517, 177,	0	
3143 X =	326.8090, 5154.771, 189,	0	
3144 X =	326.8280, 5154.931, 203,	0	
3145 X =	326.4160, 5154.933, 157,	0	
3146 X =	326.4240, 5155.359, 216,	0	
3147 X =	326.0340, 5155.363, 141,	0	
3148 X =	326.0360, 5155.74, 185,	0	
3149 X =	325.6300, 5155.751, 122,	0	
3150 X =	325.6360, 5156.006, 167,	0	
3151 X =	325.6410, 5156.26, 180,	0	
3152 X =	325.6450, 5156.546, 180,	0	
3153 X =	325.2400, 5156.55, 163,	0	
3154 X =	325.2480, 5156.808, 183,	0	
3155 X =	325.2550, 5157.065, 183,	0	
3156 X =	325.2540, 5157.319, 185,	0	
3157 X =	325.2520, 5157.572, 185,	0	
3158 X =	325.2480, 5158.071, 212,	0	
3159 X =	325.2370, 5158.569, 239,	0	
3160 X =	325.2350, 5158.855, 254,	0	
3161 X =	324.7440, 5158.866, 262,	0	
3162 X =	324.3320, 5158.878, 224,	0	
3163 X =	324.3440, 5159.275, 274,	0	
3164 X =	323.9230, 5159.286, 221,	0	
3165 X =	323.9310, 5159.538, 268,	0	
3166 X =	323.9380, 5159.79, 273,	0	
3167 X =	323.9480, 5160.145, 274,	0	
3168 X =	323.9580, 5160.5, 274,	0	
3169 X =	323.7030, 5160.51, 270,	0	
3170 X =	323.4470, 5160.519, 253,	0	
3171 X =	322.9540, 5160.53, 273,	0	
3172 X =	322.6980, 5160.534, 274,	0	
3173 X =	322.4420, 5160.538, 274,	0	
3174 X =	322.1850, 5160.546, 241,	0	
3175 X =	321.9270, 5160.553, 174,	0	
3176 X =	321.9440, 5160.811, 254,	0	
3177 X =	321.9610, 5161.069, 274,	0	
3178 X =	321.9730, 5161.565, 274,	0	
3179 X =	321.9830, 5161.815, 274,	0	
3180 X =	321.9920, 5162.065, 274,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
3181 X =	321.9960, 5162.317, 274,	0	
3182 X =	322.0000, 5162.569, 274,	0	
3183 X =	322.0050, 5163.065, 274,	0	
3184 X =	322.0180, 5163.319, 274,	0	
3185 X =	322.0310, 5163.572, 274,	0	
3186 X =	322.0390, 5164.07, 274,	0	
3187 X =	322.0450, 5164.321, 274,	0	
3188 X =	322.0510, 5164.572, 274,	0	
3189 X =	322.0590, 5165.069, 274,	0	
3190 X =	322.0600, 5165.321, 274,	0	
3191 X =	322.0610, 5165.573, 274,	0	
3192 X =	322.0760, 5166, 274,	0	
3193 X =	322.0800, 5166.25, 274,	0	
3194 X =	322.0840, 5166.5, 274,	0	
3195 X =	322.0940, 5166.75, 274,	0	
3196 X =	322.1030, 5167, 274,	0	
3197 X =	322.1130, 5167.25, 273,	0	
3198 X =	322.1220, 5167.5, 268,	0	
3199 X =	322.1370, 5167.75, 265,	0	
3200 X =	322.1520, 5168, 263,	0	
3201 X =	322.1700, 5168.25, 261,	0	
3202 X =	322.1870, 5168.5, 260,	0	
3203 X =	322.1930, 5168.75, 260,	0	
3204 X =	322.1980, 5169, 258,	0	
3205 X =	322.2100, 5169.25, 254,	0	
3206 X =	322.2210, 5169.5, 250,	0	
3207 X =	322.2270, 5169.75, 247,	0	
3208 X =	322.2320, 5170, 243,	0	
3209 X =	322.2360, 5170.233, 242,	0	
3210 X =	321.7440, 5170.255, 241,	0	
3211 X =	321.4500, 5170.257, 240,	0	
3212 X =	321.4540, 5170.512, 241,	0	
3213 X =	321.4580, 5170.767, 241,	0	
3214 X =	321.4640, 5171.019, 242,	0	
3215 X =	321.4690, 5171.271, 243,	0	
3216 X =	321.4790, 5171.527, 244,	0	
3217 X =	321.4880, 5171.782, 250,	0	
3218 X =	321.5040, 5172.274, 264,	0	
3219 X =	321.5120, 5172.532, 270,	0	
3220 X =	321.5190, 5172.79, 271,	0	
3221 X =	321.5330, 5173.135, 274,	0	
3222 X =	321.5460, 5173.48, 274,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
3223 X =	321.2940, 5173.484, 274,	0	
3224 X =	321.0420, 5173.488, 274,	0	
3225 X =	320.7520, 5173.492, 271,	0	
3226 X =	320.7580, 5173.746, 272,	0	
3227 X =	320.7630, 5174, 274,	0	
3228 X =	320.7670, 5174.25, 274,	0	
3229 X =	320.7710, 5174.5, 274,	0	
3230 X =	320.7770, 5174.75, 273,	0	
3231 X =	320.7820, 5175, 273,	0	
3232 X =	320.7880, 5175.25, 273,	0	
3233 X =	320.7940, 5175.5, 274,	0	
3234 X =	320.8020, 5175.75, 274,	0	
3235 X =	320.8090, 5176, 274,	0	
3236 X =	320.8130, 5176.25, 274,	0	
3237 X =	320.8170, 5176.5, 274,	0	
3238 X =	320.8270, 5176.75, 274,	0	
3239 X =	320.8360, 5177, 274,	0	
3240 X =	320.8470, 5177.285, 274,	0	
3241 X =	320.8580, 5177.569, 260,	0	
3242 X =	320.6070, 5177.575, 261,	0	
3243 X =	320.3550, 5177.58, 254,	0	
3244 X =	320.0000, 5177.589, 242,	0	
3245 X =	320.0040, 5177.848, 240,	0	
3246 X =	320.0080, 5178.106, 241,	0	
3247 X =	320.0190, 5178.36, 242,	0	
3248 X =	320.0300, 5178.614, 243,	0	
3249 X =	320.0350, 5178.874, 244,	0	
3250 X =	320.0390, 5179.133, 247,	0	
3251 X =	320.0430, 5179.385, 253,	0	
3252 X =	326.5000, 5135.397, 122,	0	
3253 X =	327.0000, 5135.397, 139,	0	
3254 X =	327.5000, 5135.397, 152,	0	
3255 X =	328.0000, 5135.397, 152,	0	
3256 X =	328.5000, 5135.397, 152,	0	
3257 X =	329.0000, 5135.397, 152,	0	
3258 X =	329.5000, 5135.397, 156,	0	
3259 X =	330.0000, 5135.397, 164,	0	
3260 X =	330.5000, 5135.397, 173,	0	
3261 X =	331.0000, 5135.397, 172,	0	
3262 X =	331.5000, 5135.397, 168,	0	
3263 X =	332.0000, 5135.397, 172,	0	
3264 X =	332.5000, 5135.397, 177,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
3265 X =	333.0000, 5135.397, 179,	0	
3266 X =	326.0000, 5135.897, 109,	0	
3267 X =	326.5000, 5135.897, 126,	0	
3268 X =	327.0000, 5135.897, 144,	0	
3269 X =	327.5000, 5135.897, 152,	0	
3270 X =	328.0000, 5135.897, 152,	0	
3271 X =	328.5000, 5135.897, 154,	0	
3272 X =	329.0000, 5135.897, 161,	0	
3273 X =	329.5000, 5135.897, 168,	0	
3274 X =	330.0000, 5135.897, 178,	0	
3275 X =	330.5000, 5135.897, 183,	0	
3276 X =	331.0000, 5135.897, 183,	0	
3277 X =	331.5000, 5135.897, 177,	0	
3278 X =	332.0000, 5135.897, 179,	0	
3279 X =	332.5000, 5135.897, 185,	0	
3280 X =	333.0000, 5135.897, 186,	0	
3281 X =	326.0000, 5136.397, 109,	0	
3282 X =	326.5000, 5136.397, 130,	0	
3283 X =	327.0000, 5136.397, 152,	0	
3284 X =	327.5000, 5136.397, 152,	0	
3285 X =	328.0000, 5136.397, 160,	0	
3286 X =	328.5000, 5136.397, 165,	0	
3287 X =	329.0000, 5136.397, 170,	0	
3288 X =	329.5000, 5136.397, 178,	0	
3289 X =	330.0000, 5136.397, 183,	0	
3290 X =	330.5000, 5136.397, 183,	0	
3291 X =	331.0000, 5136.397, 183,	0	
3292 X =	331.5000, 5136.397, 183,	0	
3293 X =	332.0000, 5136.397, 183,	0	
3294 X =	332.5000, 5136.397, 192,	0	
3295 X =	333.0000, 5136.397, 192,	0	
3296 X =	326.0000, 5136.897, 110,	0	
3297 X =	326.5000, 5136.897, 133,	0	
3298 X =	327.0000, 5136.897, 152,	0	
3299 X =	327.5000, 5136.897, 159,	0	
3300 X =	328.0000, 5136.897, 176,	0	
3301 X =	328.5000, 5136.897, 177,	0	
3302 X =	329.0000, 5136.897, 178,	0	
3303 X =	329.5000, 5136.897, 180,	0	
3304 X =	330.0000, 5136.897, 186,	0	
3305 X =	330.5000, 5136.897, 191,	0	
3306 X =	331.0000, 5136.897, 187,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
3307 X =	331.5000, 5136.897, 183,	0	
3308 X =	332.0000, 5136.897, 190,	0	
3309 X =	332.5000, 5136.897, 197,	0	
3310 X =	333.0000, 5136.897, 198,	0	
3311 X =	326.0000, 5137.397, 112,	0	
3312 X =	326.5000, 5137.397, 142,	0	
3313 X =	327.0000, 5137.397, 163,	0	
3314 X =	327.5000, 5137.397, 177,	0	
3315 X =	328.0000, 5137.397, 187,	0	
3316 X =	328.5000, 5137.397, 192,	0	
3317 X =	329.0000, 5137.397, 191,	0	
3318 X =	329.5000, 5137.397, 188,	0	
3319 X =	330.0000, 5137.397, 198,	0	
3320 X =	330.5000, 5137.397, 203,	0	
3321 X =	331.0000, 5137.397, 194,	0	
3322 X =	331.5000, 5137.397, 192,	0	
3323 X =	332.0000, 5137.397, 196,	0	
3324 X =	332.5000, 5137.397, 203,	0	
3325 X =	333.0000, 5137.397, 204,	0	
3326 X =	326.0000, 5137.897, 113,	0	
3327 X =	326.5000, 5137.897, 144,	0	
3328 X =	327.0000, 5137.897, 175,	0	
3329 X =	327.5000, 5137.897, 194,	0	
3330 X =	328.0000, 5137.897, 205,	0	
3331 X =	328.5000, 5137.897, 211,	0	
3332 X =	329.0000, 5137.897, 217,	0	
3333 X =	329.5000, 5137.897, 206,	0	
3334 X =	330.0000, 5137.897, 211,	0	
3335 X =	330.5000, 5137.897, 213,	0	
3336 X =	331.0000, 5137.897, 201,	0	
3337 X =	331.5000, 5137.897, 200,	0	
3338 X =	332.0000, 5137.897, 208,	0	
3339 X =	332.5000, 5137.897, 211,	0	
3340 X =	333.0000, 5137.897, 210,	0	
3341 X =	326.0000, 5138.397, 113,	0	
3342 X =	326.5000, 5138.397, 151,	0	
3343 X =	327.0000, 5138.397, 189,	0	
3344 X =	327.5000, 5138.397, 226,	0	
3345 X =	328.0000, 5138.397, 238,	0	
3346 X =	328.5000, 5138.397, 244,	0	
3347 X =	329.0000, 5138.397, 243,	0	
3348 X =	329.5000, 5138.397, 223,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
3349 X =	330.0000, 5138.397, 217,	0	
3350 X =	330.5000, 5138.397, 214,	0	
3351 X =	331.0000, 5138.397, 209,	0	
3352 X =	331.5000, 5138.397, 208,	0	
3353 X =	332.0000, 5138.397, 212,	0	
3354 X =	332.5000, 5138.397, 213,	0	
3355 X =	333.0000, 5138.397, 213,	0	
3356 X =	326.0000, 5138.897, 116,	0	
3357 X =	326.5000, 5138.897, 184,	0	
3358 X =	327.0000, 5138.897, 218,	0	
3359 X =	327.5000, 5138.897, 244,	0	
3360 X =	328.0000, 5138.897, 244,	0	
3361 X =	328.5000, 5138.897, 244,	0	
3362 X =	329.0000, 5138.897, 244,	0	
3363 X =	329.5000, 5138.897, 235,	0	
3364 X =	330.0000, 5138.897, 227,	0	
3365 X =	330.5000, 5138.897, 221,	0	
3366 X =	331.0000, 5138.897, 216,	0	
3367 X =	331.5000, 5138.897, 214,	0	
3368 X =	332.0000, 5138.897, 213,	0	
3369 X =	332.5000, 5138.897, 213,	0	
3370 X =	333.0000, 5138.897, 213,	0	
3371 X =	326.0000, 5139.397, 114,	0	
3372 X =	326.5000, 5139.397, 243,	0	
3373 X =	327.0000, 5139.397, 244,	0	
3374 X =	327.5000, 5139.397, 244,	0	
3375 X =	328.0000, 5139.397, 244,	0	
3376 X =	328.5000, 5139.397, 244,	0	
3377 X =	329.0000, 5139.397, 244,	0	
3378 X =	329.5000, 5139.397, 238,	0	
3379 X =	330.0000, 5139.397, 231,	0	
3380 X =	330.5000, 5139.397, 226,	0	
3381 X =	331.0000, 5139.397, 221,	0	
3382 X =	331.5000, 5139.397, 216,	0	
3383 X =	332.0000, 5139.397, 213,	0	
3384 X =	332.5000, 5139.397, 213,	0	
3385 X =	333.0000, 5139.397, 213,	0	
3386 X =	326.0000, 5139.897, 114,	0	
3387 X =	326.5000, 5139.897, 241,	0	
3388 X =	327.0000, 5139.897, 244,	0	
3389 X =	327.5000, 5139.897, 244,	0	
3390 X =	328.0000, 5139.897, 244,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
3391 X =	328.5000, 5139.897, 244,	0	
3392 X =	329.0000, 5139.897, 244,	0	
3393 X =	329.5000, 5139.897, 241,	0	
3394 X =	330.0000, 5139.897, 236,	0	
3395 X =	330.5000, 5139.897, 234,	0	
3396 X =	331.0000, 5139.897, 231,	0	
3397 X =	331.5000, 5139.897, 225,	0	
3398 X =	332.0000, 5139.897, 219,	0	
3399 X =	332.5000, 5139.897, 216,	0	
3400 X =	333.0000, 5139.897, 214,	0	
3401 X =	326.0000, 5140.397, 111,	0	
3402 X =	326.5000, 5140.397, 217,	0	
3403 X =	327.0000, 5140.397, 244,	0	
3404 X =	327.5000, 5140.397, 244,	0	
3405 X =	328.0000, 5140.397, 244,	0	
3406 X =	328.5000, 5140.397, 244,	0	
3407 X =	329.0000, 5140.397, 244,	0	
3408 X =	329.5000, 5140.397, 243,	0	
3409 X =	330.0000, 5140.397, 240,	0	
3410 X =	330.5000, 5140.397, 239,	0	
3411 X =	331.0000, 5140.397, 240,	0	
3412 X =	331.5000, 5140.397, 237,	0	
3413 X =	332.0000, 5140.397, 231,	0	
3414 X =	332.5000, 5140.397, 227,	0	
3415 X =	333.0000, 5140.397, 221,	0	
3416 X =	326.0000, 5140.897, 109,	0	
3417 X =	326.5000, 5140.897, 206,	0	
3418 X =	327.0000, 5140.897, 244,	0	
3419 X =	327.5000, 5140.897, 244,	0	
3420 X =	328.0000, 5140.897, 244,	0	
3421 X =	328.5000, 5140.897, 244,	0	
3422 X =	329.0000, 5140.897, 244,	0	
3423 X =	329.5000, 5140.897, 244,	0	
3424 X =	330.0000, 5140.897, 244,	0	
3425 X =	330.5000, 5140.897, 244,	0	
3426 X =	331.0000, 5140.897, 244,	0	
3427 X =	331.5000, 5140.897, 244,	0	
3428 X =	332.0000, 5140.897, 243,	0	
3429 X =	332.5000, 5140.897, 237,	0	
3430 X =	333.0000, 5140.897, 230,	0	
3431 X =	326.0000, 5141.397, 109,	0	
3432 X =	326.5000, 5141.397, 156,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
3433 X =	327.0000, 5141.397, 244,	0	
3434 X =	327.5000, 5141.397, 244,	0	
3435 X =	328.0000, 5141.397, 244,	0	
3436 X =	328.5000, 5141.397, 244,	0	
3437 X =	329.0000, 5141.397, 244,	0	
3438 X =	329.5000, 5141.397, 244,	0	
3439 X =	330.0000, 5141.397, 244,	0	
3440 X =	330.5000, 5141.397, 244,	0	
3441 X =	331.0000, 5141.397, 244,	0	
3442 X =	331.5000, 5141.397, 244,	0	
3443 X =	332.0000, 5141.397, 244,	0	
3444 X =	332.5000, 5141.397, 244,	0	
3445 X =	333.0000, 5141.397, 241,	0	
3446 X =	326.0000, 5141.897, 109,	0	
3447 X =	326.5000, 5141.897, 148,	0	
3448 X =	327.0000, 5141.897, 243,	0	
3449 X =	327.5000, 5141.897, 244,	0	
3450 X =	328.0000, 5141.897, 244,	0	
3451 X =	328.5000, 5141.897, 244,	0	
3452 X =	329.0000, 5141.897, 244,	0	
3453 X =	329.5000, 5141.897, 244,	0	
3454 X =	330.0000, 5141.897, 248,	0	
3455 X =	330.5000, 5141.897, 249,	0	
3456 X =	331.0000, 5141.897, 250,	0	
3457 X =	331.5000, 5141.897, 250,	0	
3458 X =	332.0000, 5141.897, 248,	0	
3459 X =	332.5000, 5141.897, 246,	0	
3460 X =	333.0000, 5141.897, 244,	0	
3461 X =	326.5000, 5142.397, 128,	0	
3462 X =	327.0000, 5142.397, 238,	0	
3463 X =	327.5000, 5142.397, 214,	0	
3464 X =	328.0000, 5142.397, 244,	0	
3465 X =	328.5000, 5142.397, 244,	0	
3466 X =	329.0000, 5142.397, 244,	0	
3467 X =	329.5000, 5142.397, 244,	0	
3468 X =	330.0000, 5142.397, 253,	0	
3469 X =	330.5000, 5142.397, 255,	0	
3470 X =	331.0000, 5142.397, 258,	0	
3471 X =	331.5000, 5142.397, 258,	0	
3472 X =	332.0000, 5142.397, 255,	0	
3473 X =	332.5000, 5142.397, 251,	0	
3474 X =	333.0000, 5142.397, 249,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
3475 X =	326.5000, 5142.897, 119,	0	
3476 X =	327.0000, 5142.897, 170,	0	
3477 X =	327.5000, 5142.897, 226,	0	
3478 X =	328.0000, 5142.897, 244,	0	
3479 X =	328.5000, 5142.897, 244,	0	
3480 X =	329.0000, 5142.897, 244,	0	
3481 X =	329.5000, 5142.897, 244,	0	
3482 X =	330.0000, 5142.897, 257,	0	
3483 X =	330.5000, 5142.897, 261,	0	
3484 X =	331.0000, 5142.897, 265,	0	
3485 X =	331.5000, 5142.897, 265,	0	
3486 X =	332.0000, 5142.897, 263,	0	
3487 X =	332.5000, 5142.897, 255,	0	
3488 X =	333.0000, 5142.897, 254,	0	
3489 X =	326.5000, 5143.397, 114,	0	
3490 X =	327.0000, 5143.397, 160,	0	
3491 X =	327.5000, 5143.397, 241,	0	
3492 X =	328.0000, 5143.397, 244,	0	
3493 X =	328.5000, 5143.397, 244,	0	
3494 X =	329.0000, 5143.397, 244,	0	
3495 X =	329.5000, 5143.397, 244,	0	
3496 X =	330.0000, 5143.397, 258,	0	
3497 X =	330.5000, 5143.397, 267,	0	
3498 X =	331.0000, 5143.397, 272,	0	
3499 X =	331.5000, 5143.397, 274,	0	
3500 X =	332.0000, 5143.397, 270,	0	
3501 X =	332.5000, 5143.397, 260,	0	
3502 X =	333.0000, 5143.397, 260,	0	
3503 X =	326.5000, 5143.897, 111,	0	
3504 X =	327.0000, 5143.897, 151,	0	
3505 X =	327.5000, 5143.897, 214,	0	
3506 X =	328.0000, 5143.897, 238,	0	
3507 X =	328.5000, 5143.897, 242,	0	
3508 X =	329.0000, 5143.897, 244,	0	
3509 X =	329.5000, 5143.897, 244,	0	
3510 X =	330.0000, 5143.897, 257,	0	
3511 X =	330.5000, 5143.897, 273,	0	
3512 X =	331.0000, 5143.897, 274,	0	
3513 X =	331.5000, 5143.897, 274,	0	
3514 X =	332.0000, 5143.897, 274,	0	
3515 X =	332.5000, 5143.897, 265,	0	
3516 X =	333.0000, 5143.897, 266,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
3517 X =	326.5000, 5144.397, 109,	0	
3518 X =	327.0000, 5144.397, 148,	0	
3519 X =	327.5000, 5144.397, 193,	0	
3520 X =	328.0000, 5144.397, 196,	0	
3521 X =	328.5000, 5144.397, 234,	0	
3522 X =	329.0000, 5144.397, 244,	0	
3523 X =	329.5000, 5144.397, 244,	0	
3524 X =	330.0000, 5144.397, 262,	0	
3525 X =	330.5000, 5144.397, 274,	0	
3526 X =	331.0000, 5144.397, 274,	0	
3527 X =	331.5000, 5144.397, 274,	0	
3528 X =	332.0000, 5144.397, 274,	0	
3529 X =	332.5000, 5144.397, 269,	0	
3530 X =	333.0000, 5144.397, 271,	0	
3531 X =	326.5000, 5144.897, 110,	0	
3532 X =	327.0000, 5144.897, 139,	0	
3533 X =	327.5000, 5144.897, 183,	0	
3534 X =	328.0000, 5144.897, 188,	0	
3535 X =	328.5000, 5144.897, 238,	0	
3536 X =	329.0000, 5144.897, 244,	0	
3537 X =	329.5000, 5144.897, 259,	0	
3538 X =	330.0000, 5144.897, 272,	0	
3539 X =	330.5000, 5144.897, 274,	0	
3540 X =	331.0000, 5144.897, 274,	0	
3541 X =	331.5000, 5144.897, 274,	0	
3542 X =	332.0000, 5144.897, 274,	0	
3543 X =	332.5000, 5144.897, 274,	0	
3544 X =	333.0000, 5144.897, 274,	0	
3545 X =	326.5000, 5145.397, 112,	0	
3546 X =	327.0000, 5145.397, 134,	0	
3547 X =	327.5000, 5145.397, 188,	0	
3548 X =	328.0000, 5145.397, 224,	0	
3549 X =	328.5000, 5145.397, 250,	0	
3550 X =	329.0000, 5145.397, 261,	0	
3551 X =	329.5000, 5145.397, 274,	0	
3552 X =	330.0000, 5145.397, 274,	0	
3553 X =	330.5000, 5145.397, 274,	0	
3554 X =	331.0000, 5145.397, 274,	0	
3555 X =	331.5000, 5145.397, 274,	0	
3556 X =	332.0000, 5145.397, 274,	0	
3557 X =	332.5000, 5145.397, 274,	0	
3558 X =	333.0000, 5145.397, 274,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
3559 X =	326.5000, 5145.897, 112,	0	
3560 X =	327.0000, 5145.897, 149,	0	
3561 X =	327.5000, 5145.897, 200,	0	
3562 X =	328.0000, 5145.897, 240,	0	
3563 X =	328.5000, 5145.897, 247,	0	
3564 X =	329.0000, 5145.897, 256,	0	
3565 X =	329.5000, 5145.897, 267,	0	
3566 X =	330.0000, 5145.897, 274,	0	
3567 X =	330.5000, 5145.897, 274,	0	
3568 X =	331.0000, 5145.897, 274,	0	
3569 X =	331.5000, 5145.897, 274,	0	
3570 X =	332.0000, 5145.897, 274,	0	
3571 X =	332.5000, 5145.897, 274,	0	
3572 X =	333.0000, 5145.897, 274,	0	
3573 X =	326.5000, 5146.397, 112,	0	
3574 X =	327.0000, 5146.397, 174,	0	
3575 X =	327.5000, 5146.397, 224,	0	
3576 X =	328.0000, 5146.397, 244,	0	
3577 X =	328.5000, 5146.397, 244,	0	
3578 X =	329.0000, 5146.397, 250,	0	
3579 X =	329.5000, 5146.397, 268,	0	
3580 X =	330.0000, 5146.397, 274,	0	
3581 X =	330.5000, 5146.397, 274,	0	
3582 X =	331.0000, 5146.397, 274,	0	
3583 X =	331.5000, 5146.397, 274,	0	
3584 X =	332.0000, 5146.397, 274,	0	
3585 X =	332.5000, 5146.397, 274,	0	
3586 X =	333.0000, 5146.397, 274,	0	
3587 X =	326.5000, 5146.897, 115,	0	
3588 X =	327.0000, 5146.897, 178,	0	
3589 X =	327.5000, 5146.897, 242,	0	
3590 X =	328.0000, 5146.897, 244,	0	
3591 X =	328.5000, 5146.897, 244,	0	
3592 X =	329.0000, 5146.897, 254,	0	
3593 X =	329.5000, 5146.897, 275,	0	
3594 X =	330.0000, 5146.897, 274,	0	
3595 X =	330.5000, 5146.897, 274,	0	
3596 X =	331.0000, 5146.897, 274,	0	
3597 X =	331.5000, 5146.897, 274,	0	
3598 X =	332.0000, 5146.897, 274,	0	
3599 X =	332.5000, 5146.897, 274,	0	
3600 X =	333.0000, 5146.897, 274,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
3601 X =	326.5000, 5147.397, 114,	0	
3602 X =	327.0000, 5147.397, 150,	0	
3603 X =	327.5000, 5147.397, 243,	0	
3604 X =	328.0000, 5147.397, 232,	0	
3605 X =	328.5000, 5147.397, 245,	0	
3606 X =	329.0000, 5147.397, 266,	0	
3607 X =	329.5000, 5147.397, 276,	0	
3608 X =	330.0000, 5147.397, 274,	0	
3609 X =	330.5000, 5147.397, 274,	0	
3610 X =	331.0000, 5147.397, 274,	0	
3611 X =	331.5000, 5147.397, 274,	0	
3612 X =	332.0000, 5147.397, 274,	0	
3613 X =	332.5000, 5147.397, 274,	0	
3614 X =	333.0000, 5147.397, 274,	0	
3615 X =	326.5000, 5147.897, 112,	0	
3616 X =	327.0000, 5147.897, 124,	0	
3617 X =	327.5000, 5147.897, 197,	0	
3618 X =	328.0000, 5147.897, 188,	0	
3619 X =	328.5000, 5147.897, 244,	0	
3620 X =	329.0000, 5147.897, 263,	0	
3621 X =	329.5000, 5147.897, 277,	0	
3622 X =	330.0000, 5147.897, 274,	0	
3623 X =	330.5000, 5147.897, 274,	0	
3624 X =	331.0000, 5147.897, 274,	0	
3625 X =	331.5000, 5147.897, 274,	0	
3626 X =	332.0000, 5147.897, 274,	0	
3627 X =	332.5000, 5147.897, 274,	0	
3628 X =	333.0000, 5147.897, 274,	0	
3629 X =	326.5000, 5148.397, 112,	0	
3630 X =	327.0000, 5148.397, 114,	0	
3631 X =	327.5000, 5148.397, 182,	0	
3632 X =	328.0000, 5148.397, 237,	0	
3633 X =	328.5000, 5148.397, 255,	0	
3634 X =	329.0000, 5148.397, 274,	0	
3635 X =	329.5000, 5148.397, 277,	0	
3636 X =	330.0000, 5148.397, 274,	0	
3637 X =	330.5000, 5148.397, 274,	0	
3638 X =	331.0000, 5148.397, 274,	0	
3639 X =	331.5000, 5148.397, 274,	0	
3640 X =	332.0000, 5148.397, 274,	0	
3641 X =	332.5000, 5148.397, 274,	0	
3642 X =	333.0000, 5148.397, 274,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
3643 X =	326.5000, 5148.897, 112,	0	
3644 X =	327.0000, 5148.897, 114,	0	
3645 X =	327.5000, 5148.897, 227,	0	
3646 X =	328.0000, 5148.897, 244,	0	
3647 X =	328.5000, 5148.897, 270,	0	
3648 X =	329.0000, 5148.897, 274,	0	
3649 X =	329.5000, 5148.897, 278,	0	
3650 X =	330.0000, 5148.897, 274,	0	
3651 X =	330.5000, 5148.897, 274,	0	
3652 X =	331.0000, 5148.897, 274,	0	
3653 X =	331.5000, 5148.897, 274,	0	
3654 X =	332.0000, 5148.897, 274,	0	
3655 X =	332.5000, 5148.897, 274,	0	
3656 X =	333.0000, 5148.897, 274,	0	
3657 X =	326.5000, 5149.397, 112,	0	
3658 X =	327.0000, 5149.397, 114,	0	
3659 X =	327.5000, 5149.397, 235,	0	
3660 X =	328.0000, 5149.397, 252,	0	
3661 X =	328.5000, 5149.397, 265,	0	
3662 X =	329.0000, 5149.397, 274,	0	
3663 X =	329.5000, 5149.397, 277,	0	
3664 X =	330.0000, 5149.397, 274,	0	
3665 X =	330.5000, 5149.397, 274,	0	
3666 X =	331.0000, 5149.397, 274,	0	
3667 X =	331.5000, 5149.397, 274,	0	
3668 X =	332.0000, 5149.397, 274,	0	
3669 X =	332.5000, 5149.397, 274,	0	
3670 X =	333.0000, 5149.397, 274,	0	
3671 X =	326.5000, 5149.897, 112,	0	
3672 X =	327.0000, 5149.897, 116,	0	
3673 X =	327.5000, 5149.897, 236,	0	
3674 X =	328.0000, 5149.897, 250,	0	
3675 X =	328.5000, 5149.897, 262,	0	
3676 X =	329.0000, 5149.897, 274,	0	
3677 X =	329.5000, 5149.897, 276,	0	
3678 X =	330.0000, 5149.897, 274,	0	
3679 X =	330.5000, 5149.897, 274,	0	
3680 X =	331.0000, 5149.897, 274,	0	
3681 X =	331.5000, 5149.897, 274,	0	
3682 X =	332.0000, 5149.897, 274,	0	
3683 X =	332.5000, 5149.897, 274,	0	
3684 X =	333.0000, 5149.897, 274,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
3685 X =	327.0000, 5150.397, 123,	0	
3686 X =	327.5000, 5150.397, 220,	0	
3687 X =	328.0000, 5150.397, 248,	0	
3688 X =	328.5000, 5150.397, 256,	0	
3689 X =	329.0000, 5150.397, 264,	0	
3690 X =	329.5000, 5150.397, 272,	0	
3691 X =	330.0000, 5150.397, 275,	0	
3692 X =	330.5000, 5150.397, 274,	0	
3693 X =	331.0000, 5150.397, 274,	0	
3694 X =	331.5000, 5150.397, 274,	0	
3695 X =	332.0000, 5150.397, 274,	0	
3696 X =	332.5000, 5150.397, 274,	0	
3697 X =	333.0000, 5150.397, 274,	0	
3698 X =	327.0000, 5150.897, 125,	0	
3699 X =	327.5000, 5150.897, 221,	0	
3700 X =	328.0000, 5150.897, 245,	0	
3701 X =	328.5000, 5150.897, 251,	0	
3702 X =	329.0000, 5150.897, 256,	0	
3703 X =	329.5000, 5150.897, 264,	0	
3704 X =	330.0000, 5150.897, 274,	0	
3705 X =	330.5000, 5150.897, 274,	0	
3706 X =	331.0000, 5150.897, 274,	0	
3707 X =	331.5000, 5150.897, 274,	0	
3708 X =	332.0000, 5150.897, 274,	0	
3709 X =	332.5000, 5150.897, 274,	0	
3710 X =	333.0000, 5150.897, 274,	0	
3711 X =	327.0000, 5151.397, 126,	0	
3712 X =	327.5000, 5151.397, 188,	0	
3713 X =	328.0000, 5151.397, 230,	0	
3714 X =	328.5000, 5151.397, 247,	0	
3715 X =	329.0000, 5151.397, 250,	0	
3716 X =	329.5000, 5151.397, 257,	0	
3717 X =	330.0000, 5151.397, 263,	0	
3718 X =	330.5000, 5151.397, 273,	0	
3719 X =	331.0000, 5151.397, 274,	0	
3720 X =	331.5000, 5151.397, 274,	0	
3721 X =	332.0000, 5151.397, 274,	0	
3722 X =	332.5000, 5151.397, 274,	0	
3723 X =	333.0000, 5151.397, 274,	0	
3724 X =	327.0000, 5151.897, 121,	0	
3725 X =	327.5000, 5151.897, 180,	0	
3726 X =	328.0000, 5151.897, 205,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
3727 X =	328.5000, 5151.897, 226,	0	
3728 X =	329.0000, 5151.897, 240,	0	
3729 X =	329.5000, 5151.897, 249,	0	
3730 X =	330.0000, 5151.897, 254,	0	
3731 X =	330.5000, 5151.897, 261,	0	
3732 X =	331.0000, 5151.897, 268,	0	
3733 X =	331.5000, 5151.897, 273,	0	
3734 X =	332.0000, 5151.897, 274,	0	
3735 X =	332.5000, 5151.897, 274,	0	
3736 X =	333.0000, 5151.897, 274,	0	
3737 X =	327.0000, 5152.397, 120,	0	
3738 X =	327.5000, 5152.397, 161,	0	
3739 X =	328.0000, 5152.397, 184,	0	
3740 X =	328.5000, 5152.397, 197,	0	
3741 X =	329.0000, 5152.397, 208,	0	
3742 X =	329.5000, 5152.397, 229,	0	
3743 X =	330.0000, 5152.397, 246,	0	
3744 X =	330.5000, 5152.397, 251,	0	
3745 X =	331.0000, 5152.397, 255,	0	
3746 X =	331.5000, 5152.397, 261,	0	
3747 X =	332.0000, 5152.397, 271,	0	
3748 X =	332.5000, 5152.397, 274,	0	
3749 X =	333.0000, 5152.397, 272,	0	
3750 X =	326.5000, 5152.897, 113,	0	
3751 X =	327.0000, 5152.897, 127,	0	
3752 X =	327.5000, 5152.897, 152,	0	
3753 X =	328.0000, 5152.897, 173,	0	
3754 X =	328.5000, 5152.897, 194,	0	
3755 X =	329.0000, 5152.897, 209,	0	
3756 X =	329.5000, 5152.897, 211,	0	
3757 X =	330.0000, 5152.897, 212,	0	
3758 X =	330.5000, 5152.897, 224,	0	
3759 X =	331.0000, 5152.897, 244,	0	
3760 X =	331.5000, 5152.897, 249,	0	
3761 X =	332.0000, 5152.897, 258,	0	
3762 X =	332.5000, 5152.897, 259,	0	
3763 X =	333.0000, 5152.897, 261,	0	
3764 X =	326.5000, 5153.397, 113,	0	
3765 X =	327.0000, 5153.397, 148,	0	
3766 X =	327.5000, 5153.397, 152,	0	
3767 X =	328.0000, 5153.397, 152,	0	
3768 X =	328.5000, 5153.397, 179,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
3769 X =	329.0000, 5153.397, 227,	0	
3770 X =	329.5000, 5153.397, 212,	0	
3771 X =	330.0000, 5153.397, 212,	0	
3772 X =	330.5000, 5153.397, 212,	0	
3773 X =	331.0000, 5153.397, 212,	0	
3774 X =	331.5000, 5153.397, 213,	0	
3775 X =	332.0000, 5153.397, 235,	0	
3776 X =	332.5000, 5153.397, 246,	0	
3777 X =	333.0000, 5153.397, 250,	0	
3778 X =	327.0000, 5153.897, 165,	0	
3779 X =	327.5000, 5153.897, 162,	0	
3780 X =	328.0000, 5153.897, 155,	0	
3781 X =	328.5000, 5153.897, 152,	0	
3782 X =	329.0000, 5153.897, 196,	0	
3783 X =	329.5000, 5153.897, 243,	0	
3784 X =	330.0000, 5153.897, 237,	0	
3785 X =	330.5000, 5153.897, 215,	0	
3786 X =	331.0000, 5153.897, 213,	0	
3787 X =	331.5000, 5153.897, 213,	0	
3788 X =	332.0000, 5153.897, 212,	0	
3789 X =	332.5000, 5153.897, 212,	0	
3790 X =	333.0000, 5153.897, 217,	0	
3791 X =	327.0000, 5154.397, 183,	0	
3792 X =	327.5000, 5154.397, 172,	0	
3793 X =	328.0000, 5154.397, 163,	0	
3794 X =	328.5000, 5154.397, 161,	0	
3795 X =	329.0000, 5154.397, 174,	0	
3796 X =	329.5000, 5154.397, 202,	0	
3797 X =	330.0000, 5154.397, 243,	0	
3798 X =	330.5000, 5154.397, 241,	0	
3799 X =	331.0000, 5154.397, 226,	0	
3800 X =	331.5000, 5154.397, 225,	0	
3801 X =	332.0000, 5154.397, 214,	0	
3802 X =	332.5000, 5154.397, 213,	0	
3803 X =	333.0000, 5154.397, 212,	0	
3804 X =	327.0000, 5154.897, 199,	0	
3805 X =	327.5000, 5154.897, 184,	0	
3806 X =	328.0000, 5154.897, 173,	0	
3807 X =	328.5000, 5154.897, 172,	0	
3808 X =	329.0000, 5154.897, 175,	0	
3809 X =	329.5000, 5154.897, 180,	0	
3810 X =	330.0000, 5154.897, 230,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
3811 X =	330.5000, 5154.897, 243,	0	
3812 X =	331.0000, 5154.897, 243,	0	
3813 X =	331.5000, 5154.897, 244,	0	
3814 X =	332.0000, 5154.897, 244,	0	
3815 X =	332.5000, 5154.897, 224,	0	
3816 X =	333.0000, 5154.897, 213,	0	
3817 X =	326.5000, 5155.397, 232,	0	
3818 X =	327.0000, 5155.397, 240,	0	
3819 X =	327.5000, 5155.397, 205,	0	
3820 X =	328.0000, 5155.397, 183,	0	
3821 X =	328.5000, 5155.397, 176,	0	
3822 X =	329.0000, 5155.397, 177,	0	
3823 X =	329.5000, 5155.397, 179,	0	
3824 X =	330.0000, 5155.397, 182,	0	
3825 X =	330.5000, 5155.397, 236,	0	
3826 X =	331.0000, 5155.397, 244,	0	
3827 X =	331.5000, 5155.397, 244,	0	
3828 X =	332.0000, 5155.397, 244,	0	
3829 X =	332.5000, 5155.397, 244,	0	
3830 X =	333.0000, 5155.397, 235,	0	
3831 X =	326.0000, 5155.897, 189,	0	
3832 X =	326.5000, 5155.897, 215,	0	
3833 X =	327.0000, 5155.897, 230,	0	
3834 X =	327.5000, 5155.897, 211,	0	
3835 X =	328.0000, 5155.897, 193,	0	
3836 X =	328.5000, 5155.897, 181,	0	
3837 X =	329.0000, 5155.897, 178,	0	
3838 X =	329.5000, 5155.897, 179,	0	
3839 X =	330.0000, 5155.897, 180,	0	
3840 X =	330.5000, 5155.897, 184,	0	
3841 X =	331.0000, 5155.897, 223,	0	
3842 X =	331.5000, 5155.897, 238,	0	
3843 X =	332.0000, 5155.897, 244,	0	
3844 X =	332.5000, 5155.897, 244,	0	
3845 X =	333.0000, 5155.897, 244,	0	
3846 X =	326.0000, 5156.397, 203,	0	
3847 X =	326.5000, 5156.397, 212,	0	
3848 X =	327.0000, 5156.397, 224,	0	
3849 X =	327.5000, 5156.397, 212,	0	
3850 X =	328.0000, 5156.397, 198,	0	
3851 X =	328.5000, 5156.397, 186,	0	
3852 X =	329.0000, 5156.397, 180,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
3853 X =	329.5000, 5156.397, 179,	0	
3854 X =	330.0000, 5156.397, 180,	0	
3855 X =	330.5000, 5156.397, 181,	0	
3856 X =	331.0000, 5156.397, 186,	0	
3857 X =	331.5000, 5156.397, 231,	0	
3858 X =	332.0000, 5156.397, 244,	0	
3859 X =	332.5000, 5156.397, 244,	0	
3860 X =	333.0000, 5156.397, 244,	0	
3861 X =	325.5000, 5156.897, 187,	0	
3862 X =	326.0000, 5156.897, 243,	0	
3863 X =	326.5000, 5156.897, 217,	0	
3864 X =	327.0000, 5156.897, 217,	0	
3865 X =	327.5000, 5156.897, 213,	0	
3866 X =	328.0000, 5156.897, 204,	0	
3867 X =	328.5000, 5156.897, 192,	0	
3868 X =	329.0000, 5156.897, 182,	0	
3869 X =	329.5000, 5156.897, 180,	0	
3870 X =	330.0000, 5156.897, 180,	0	
3871 X =	330.5000, 5156.897, 180,	0	
3872 X =	331.0000, 5156.897, 181,	0	
3873 X =	331.5000, 5156.897, 200,	0	
3874 X =	332.0000, 5156.897, 242,	0	
3875 X =	332.5000, 5156.897, 244,	0	
3876 X =	333.0000, 5156.897, 244,	0	
3877 X =	325.5000, 5157.397, 208,	0	
3878 X =	326.0000, 5157.397, 244,	0	
3879 X =	326.5000, 5157.397, 244,	0	
3880 X =	327.0000, 5157.397, 239,	0	
3881 X =	327.5000, 5157.397, 219,	0	
3882 X =	328.0000, 5157.397, 211,	0	
3883 X =	328.5000, 5157.397, 203,	0	
3884 X =	329.0000, 5157.397, 189,	0	
3885 X =	329.5000, 5157.397, 182,	0	
3886 X =	330.0000, 5157.397, 180,	0	
3887 X =	330.5000, 5157.397, 180,	0	
3888 X =	331.0000, 5157.397, 180,	0	
3889 X =	331.5000, 5157.397, 182,	0	
3890 X =	332.0000, 5157.397, 205,	0	
3891 X =	332.5000, 5157.397, 244,	0	
3892 X =	333.0000, 5157.397, 244,	0	
3893 X =	325.5000, 5157.897, 217,	0	
3894 X =	326.0000, 5157.897, 244,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
3895 X =	326.5000, 5157.897, 244,	0	
3896 X =	327.0000, 5157.897, 244,	0	
3897 X =	327.5000, 5157.897, 244,	0	
3898 X =	328.0000, 5157.897, 244,	0	
3899 X =	328.5000, 5157.897, 219,	0	
3900 X =	329.0000, 5157.897, 203,	0	
3901 X =	329.5000, 5157.897, 188,	0	
3902 X =	330.0000, 5157.897, 182,	0	
3903 X =	330.5000, 5157.897, 180,	0	
3904 X =	331.0000, 5157.897, 180,	0	
3905 X =	331.5000, 5157.897, 181,	0	
3906 X =	332.0000, 5157.897, 185,	0	
3907 X =	332.5000, 5157.897, 214,	0	
3908 X =	333.0000, 5157.897, 244,	0	
3909 X =	325.5000, 5158.397, 218,	0	
3910 X =	326.0000, 5158.397, 237,	0	
3911 X =	326.5000, 5158.397, 244,	0	
3912 X =	327.0000, 5158.397, 244,	0	
3913 X =	327.5000, 5158.397, 244,	0	
3914 X =	328.0000, 5158.397, 246,	0	
3915 X =	328.5000, 5158.397, 247,	0	
3916 X =	329.0000, 5158.397, 247,	0	
3917 X =	329.5000, 5158.397, 211,	0	
3918 X =	330.0000, 5158.397, 187,	0	
3919 X =	330.5000, 5158.397, 182,	0	
3920 X =	331.0000, 5158.397, 180,	0	
3921 X =	331.5000, 5158.397, 180,	0	
3922 X =	332.0000, 5158.397, 181,	0	
3923 X =	332.5000, 5158.397, 191,	0	
3924 X =	333.0000, 5158.397, 220,	0	
3925 X =	324.5000, 5158.897, 261,	0	
3926 X =	325.0000, 5158.897, 252,	0	
3927 X =	325.5000, 5158.897, 253,	0	
3928 X =	326.0000, 5158.897, 243,	0	
3929 X =	326.5000, 5158.897, 243,	0	
3930 X =	327.0000, 5158.897, 244,	0	
3931 X =	327.5000, 5158.897, 244,	0	
3932 X =	328.0000, 5158.897, 257,	0	
3933 X =	328.5000, 5158.897, 263,	0	
3934 X =	329.0000, 5158.897, 272,	0	
3935 X =	329.5000, 5158.897, 259,	0	
3936 X =	330.0000, 5158.897, 233,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
3937 X =	330.5000, 5158.897, 186,	0	
3938 X =	331.0000, 5158.897, 181,	0	
3939 X =	331.5000, 5158.897, 180,	0	
3940 X =	332.0000, 5158.897, 181,	0	
3941 X =	332.5000, 5158.897, 182,	0	
3942 X =	333.0000, 5158.897, 198,	0	
3943 X =	324.0000, 5159.397, 261,	0	
3944 X =	324.5000, 5159.397, 274,	0	
3945 X =	325.0000, 5159.397, 271,	0	
3946 X =	325.5000, 5159.397, 274,	0	
3947 X =	326.0000, 5159.397, 274,	0	
3948 X =	326.5000, 5159.397, 248,	0	
3949 X =	327.0000, 5159.397, 274,	0	
3950 X =	327.5000, 5159.397, 272,	0	
3951 X =	328.0000, 5159.397, 270,	0	
3952 X =	328.5000, 5159.397, 273,	0	
3953 X =	329.0000, 5159.397, 274,	0	
3954 X =	329.5000, 5159.397, 274,	0	
3955 X =	330.0000, 5159.397, 274,	0	
3956 X =	330.5000, 5159.397, 251,	0	
3957 X =	331.0000, 5159.397, 184,	0	
3958 X =	331.5000, 5159.397, 181,	0	
3959 X =	332.0000, 5159.397, 181,	0	
3960 X =	332.5000, 5159.397, 182,	0	
3961 X =	333.0000, 5159.397, 186,	0	
3962 X =	324.0000, 5159.897, 274,	0	
3963 X =	324.5000, 5159.897, 274,	0	
3964 X =	325.0000, 5159.897, 274,	0	
3965 X =	325.5000, 5159.897, 274,	0	
3966 X =	326.0000, 5159.897, 274,	0	
3967 X =	326.5000, 5159.897, 269,	0	
3968 X =	327.0000, 5159.897, 274,	0	
3969 X =	327.5000, 5159.897, 274,	0	
3970 X =	328.0000, 5159.897, 274,	0	
3971 X =	328.5000, 5159.897, 274,	0	
3972 X =	329.0000, 5159.897, 274,	0	
3973 X =	329.5000, 5159.897, 274,	0	
3974 X =	330.0000, 5159.897, 274,	0	
3975 X =	330.5000, 5159.897, 274,	0	
3976 X =	331.0000, 5159.897, 242,	0	
3977 X =	331.5000, 5159.897, 183,	0	
3978 X =	332.0000, 5159.897, 181,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
3979 X =	332.5000, 5159.897, 181,	0	
3980 X =	333.0000, 5159.897, 184,	0	
3981 X =	324.0000, 5160.397, 274,	0	
3982 X =	324.5000, 5160.397, 274,	0	
3983 X =	325.0000, 5160.397, 274,	0	
3984 X =	325.5000, 5160.397, 274,	0	
3985 X =	326.0000, 5160.397, 274,	0	
3986 X =	326.5000, 5160.397, 276,	0	
3987 X =	327.0000, 5160.397, 277,	0	
3988 X =	327.5000, 5160.397, 279,	0	
3989 X =	328.0000, 5160.397, 277,	0	
3990 X =	328.5000, 5160.397, 276,	0	
3991 X =	329.0000, 5160.397, 275,	0	
3992 X =	329.5000, 5160.397, 275,	0	
3993 X =	330.0000, 5160.397, 274,	0	
3994 X =	330.5000, 5160.397, 274,	0	
3995 X =	331.0000, 5160.397, 274,	0	
3996 X =	331.5000, 5160.397, 220,	0	
3997 X =	332.0000, 5160.397, 182,	0	
3998 X =	332.5000, 5160.397, 182,	0	
3999 X =	333.0000, 5160.397, 183,	0	
4000 X =	322.0000, 5160.897, 271,	0	
4001 X =	322.5000, 5160.897, 274,	0	
4002 X =	323.0000, 5160.897, 274,	0	
4003 X =	323.5000, 5160.897, 274,	0	
4004 X =	324.0000, 5160.897, 274,	0	
4005 X =	324.5000, 5160.897, 274,	0	
4006 X =	325.0000, 5160.897, 274,	0	
4007 X =	325.5000, 5160.897, 274,	0	
4008 X =	326.0000, 5160.897, 274,	0	
4009 X =	326.5000, 5160.897, 279,	0	
4010 X =	327.0000, 5160.897, 281,	0	
4011 X =	327.5000, 5160.897, 283,	0	
4012 X =	328.0000, 5160.897, 280,	0	
4013 X =	328.5000, 5160.897, 279,	0	
4014 X =	329.0000, 5160.897, 278,	0	
4015 X =	329.5000, 5160.897, 276,	0	
4016 X =	330.0000, 5160.897, 275,	0	
4017 X =	330.5000, 5160.897, 274,	0	
4018 X =	331.0000, 5160.897, 274,	0	
4019 X =	331.5000, 5160.897, 273,	0	
4020 X =	332.0000, 5160.897, 200,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
4021 X =	332.5000, 5160.897, 182,	0	
4022 X =	333.0000, 5160.897, 183,	0	
4023 X =	322.0000, 5161.397, 274,	0	
4024 X =	322.5000, 5161.397, 274,	0	
4025 X =	323.0000, 5161.397, 274,	0	
4026 X =	323.5000, 5161.397, 274,	0	
4027 X =	324.0000, 5161.397, 274,	0	
4028 X =	324.5000, 5161.397, 274,	0	
4029 X =	325.0000, 5161.397, 274,	0	
4030 X =	325.5000, 5161.397, 274,	0	
4031 X =	326.0000, 5161.397, 274,	0	
4032 X =	326.5000, 5161.397, 281,	0	
4033 X =	327.0000, 5161.397, 286,	0	
4034 X =	327.5000, 5161.397, 287,	0	
4035 X =	328.0000, 5161.397, 284,	0	
4036 X =	328.5000, 5161.397, 282,	0	
4037 X =	329.0000, 5161.397, 280,	0	
4038 X =	329.5000, 5161.397, 279,	0	
4039 X =	330.0000, 5161.397, 277,	0	
4040 X =	330.5000, 5161.397, 276,	0	
4041 X =	331.0000, 5161.397, 275,	0	
4042 X =	331.5000, 5161.397, 274,	0	
4043 X =	332.0000, 5161.397, 249,	0	
4044 X =	332.5000, 5161.397, 185,	0	
4045 X =	333.0000, 5161.397, 183,	0	
4046 X =	322.0000, 5161.897, 274,	0	
4047 X =	322.5000, 5161.897, 274,	0	
4048 X =	323.0000, 5161.897, 274,	0	
4049 X =	323.5000, 5161.897, 274,	0	
4050 X =	324.0000, 5161.897, 274,	0	
4051 X =	324.5000, 5161.897, 274,	0	
4052 X =	325.0000, 5161.897, 274,	0	
4053 X =	325.5000, 5161.897, 274,	0	
4054 X =	326.0000, 5161.897, 274,	0	
4055 X =	326.5000, 5161.897, 283,	0	
4056 X =	327.0000, 5161.897, 291,	0	
4057 X =	327.5000, 5161.897, 292,	0	
4058 X =	328.0000, 5161.897, 287,	0	
4059 X =	328.5000, 5161.897, 285,	0	
4060 X =	329.0000, 5161.897, 284,	0	
4061 X =	329.5000, 5161.897, 283,	0	
4062 X =	330.0000, 5161.897, 281,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
4063 X =	330.5000, 5161.897, 278,	0	
4064 X =	331.0000, 5161.897, 277,	0	
4065 X =	331.5000, 5161.897, 275,	0	
4066 X =	332.0000, 5161.897, 274,	0	
4067 X =	332.5000, 5161.897, 217,	0	
4068 X =	333.0000, 5161.897, 183,	0	
4069 X =	322.0000, 5162.397, 274,	0	
4070 X =	322.5000, 5162.397, 274,	0	
4071 X =	323.0000, 5162.397, 274,	0	
4072 X =	323.5000, 5162.397, 274,	0	
4073 X =	324.0000, 5162.397, 274,	0	
4074 X =	324.5000, 5162.397, 274,	0	
4075 X =	325.0000, 5162.397, 274,	0	
4076 X =	325.5000, 5162.397, 274,	0	
4077 X =	326.0000, 5162.397, 274,	0	
4078 X =	326.5000, 5162.397, 282,	0	
4079 X =	327.0000, 5162.397, 294,	0	
4080 X =	327.5000, 5162.397, 296,	0	
4081 X =	328.0000, 5162.397, 292,	0	
4082 X =	328.5000, 5162.397, 290,	0	
4083 X =	329.0000, 5162.397, 289,	0	
4084 X =	329.5000, 5162.397, 287,	0	
4085 X =	330.0000, 5162.397, 284,	0	
4086 X =	330.5000, 5162.397, 283,	0	
4087 X =	331.0000, 5162.397, 282,	0	
4088 X =	331.5000, 5162.397, 281,	0	
4089 X =	332.0000, 5162.397, 278,	0	
4090 X =	332.5000, 5162.397, 271,	0	
4091 X =	333.0000, 5162.397, 195,	0	
4092 X =	322.5000, 5162.897, 274,	0	
4093 X =	323.0000, 5162.897, 274,	0	
4094 X =	323.5000, 5162.897, 274,	0	
4095 X =	324.0000, 5162.897, 274,	0	
4096 X =	324.5000, 5162.897, 274,	0	
4097 X =	325.0000, 5162.897, 274,	0	
4098 X =	325.5000, 5162.897, 274,	0	
4099 X =	326.0000, 5162.897, 274,	0	
4100 X =	326.5000, 5162.897, 282,	0	
4101 X =	327.0000, 5162.897, 295,	0	
4102 X =	327.5000, 5162.897, 302,	0	
4103 X =	328.0000, 5162.897, 295,	0	
4104 X =	328.5000, 5162.897, 293,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
4105 X =	329.0000, 5162.897, 293,	0	
4106 X =	329.5000, 5162.897, 292,	0	
4107 X =	330.0000, 5162.897, 290,	0	
4108 X =	330.5000, 5162.897, 290,	0	
4109 X =	331.0000, 5162.897, 292,	0	
4110 X =	331.5000, 5162.897, 292,	0	
4111 X =	332.0000, 5162.897, 289,	0	
4112 X =	332.5000, 5162.897, 280,	0	
4113 X =	333.0000, 5162.897, 230,	0	
4114 X =	322.5000, 5163.397, 274,	0	
4115 X =	323.0000, 5163.397, 274,	0	
4116 X =	323.5000, 5163.397, 274,	0	
4117 X =	324.0000, 5163.397, 274,	0	
4118 X =	324.5000, 5163.397, 274,	0	
4119 X =	325.0000, 5163.397, 274,	0	
4120 X =	325.5000, 5163.397, 274,	0	
4121 X =	326.0000, 5163.397, 274,	0	
4122 X =	326.5000, 5163.397, 280,	0	
4123 X =	327.0000, 5163.397, 291,	0	
4124 X =	327.5000, 5163.397, 303,	0	
4125 X =	328.0000, 5163.397, 299,	0	
4126 X =	328.5000, 5163.397, 297,	0	
4127 X =	329.0000, 5163.397, 298,	0	
4128 X =	329.5000, 5163.397, 297,	0	
4129 X =	330.0000, 5163.397, 294,	0	
4130 X =	330.5000, 5163.397, 294,	0	
4131 X =	331.0000, 5163.397, 298,	0	
4132 X =	331.5000, 5163.397, 303,	0	
4133 X =	332.0000, 5163.397, 303,	0	
4134 X =	332.5000, 5163.397, 285,	0	
4135 X =	333.0000, 5163.397, 250,	0	
4136 X =	322.5000, 5163.897, 274,	0	
4137 X =	323.0000, 5163.897, 274,	0	
4138 X =	323.5000, 5163.897, 274,	0	
4139 X =	324.0000, 5163.897, 274,	0	
4140 X =	324.5000, 5163.897, 274,	0	
4141 X =	325.0000, 5163.897, 274,	0	
4142 X =	325.5000, 5163.897, 274,	0	
4143 X =	326.0000, 5163.897, 274,	0	
4144 X =	326.5000, 5163.897, 278,	0	
4145 X =	327.0000, 5163.897, 287,	0	
4146 X =	327.5000, 5163.897, 296,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
4147 X =	328.0000, 5163.897, 302,	0	
4148 X =	328.5000, 5163.897, 301,	0	
4149 X =	329.0000, 5163.897, 301,	0	
4150 X =	329.5000, 5163.897, 302,	0	
4151 X =	330.0000, 5163.897, 299,	0	
4152 X =	330.5000, 5163.897, 299,	0	
4153 X =	331.0000, 5163.897, 301,	0	
4154 X =	331.5000, 5163.897, 304,	0	
4155 X =	332.0000, 5163.897, 301,	0	
4156 X =	332.5000, 5163.897, 282,	0	
4157 X =	333.0000, 5163.897, 248,	0	
4158 X =	322.5000, 5164.397, 274,	0	
4159 X =	323.0000, 5164.397, 274,	0	
4160 X =	323.5000, 5164.397, 274,	0	
4161 X =	324.0000, 5164.397, 274,	0	
4162 X =	324.5000, 5164.397, 274,	0	
4163 X =	325.0000, 5164.397, 274,	0	
4164 X =	325.5000, 5164.397, 275,	0	
4165 X =	326.0000, 5164.397, 278,	0	
4166 X =	326.5000, 5164.397, 281,	0	
4167 X =	327.0000, 5164.397, 287,	0	
4168 X =	327.5000, 5164.397, 294,	0	
4169 X =	328.0000, 5164.397, 301,	0	
4170 X =	328.5000, 5164.397, 304,	0	
4171 X =	329.0000, 5164.397, 303,	0	
4172 X =	329.5000, 5164.397, 304,	0	
4173 X =	330.0000, 5164.397, 304,	0	
4174 X =	330.5000, 5164.397, 303,	0	
4175 X =	331.0000, 5164.397, 304,	0	
4176 X =	331.5000, 5164.397, 304,	0	
4177 X =	332.0000, 5164.397, 303,	0	
4178 X =	332.5000, 5164.397, 290,	0	
4179 X =	333.0000, 5164.397, 278,	0	
4180 X =	322.5000, 5164.897, 274,	0	
4181 X =	323.0000, 5164.897, 276,	0	
4182 X =	323.5000, 5164.897, 276,	0	
4183 X =	324.0000, 5164.897, 277,	0	
4184 X =	324.5000, 5164.897, 279,	0	
4185 X =	325.0000, 5164.897, 281,	0	
4186 X =	325.5000, 5164.897, 282,	0	
4187 X =	326.0000, 5164.897, 284,	0	
4188 X =	326.5000, 5164.897, 287,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
4189 X =	327.0000, 5164.897, 290,	0	
4190 X =	327.5000, 5164.897, 295,	0	
4191 X =	328.0000, 5164.897, 299,	0	
4192 X =	328.5000, 5164.897, 304,	0	
4193 X =	329.0000, 5164.897, 305,	0	
4194 X =	329.5000, 5164.897, 304,	0	
4195 X =	330.0000, 5164.897, 304,	0	
4196 X =	330.5000, 5164.897, 304,	0	
4197 X =	331.0000, 5164.897, 304,	0	
4198 X =	331.5000, 5164.897, 304,	0	
4199 X =	332.0000, 5164.897, 304,	0	
4200 X =	332.5000, 5164.897, 294,	0	
4201 X =	333.0000, 5164.897, 283,	0	
4202 X =	322.5000, 5165.397, 274,	0	
4203 X =	323.0000, 5165.397, 278,	0	
4204 X =	323.5000, 5165.397, 279,	0	
4205 X =	324.0000, 5165.397, 278,	0	
4206 X =	324.5000, 5165.397, 282,	0	
4207 X =	325.0000, 5165.397, 285,	0	
4208 X =	325.5000, 5165.397, 287,	0	
4209 X =	326.0000, 5165.397, 289,	0	
4210 X =	326.5000, 5165.397, 292,	0	
4211 X =	327.0000, 5165.397, 295,	0	
4212 X =	327.5000, 5165.397, 297,	0	
4213 X =	328.0000, 5165.397, 300,	0	
4214 X =	328.5000, 5165.397, 302,	0	
4215 X =	329.0000, 5165.397, 304,	0	
4216 X =	329.5000, 5165.397, 304,	0	
4217 X =	330.0000, 5165.397, 304,	0	
4218 X =	330.5000, 5165.397, 304,	0	
4219 X =	331.0000, 5165.397, 304,	0	
4220 X =	331.5000, 5165.397, 304,	0	
4221 X =	332.0000, 5165.397, 303,	0	
4222 X =	332.5000, 5165.397, 293,	0	
4223 X =	333.0000, 5165.397, 284,	0	
4224 X =	322.5000, 5165.897, 274,	0	
4225 X =	323.0000, 5165.897, 279,	0	
4226 X =	323.5000, 5165.897, 281,	0	
4227 X =	324.0000, 5165.897, 279,	0	
4228 X =	324.5000, 5165.897, 283,	0	
4229 X =	325.0000, 5165.897, 287,	0	
4230 X =	325.5000, 5165.897, 290,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
4231 X =	326.0000, 5165.897, 294,	0	
4232 X =	326.5000, 5165.897, 297,	0	
4233 X =	327.0000, 5165.897, 300,	0	
4234 X =	327.5000, 5165.897, 300,	0	
4235 X =	328.0000, 5165.897, 301,	0	
4236 X =	328.5000, 5165.897, 303,	0	
4237 X =	329.0000, 5165.897, 303,	0	
4238 X =	329.5000, 5165.897, 304,	0	
4239 X =	330.0000, 5165.897, 304,	0	
4240 X =	330.5000, 5165.897, 304,	0	
4241 X =	331.0000, 5165.897, 304,	0	
4242 X =	331.5000, 5165.897, 304,	0	
4243 X =	332.0000, 5165.897, 299,	0	
4244 X =	332.5000, 5165.897, 291,	0	
4245 X =	333.0000, 5165.897, 284,	0	
4246 X =	322.5000, 5166.397, 274,	0	
4247 X =	323.0000, 5166.397, 280,	0	
4248 X =	323.5000, 5166.397, 283,	0	
4249 X =	324.0000, 5166.397, 278,	0	
4250 X =	324.5000, 5166.397, 283,	0	
4251 X =	325.0000, 5166.397, 287,	0	
4252 X =	325.5000, 5166.397, 291,	0	
4253 X =	326.0000, 5166.397, 295,	0	
4254 X =	326.5000, 5166.397, 299,	0	
4255 X =	327.0000, 5166.397, 303,	0	
4256 X =	327.5000, 5166.397, 304,	0	
4257 X =	328.0000, 5166.397, 304,	0	
4258 X =	328.5000, 5166.397, 304,	0	
4259 X =	329.0000, 5166.397, 304,	0	
4260 X =	329.5000, 5166.397, 304,	0	
4261 X =	330.0000, 5166.397, 304,	0	
4262 X =	330.5000, 5166.397, 304,	0	
4263 X =	331.0000, 5166.397, 304,	0	
4264 X =	331.5000, 5166.397, 303,	0	
4265 X =	332.0000, 5166.397, 297,	0	
4266 X =	332.5000, 5166.397, 291,	0	
4267 X =	333.0000, 5166.397, 284,	0	
4268 X =	322.5000, 5166.897, 274,	0	
4269 X =	323.0000, 5166.897, 280,	0	
4270 X =	323.5000, 5166.897, 286,	0	
4271 X =	324.0000, 5166.897, 279,	0	
4272 X =	324.5000, 5166.897, 283,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
4273 X =	325.0000, 5166.897, 287,	0	
4274 X =	325.5000, 5166.897, 291,	0	
4275 X =	326.0000, 5166.897, 295,	0	
4276 X =	326.5000, 5166.897, 299,	0	
4277 X =	327.0000, 5166.897, 303,	0	
4278 X =	327.5000, 5166.897, 304,	0	
4279 X =	328.0000, 5166.897, 304,	0	
4280 X =	328.5000, 5166.897, 304,	0	
4281 X =	329.0000, 5166.897, 304,	0	
4282 X =	329.5000, 5166.897, 305,	0	
4283 X =	330.0000, 5166.897, 304,	0	
4284 X =	330.5000, 5166.897, 304,	0	
4285 X =	331.0000, 5166.897, 304,	0	
4286 X =	331.5000, 5166.897, 303,	0	
4287 X =	332.0000, 5166.897, 297,	0	
4288 X =	332.5000, 5166.897, 291,	0	
4289 X =	333.0000, 5166.897, 284,	0	
4290 X =	322.5000, 5167.397, 274,	0	
4291 X =	323.0000, 5167.397, 279,	0	
4292 X =	323.5000, 5167.397, 288,	0	
4293 X =	324.0000, 5167.397, 280,	0	
4294 X =	324.5000, 5167.397, 285,	0	
4295 X =	325.0000, 5167.397, 289,	0	
4296 X =	325.5000, 5167.397, 293,	0	
4297 X =	326.0000, 5167.397, 296,	0	
4298 X =	326.5000, 5167.397, 299,	0	
4299 X =	327.0000, 5167.397, 302,	0	
4300 X =	327.5000, 5167.397, 304,	0	
4301 X =	328.0000, 5167.397, 304,	0	
4302 X =	328.5000, 5167.397, 304,	0	
4303 X =	329.0000, 5167.397, 304,	0	
4304 X =	329.5000, 5167.397, 304,	0	
4305 X =	330.0000, 5167.397, 304,	0	
4306 X =	330.5000, 5167.397, 304,	0	
4307 X =	331.0000, 5167.397, 304,	0	
4308 X =	331.5000, 5167.397, 303,	0	
4309 X =	332.0000, 5167.397, 297,	0	
4310 X =	332.5000, 5167.397, 291,	0	
4311 X =	333.0000, 5167.397, 285,	0	
4312 X =	322.5000, 5167.897, 274,	0	
4313 X =	323.0000, 5167.897, 279,	0	
4314 X =	323.5000, 5167.897, 289,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
4315 X =	324.0000, 5167.897, 281,	0	
4316 X =	324.5000, 5167.897, 289,	0	
4317 X =	325.0000, 5167.897, 292,	0	
4318 X =	325.5000, 5167.897, 296,	0	
4319 X =	326.0000, 5167.897, 300,	0	
4320 X =	326.5000, 5167.897, 302,	0	
4321 X =	327.0000, 5167.897, 304,	0	
4322 X =	327.5000, 5167.897, 304,	0	
4323 X =	328.0000, 5167.897, 304,	0	
4324 X =	328.5000, 5167.897, 304,	0	
4325 X =	329.0000, 5167.897, 304,	0	
4326 X =	329.5000, 5167.897, 304,	0	
4327 X =	330.0000, 5167.897, 305,	0	
4328 X =	330.5000, 5167.897, 305,	0	
4329 X =	331.0000, 5167.897, 304,	0	
4330 X =	331.5000, 5167.897, 303,	0	
4331 X =	332.0000, 5167.897, 297,	0	
4332 X =	332.5000, 5167.897, 291,	0	
4333 X =	333.0000, 5167.897, 285,	0	
4334 X =	322.5000, 5168.397, 273,	0	
4335 X =	323.0000, 5168.397, 279,	0	
4336 X =	323.5000, 5168.397, 290,	0	
4337 X =	324.0000, 5168.397, 282,	0	
4338 X =	324.5000, 5168.397, 293,	0	
4339 X =	325.0000, 5168.397, 296,	0	
4340 X =	325.5000, 5168.397, 299,	0	
4341 X =	326.0000, 5168.397, 303,	0	
4342 X =	326.5000, 5168.397, 304,	0	
4343 X =	327.0000, 5168.397, 304,	0	
4344 X =	327.5000, 5168.397, 304,	0	
4345 X =	328.0000, 5168.397, 304,	0	
4346 X =	328.5000, 5168.397, 304,	0	
4347 X =	329.0000, 5168.397, 304,	0	
4348 X =	329.5000, 5168.397, 319,	0	
4349 X =	330.0000, 5168.397, 316,	0	
4350 X =	330.5000, 5168.397, 311,	0	
4351 X =	331.0000, 5168.397, 305,	0	
4352 X =	331.5000, 5168.397, 303,	0	
4353 X =	332.0000, 5168.397, 294,	0	
4354 X =	332.5000, 5168.397, 289,	0	
4355 X =	333.0000, 5168.397, 284,	0	
4356 X =	322.5000, 5168.897, 273,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
4357 X =	323.0000, 5168.897, 277,	0	
4358 X =	323.5000, 5168.897, 287,	0	
4359 X =	324.0000, 5168.897, 281,	0	
4360 X =	324.5000, 5168.897, 297,	0	
4361 X =	325.0000, 5168.897, 299,	0	
4362 X =	325.5000, 5168.897, 301,	0	
4363 X =	326.0000, 5168.897, 304,	0	
4364 X =	326.5000, 5168.897, 304,	0	
4365 X =	327.0000, 5168.897, 304,	0	
4366 X =	327.5000, 5168.897, 304,	0	
4367 X =	328.0000, 5168.897, 304,	0	
4368 X =	328.5000, 5168.897, 304,	0	
4369 X =	329.0000, 5168.897, 304,	0	
4370 X =	329.5000, 5168.897, 336,	0	
4371 X =	330.0000, 5168.897, 333,	0	
4372 X =	330.5000, 5168.897, 323,	0	
4373 X =	331.0000, 5168.897, 312,	0	
4374 X =	331.5000, 5168.897, 304,	0	
4375 X =	332.0000, 5168.897, 291,	0	
4376 X =	332.5000, 5168.897, 287,	0	
4377 X =	333.0000, 5168.897, 283,	0	
4378 X =	322.5000, 5169.397, 264,	0	
4379 X =	323.0000, 5169.397, 275,	0	
4380 X =	323.5000, 5169.397, 281,	0	
4381 X =	324.0000, 5169.397, 281,	0	
4382 X =	324.5000, 5169.397, 300,	0	
4383 X =	325.0000, 5169.397, 301,	0	
4384 X =	325.5000, 5169.397, 302,	0	
4385 X =	326.0000, 5169.397, 304,	0	
4386 X =	326.5000, 5169.397, 304,	0	
4387 X =	327.0000, 5169.397, 304,	0	
4388 X =	327.5000, 5169.397, 304,	0	
4389 X =	328.0000, 5169.397, 304,	0	
4390 X =	328.5000, 5169.397, 304,	0	
4391 X =	329.0000, 5169.397, 305,	0	
4392 X =	329.5000, 5169.397, 346,	0	
4393 X =	330.0000, 5169.397, 351,	0	
4394 X =	330.5000, 5169.397, 331,	0	
4395 X =	331.0000, 5169.397, 315,	0	
4396 X =	331.5000, 5169.397, 304,	0	
4397 X =	332.0000, 5169.397, 287,	0	
4398 X =	332.5000, 5169.397, 284,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
4399 X =	333.0000, 5169.397, 281,	0	
4400 X =	322.5000, 5169.897, 251,	0	
4401 X =	323.0000, 5169.897, 270,	0	
4402 X =	323.5000, 5169.897, 276,	0	
4403 X =	324.0000, 5169.897, 281,	0	
4404 X =	324.5000, 5169.897, 303,	0	
4405 X =	325.0000, 5169.897, 287,	0	
4406 X =	325.5000, 5169.897, 287,	0	
4407 X =	326.0000, 5169.897, 291,	0	
4408 X =	326.5000, 5169.897, 295,	0	
4409 X =	327.0000, 5169.897, 303,	0	
4410 X =	327.5000, 5169.897, 304,	0	
4411 X =	328.0000, 5169.897, 304,	0	
4412 X =	328.5000, 5169.897, 304,	0	
4413 X =	329.0000, 5169.897, 317,	0	
4414 X =	329.5000, 5169.897, 328,	0	
4415 X =	330.0000, 5169.897, 332,	0	
4416 X =	330.5000, 5169.897, 322,	0	
4417 X =	331.0000, 5169.897, 312,	0	
4418 X =	331.5000, 5169.897, 305,	0	
4419 X =	332.0000, 5169.897, 283,	0	
4420 X =	332.5000, 5169.897, 281,	0	
4421 X =	333.0000, 5169.897, 279,	0	
4422 X =	321.5000, 5170.397, 241,	0	
4423 X =	322.0000, 5170.397, 242,	0	
4424 X =	322.5000, 5170.397, 243,	0	
4425 X =	323.0000, 5170.397, 248,	0	
4426 X =	323.5000, 5170.397, 263,	0	
4427 X =	324.0000, 5170.397, 274,	0	
4428 X =	324.5000, 5170.397, 278,	0	
4429 X =	325.0000, 5170.397, 263,	0	
4430 X =	325.5000, 5170.397, 270,	0	
4431 X =	326.0000, 5170.397, 274,	0	
4432 X =	326.5000, 5170.397, 274,	0	
4433 X =	327.0000, 5170.397, 298,	0	
4434 X =	327.5000, 5170.397, 305,	0	
4435 X =	328.0000, 5170.397, 304,	0	
4436 X =	328.5000, 5170.397, 304,	0	
4437 X =	329.0000, 5170.397, 314,	0	
4438 X =	329.5000, 5170.397, 320,	0	
4439 X =	330.0000, 5170.397, 318,	0	
4440 X =	330.5000, 5170.397, 314,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
4441 X =	331.0000, 5170.397, 309,	0	
4442 X =	331.5000, 5170.397, 305,	0	
4443 X =	332.0000, 5170.397, 280,	0	
4444 X =	332.5000, 5170.397, 280,	0	
4445 X =	333.0000, 5170.397, 281,	0	
4446 X =	321.5000, 5170.897, 242,	0	
4447 X =	322.0000, 5170.897, 242,	0	
4448 X =	322.5000, 5170.897, 242,	0	
4449 X =	323.0000, 5170.897, 243,	0	
4450 X =	323.5000, 5170.897, 244,	0	
4451 X =	324.0000, 5170.897, 244,	0	
4452 X =	324.5000, 5170.897, 244,	0	
4453 X =	325.0000, 5170.897, 244,	0	
4454 X =	325.5000, 5170.897, 245,	0	
4455 X =	326.0000, 5170.897, 246,	0	
4456 X =	326.5000, 5170.897, 276,	0	
4457 X =	327.0000, 5170.897, 293,	0	
4458 X =	327.5000, 5170.897, 304,	0	
4459 X =	328.0000, 5170.897, 304,	0	
4460 X =	328.5000, 5170.897, 304,	0	
4461 X =	329.0000, 5170.897, 310,	0	
4462 X =	329.5000, 5170.897, 316,	0	
4463 X =	330.0000, 5170.897, 312,	0	
4464 X =	330.5000, 5170.897, 309,	0	
4465 X =	331.0000, 5170.897, 306,	0	
4466 X =	331.5000, 5170.897, 304,	0	
4467 X =	332.0000, 5170.897, 276,	0	
4468 X =	332.5000, 5170.897, 282,	0	
4469 X =	333.0000, 5170.897, 288,	0	
4470 X =	321.5000, 5171.397, 243,	0	
4471 X =	322.0000, 5171.397, 245,	0	
4472 X =	322.5000, 5171.397, 244,	0	
4473 X =	323.0000, 5171.397, 245,	0	
4474 X =	323.5000, 5171.397, 245,	0	
4475 X =	324.0000, 5171.397, 249,	0	
4476 X =	324.5000, 5171.397, 255,	0	
4477 X =	325.0000, 5171.397, 267,	0	
4478 X =	325.5000, 5171.397, 273,	0	
4479 X =	326.0000, 5171.397, 244,	0	
4480 X =	326.5000, 5171.397, 273,	0	
4481 X =	327.0000, 5171.397, 287,	0	
4482 X =	327.5000, 5171.397, 303,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
4483 X =	328.0000, 5171.397, 304,	0	
4484 X =	328.5000, 5171.397, 304,	0	
4485 X =	329.0000, 5171.397, 307,	0	
4486 X =	329.5000, 5171.397, 312,	0	
4487 X =	330.0000, 5171.397, 308,	0	
4488 X =	330.5000, 5171.397, 304,	0	
4489 X =	331.0000, 5171.397, 303,	0	
4490 X =	331.5000, 5171.397, 280,	0	
4491 X =	332.0000, 5171.397, 274,	0	
4492 X =	332.5000, 5171.397, 280,	0	
4493 X =	333.0000, 5171.397, 288,	0	
4494 X =	321.5000, 5171.897, 254,	0	
4495 X =	322.0000, 5171.897, 261,	0	
4496 X =	322.5000, 5171.897, 259,	0	
4497 X =	323.0000, 5171.897, 256,	0	
4498 X =	323.5000, 5171.897, 257,	0	
4499 X =	324.0000, 5171.897, 263,	0	
4500 X =	324.5000, 5171.897, 273,	0	
4501 X =	325.0000, 5171.897, 274,	0	
4502 X =	325.5000, 5171.897, 274,	0	
4503 X =	326.0000, 5171.897, 262,	0	
4504 X =	326.5000, 5171.897, 248,	0	
4505 X =	327.0000, 5171.897, 279,	0	
4506 X =	327.5000, 5171.897, 302,	0	
4507 X =	328.0000, 5171.897, 304,	0	
4508 X =	328.5000, 5171.897, 304,	0	
4509 X =	329.0000, 5171.897, 305,	0	
4510 X =	329.5000, 5171.897, 307,	0	
4511 X =	330.0000, 5171.897, 301,	0	
4512 X =	330.5000, 5171.897, 289,	0	
4513 X =	331.0000, 5171.897, 290,	0	
4514 X =	331.5000, 5171.897, 274,	0	
4515 X =	332.0000, 5171.897, 275,	0	
4516 X =	332.5000, 5171.897, 284,	0	
4517 X =	333.0000, 5171.897, 290,	0	
4518 X =	322.0000, 5172.397, 274,	0	
4519 X =	322.5000, 5172.397, 274,	0	
4520 X =	323.0000, 5172.397, 271,	0	
4521 X =	323.5000, 5172.397, 269,	0	
4522 X =	324.0000, 5172.397, 273,	0	
4523 X =	324.5000, 5172.397, 274,	0	
4524 X =	325.0000, 5172.397, 274,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
4525 X =	325.5000, 5172.397, 274,	0	
4526 X =	326.0000, 5172.397, 274,	0	
4527 X =	326.5000, 5172.397, 245,	0	
4528 X =	327.0000, 5172.397, 269,	0	
4529 X =	327.5000, 5172.397, 289,	0	
4530 X =	328.0000, 5172.397, 302,	0	
4531 X =	328.5000, 5172.397, 292,	0	
4532 X =	329.0000, 5172.397, 283,	0	
4533 X =	329.5000, 5172.397, 276,	0	
4534 X =	330.0000, 5172.397, 274,	0	
4535 X =	330.5000, 5172.397, 274,	0	
4536 X =	331.0000, 5172.397, 274,	0	
4537 X =	331.5000, 5172.397, 274,	0	
4538 X =	332.0000, 5172.397, 275,	0	
4539 X =	332.5000, 5172.397, 289,	0	
4540 X =	333.0000, 5172.397, 293,	0	
4541 X =	322.0000, 5172.897, 274,	0	
4542 X =	322.5000, 5172.897, 274,	0	
4543 X =	323.0000, 5172.897, 274,	0	
4544 X =	323.5000, 5172.897, 274,	0	
4545 X =	324.0000, 5172.897, 274,	0	
4546 X =	324.5000, 5172.897, 274,	0	
4547 X =	325.0000, 5172.897, 274,	0	
4548 X =	325.5000, 5172.897, 274,	0	
4549 X =	326.0000, 5172.897, 274,	0	
4550 X =	326.5000, 5172.897, 266,	0	
4551 X =	327.0000, 5172.897, 268,	0	
4552 X =	327.5000, 5172.897, 272,	0	
4553 X =	328.0000, 5172.897, 274,	0	
4554 X =	328.5000, 5172.897, 274,	0	
4555 X =	329.0000, 5172.897, 274,	0	
4556 X =	329.5000, 5172.897, 277,	0	
4557 X =	330.0000, 5172.897, 291,	0	
4558 X =	330.5000, 5172.897, 286,	0	
4559 X =	331.0000, 5172.897, 282,	0	
4560 X =	331.5000, 5172.897, 283,	0	
4561 X =	332.0000, 5172.897, 286,	0	
4562 X =	332.5000, 5172.897, 295,	0	
4563 X =	333.0000, 5172.897, 299,	0	
4564 X =	322.0000, 5173.397, 274,	0	
4565 X =	322.5000, 5173.397, 274,	0	
4566 X =	323.0000, 5173.397, 274,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
4567 X =	323.5000, 5173.397, 274,	0	
4568 X =	324.0000, 5173.397, 274,	0	
4569 X =	324.5000, 5173.397, 274,	0	
4570 X =	325.0000, 5173.397, 274,	0	
4571 X =	325.5000, 5173.397, 274,	0	
4572 X =	326.0000, 5173.397, 275,	0	
4573 X =	326.5000, 5173.397, 277,	0	
4574 X =	327.0000, 5173.397, 277,	0	
4575 X =	327.5000, 5173.397, 275,	0	
4576 X =	328.0000, 5173.397, 281,	0	
4577 X =	328.5000, 5173.397, 283,	0	
4578 X =	329.0000, 5173.397, 304,	0	
4579 X =	329.5000, 5173.397, 304,	0	
4580 X =	330.0000, 5173.397, 304,	0	
4581 X =	330.5000, 5173.397, 304,	0	
4582 X =	331.0000, 5173.397, 297,	0	
4583 X =	331.5000, 5173.397, 296,	0	
4584 X =	332.0000, 5173.397, 299,	0	
4585 X =	332.5000, 5173.397, 301,	0	
4586 X =	333.0000, 5173.397, 304,	0	
4587 X =	321.0000, 5173.897, 274,	0	
4588 X =	321.5000, 5173.897, 274,	0	
4589 X =	322.0000, 5173.897, 274,	0	
4590 X =	322.5000, 5173.897, 274,	0	
4591 X =	323.0000, 5173.897, 274,	0	
4592 X =	323.5000, 5173.897, 274,	0	
4593 X =	324.0000, 5173.897, 274,	0	
4594 X =	324.5000, 5173.897, 275,	0	
4595 X =	325.0000, 5173.897, 275,	0	
4596 X =	325.5000, 5173.897, 276,	0	
4597 X =	326.0000, 5173.897, 280,	0	
4598 X =	326.5000, 5173.897, 289,	0	
4599 X =	327.0000, 5173.897, 296,	0	
4600 X =	327.5000, 5173.897, 301,	0	
4601 X =	328.0000, 5173.897, 304,	0	
4602 X =	328.5000, 5173.897, 304,	0	
4603 X =	329.0000, 5173.897, 304,	0	
4604 X =	329.5000, 5173.897, 304,	0	
4605 X =	330.0000, 5173.897, 306,	0	
4606 X =	330.5000, 5173.897, 308,	0	
4607 X =	331.0000, 5173.897, 308,	0	
4608 X =	331.5000, 5173.897, 307,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
4609 X =	332.0000, 5173.897, 308,	0	
4610 X =	332.5000, 5173.897, 307,	0	
4611 X =	333.0000, 5173.897, 311,	0	
4612 X =	321.0000, 5174.397, 274,	0	
4613 X =	321.5000, 5174.397, 274,	0	
4614 X =	322.0000, 5174.397, 274,	0	
4615 X =	322.5000, 5174.397, 274,	0	
4616 X =	323.0000, 5174.397, 277,	0	
4617 X =	323.5000, 5174.397, 279,	0	
4618 X =	324.0000, 5174.397, 280,	0	
4619 X =	324.5000, 5174.397, 281,	0	
4620 X =	325.0000, 5174.397, 282,	0	
4621 X =	325.5000, 5174.397, 283,	0	
4622 X =	326.0000, 5174.397, 288,	0	
4623 X =	326.5000, 5174.397, 297,	0	
4624 X =	327.0000, 5174.397, 303,	0	
4625 X =	327.5000, 5174.397, 304,	0	
4626 X =	328.0000, 5174.397, 305,	0	
4627 X =	328.5000, 5174.397, 304,	0	
4628 X =	329.0000, 5174.397, 304,	0	
4629 X =	329.5000, 5174.397, 310,	0	
4630 X =	330.0000, 5174.397, 312,	0	
4631 X =	330.5000, 5174.397, 315,	0	
4632 X =	331.0000, 5174.397, 316,	0	
4633 X =	331.5000, 5174.397, 314,	0	
4634 X =	332.0000, 5174.397, 315,	0	
4635 X =	332.5000, 5174.397, 316,	0	
4636 X =	333.0000, 5174.397, 318,	0	
4637 X =	321.0000, 5174.897, 274,	0	
4638 X =	321.5000, 5174.897, 274,	0	
4639 X =	322.0000, 5174.897, 274,	0	
4640 X =	322.5000, 5174.897, 274,	0	
4641 X =	323.0000, 5174.897, 279,	0	
4642 X =	323.5000, 5174.897, 284,	0	
4643 X =	324.0000, 5174.897, 286,	0	
4644 X =	324.5000, 5174.897, 287,	0	
4645 X =	325.0000, 5174.897, 289,	0	
4646 X =	325.5000, 5174.897, 292,	0	
4647 X =	326.0000, 5174.897, 297,	0	
4648 X =	326.5000, 5174.897, 302,	0	
4649 X =	327.0000, 5174.897, 304,	0	
4650 X =	327.5000, 5174.897, 304,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
4651 X =	328.0000, 5174.897, 307,	0	
4652 X =	328.5000, 5174.897, 308,	0	
4653 X =	329.0000, 5174.897, 309,	0	
4654 X =	329.5000, 5174.897, 315,	0	
4655 X =	330.0000, 5174.897, 318,	0	
4656 X =	330.5000, 5174.897, 321,	0	
4657 X =	331.0000, 5174.897, 324,	0	
4658 X =	331.5000, 5174.897, 323,	0	
4659 X =	332.0000, 5174.897, 323,	0	
4660 X =	332.5000, 5174.897, 323,	0	
4661 X =	333.0000, 5174.897, 324,	0	
4662 X =	321.0000, 5175.397, 274,	0	
4663 X =	321.5000, 5175.397, 274,	0	
4664 X =	322.0000, 5175.397, 274,	0	
4665 X =	322.5000, 5175.397, 274,	0	
4666 X =	323.0000, 5175.397, 281,	0	
4667 X =	323.5000, 5175.397, 288,	0	
4668 X =	324.0000, 5175.397, 291,	0	
4669 X =	324.5000, 5175.397, 294,	0	
4670 X =	325.0000, 5175.397, 296,	0	
4671 X =	325.5000, 5175.397, 299,	0	
4672 X =	326.0000, 5175.397, 304,	0	
4673 X =	326.5000, 5175.397, 305,	0	
4674 X =	327.0000, 5175.397, 305,	0	
4675 X =	327.5000, 5175.397, 307,	0	
4676 X =	328.0000, 5175.397, 314,	0	
4677 X =	328.5000, 5175.397, 314,	0	
4678 X =	329.0000, 5175.397, 316,	0	
4679 X =	329.5000, 5175.397, 320,	0	
4680 X =	330.0000, 5175.397, 324,	0	
4681 X =	330.5000, 5175.397, 328,	0	
4682 X =	331.0000, 5175.397, 332,	0	
4683 X =	331.5000, 5175.397, 330,	0	
4684 X =	332.0000, 5175.397, 330,	0	
4685 X =	332.5000, 5175.397, 331,	0	
4686 X =	333.0000, 5175.397, 332,	0	
4687 X =	321.0000, 5175.897, 274,	0	
4688 X =	321.5000, 5175.897, 274,	0	
4689 X =	322.0000, 5175.897, 274,	0	
4690 X =	322.5000, 5175.897, 274,	0	
4691 X =	323.0000, 5175.897, 279,	0	
4692 X =	323.5000, 5175.897, 294,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
4693 X =	324.0000, 5175.897, 297,	0	
4694 X =	324.5000, 5175.897, 300,	0	
4695 X =	325.0000, 5175.897, 303,	0	
4696 X =	325.5000, 5175.897, 306,	0	
4697 X =	326.0000, 5175.897, 310,	0	
4698 X =	326.5000, 5175.897, 311,	0	
4699 X =	327.0000, 5175.897, 313,	0	
4700 X =	327.5000, 5175.897, 314,	0	
4701 X =	328.0000, 5175.897, 321,	0	
4702 X =	328.5000, 5175.897, 321,	0	
4703 X =	329.0000, 5175.897, 325,	0	
4704 X =	329.5000, 5175.897, 327,	0	
4705 X =	330.0000, 5175.897, 330,	0	
4706 X =	330.5000, 5175.897, 332,	0	
4707 X =	331.0000, 5175.897, 336,	0	
4708 X =	331.5000, 5175.897, 338,	0	
4709 X =	332.0000, 5175.897, 345,	0	
4710 X =	332.5000, 5175.897, 350,	0	
4711 X =	333.0000, 5175.897, 353,	0	
4712 X =	321.0000, 5176.397, 274,	0	
4713 X =	321.5000, 5176.397, 274,	0	
4714 X =	322.0000, 5176.397, 274,	0	
4715 X =	322.5000, 5176.397, 274,	0	
4716 X =	323.0000, 5176.397, 280,	0	
4717 X =	323.5000, 5176.397, 298,	0	
4718 X =	324.0000, 5176.397, 301,	0	
4719 X =	324.5000, 5176.397, 304,	0	
4720 X =	325.0000, 5176.397, 304,	0	
4721 X =	325.5000, 5176.397, 312,	0	
4722 X =	326.0000, 5176.397, 316,	0	
4723 X =	326.5000, 5176.397, 318,	0	
4724 X =	327.0000, 5176.397, 320,	0	
4725 X =	327.5000, 5176.397, 323,	0	
4726 X =	328.0000, 5176.397, 328,	0	
4727 X =	328.5000, 5176.397, 329,	0	
4728 X =	329.0000, 5176.397, 332,	0	
4729 X =	329.5000, 5176.397, 333,	0	
4730 X =	330.0000, 5176.397, 335,	0	
4731 X =	330.5000, 5176.397, 334,	0	
4732 X =	331.0000, 5176.397, 343,	0	
4733 X =	331.5000, 5176.397, 354,	0	
4734 X =	332.0000, 5176.397, 360,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
4735 X =	332.5000, 5176.397, 365,	0	
4736 X =	333.0000, 5176.397, 365,	0	
4737 X =	321.0000, 5176.897, 274,	0	
4738 X =	321.5000, 5176.897, 274,	0	
4739 X =	322.0000, 5176.897, 274,	0	
4740 X =	322.5000, 5176.897, 274,	0	
4741 X =	323.0000, 5176.897, 280,	0	
4742 X =	323.5000, 5176.897, 302,	0	
4743 X =	324.0000, 5176.897, 304,	0	
4744 X =	324.5000, 5176.897, 304,	0	
4745 X =	325.0000, 5176.897, 304,	0	
4746 X =	325.5000, 5176.897, 317,	0	
4747 X =	326.0000, 5176.897, 321,	0	
4748 X =	326.5000, 5176.897, 325,	0	
4749 X =	327.0000, 5176.897, 328,	0	
4750 X =	327.5000, 5176.897, 333,	0	
4751 X =	328.0000, 5176.897, 335,	0	
4752 X =	328.5000, 5176.897, 336,	0	
4753 X =	329.0000, 5176.897, 339,	0	
4754 X =	329.5000, 5176.897, 345,	0	
4755 X =	330.0000, 5176.897, 349,	0	
4756 X =	330.5000, 5176.897, 348,	0	
4757 X =	331.0000, 5176.897, 341,	0	
4758 X =	331.5000, 5176.897, 365,	0	
4759 X =	332.0000, 5176.897, 365,	0	
4760 X =	332.5000, 5176.897, 365,	0	
4761 X =	333.0000, 5176.897, 364,	0	
4762 X =	321.0000, 5177.397, 272,	0	
4763 X =	321.5000, 5177.397, 269,	0	
4764 X =	322.0000, 5177.397, 272,	0	
4765 X =	322.5000, 5177.397, 274,	0	
4766 X =	323.0000, 5177.397, 277,	0	
4767 X =	323.5000, 5177.397, 304,	0	
4768 X =	324.0000, 5177.397, 304,	0	
4769 X =	324.5000, 5177.397, 304,	0	
4770 X =	325.0000, 5177.397, 304,	0	
4771 X =	325.5000, 5177.397, 321,	0	
4772 X =	326.0000, 5177.397, 328,	0	
4773 X =	326.5000, 5177.397, 331,	0	
4774 X =	327.0000, 5177.397, 334,	0	
4775 X =	327.5000, 5177.397, 341,	0	
4776 X =	328.0000, 5177.397, 346,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
4777 X =	328.5000, 5177.397, 346,	0	
4778 X =	329.0000, 5177.397, 348,	0	
4779 X =	329.5000, 5177.397, 354,	0	
4780 X =	330.0000, 5177.397, 361,	0	
4781 X =	330.5000, 5177.397, 365,	0	
4782 X =	331.0000, 5177.397, 359,	0	
4783 X =	331.5000, 5177.397, 359,	0	
4784 X =	332.0000, 5177.397, 362,	0	
4785 X =	332.5000, 5177.397, 346,	0	
4786 X =	333.0000, 5177.397, 299,	0	
4787 X =	320.5000, 5177.897, 244,	0	
4788 X =	321.0000, 5177.897, 244,	0	
4789 X =	321.5000, 5177.897, 244,	0	
4790 X =	322.0000, 5177.897, 247,	0	
4791 X =	322.5000, 5177.897, 266,	0	
4792 X =	323.0000, 5177.897, 272,	0	
4793 X =	323.5000, 5177.897, 274,	0	
4794 X =	324.0000, 5177.897, 277,	0	
4795 X =	324.5000, 5177.897, 303,	0	
4796 X =	325.0000, 5177.897, 304,	0	
4797 X =	325.5000, 5177.897, 323,	0	
4798 X =	326.0000, 5177.897, 333,	0	
4799 X =	326.5000, 5177.897, 338,	0	
4800 X =	327.0000, 5177.897, 344,	0	
4801 X =	327.5000, 5177.897, 351,	0	
4802 X =	328.0000, 5177.897, 357,	0	
4803 X =	328.5000, 5177.897, 355,	0	
4804 X =	329.0000, 5177.897, 356,	0	
4805 X =	329.5000, 5177.897, 359,	0	
4806 X =	330.0000, 5177.897, 363,	0	
4807 X =	330.5000, 5177.897, 370,	0	
4808 X =	331.0000, 5177.897, 367,	0	
4809 X =	331.5000, 5177.897, 340,	0	
4810 X =	332.0000, 5177.897, 329,	0	
4811 X =	332.5000, 5177.897, 301,	0	
4812 X =	333.0000, 5177.897, 274,	0	
4813 X =	320.5000, 5178.397, 244,	0	
4814 X =	321.0000, 5178.397, 244,	0	
4815 X =	321.5000, 5178.397, 250,	0	
4816 X =	322.0000, 5178.397, 259,	0	
4817 X =	322.5000, 5178.397, 270,	0	
4818 X =	323.0000, 5178.397, 274,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
4819 X =	323.5000, 5178.397, 282,	0	
4820 X =	324.0000, 5178.397, 291,	0	
4821 X =	324.5000, 5178.397, 304,	0	
4822 X =	325.0000, 5178.397, 314,	0	
4823 X =	325.5000, 5178.397, 329,	0	
4824 X =	326.0000, 5178.397, 341,	0	
4825 X =	326.5000, 5178.397, 349,	0	
4826 X =	327.0000, 5178.397, 355,	0	
4827 X =	327.5000, 5178.397, 360,	0	
4828 X =	328.0000, 5178.397, 366,	0	
4829 X =	328.5000, 5178.397, 365,	0	
4830 X =	329.0000, 5178.397, 365,	0	
4831 X =	329.5000, 5178.397, 363,	0	
4832 X =	330.0000, 5178.397, 365,	0	
4833 X =	330.5000, 5178.397, 375,	0	
4834 X =	331.0000, 5178.397, 367,	0	
4835 X =	331.5000, 5178.397, 322,	0	
4836 X =	332.0000, 5178.397, 298,	0	
4837 X =	332.5000, 5178.397, 274,	0	
4838 X =	333.0000, 5178.397, 274,	0	
4839 X =	320.5000, 5178.897, 244,	0	
4840 X =	321.0000, 5178.897, 251,	0	
4841 X =	321.5000, 5178.897, 263,	0	
4842 X =	322.0000, 5178.897, 273,	0	
4843 X =	322.5000, 5178.897, 285,	0	
4844 X =	323.0000, 5178.897, 294,	0	
4845 X =	323.5000, 5178.897, 303,	0	
4846 X =	324.0000, 5178.897, 315,	0	
4847 X =	324.5000, 5178.897, 327,	0	
4848 X =	325.0000, 5178.897, 334,	0	
4849 X =	325.5000, 5178.897, 338,	0	
4850 X =	326.0000, 5178.897, 347,	0	
4851 X =	326.5000, 5178.897, 356,	0	
4852 X =	327.0000, 5178.897, 364,	0	
4853 X =	327.5000, 5178.897, 371,	0	
4854 X =	328.0000, 5178.897, 372,	0	
4855 X =	328.5000, 5178.897, 369,	0	
4856 X =	329.0000, 5178.897, 366,	0	
4857 X =	329.5000, 5178.897, 365,	0	
4858 X =	330.0000, 5178.897, 365,	0	
4859 X =	330.5000, 5178.897, 367,	0	
4860 X =	331.0000, 5178.897, 341,	0	

Table A-2 CALPUFF Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
4861 X =	331.5000, 5178.897, 296,	0	
4862 X =	332.0000, 5178.897, 274,	0	
4863 X =	332.5000, 5178.897, 274,	0	
4864 X =	333.0000, 5178.897, 274,	0	
4865 X =	320.5000, 5179.397, 257,	0	
4866 X =	321.0000, 5179.397, 269,	0	
4867 X =	321.5000, 5179.397, 278,	0	
4868 X =	322.0000, 5179.397, 289,	0	
4869 X =	322.5000, 5179.397, 303,	0	
4870 X =	323.0000, 5179.397, 313,	0	
4871 X =	323.5000, 5179.397, 327,	0	
4872 X =	324.0000, 5179.397, 340,	0	
4873 X =	324.5000, 5179.397, 342,	0	
4874 X =	325.0000, 5179.397, 344,	0	
4875 X =	325.5000, 5179.397, 347,	0	
4876 X =	326.0000, 5179.397, 353,	0	
4877 X =	326.5000, 5179.397, 361,	0	
4878 X =	327.0000, 5179.397, 379,	0	
4879 X =	327.5000, 5179.397, 390,	0	
4880 X =	328.0000, 5179.397, 385,	0	
4881 X =	328.5000, 5179.397, 374,	0	
4882 X =	329.0000, 5179.397, 366,	0	
4883 X =	329.5000, 5179.397, 365,	0	
4884 X =	330.0000, 5179.397, 365,	0	
4885 X =	330.5000, 5179.397, 365,	0	
4886 X =	331.0000, 5179.397, 299,	0	
4887 X =	331.5000, 5179.397, 274,	0	
4888 X =	332.0000, 5179.397, 274,	0	
4889 X =	332.5000, 5179.397, 274,	0	
4890 X =	333.0000, 5179.397, 274,	0	

Table A-3 CALPOST Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
INPUT GROUP: 0 -- Input and Output File Names			
MODDAT	Conc/Dep Flux File	MODEL.DAT	path\filename (see Table 6-1)
VISDAT	Relative Humidity File	VISB.DAT	not used
BACKDAT	Background Data File	BACK.DAT	not used
VSRDAT	Nephelometer Data File or DATSAV Weather Data File or Prognostic Weather File	VSRN.DAT	not used
PSTLST	List File	CALPOST.LST	CalPost.lst
TSPATH	Pathname for Timeseries Files	blank	not used
PLPATH	Pathname for Plot Files	blank	not used
TSUNAM	Timeseries Peak Value	TSERIES_ASPEC_ttHR_CONC_TSUNAM.DAT or PEAKVAL_ASPEC_ttHR_CONC_TSUNAM.DAT	not used
TUNAM	Top Nth Rank Plot	RANK(ALL)_ASPEC_ttHR_CONC_TUNAM.DAT or RANK(ii)_ASPEC_ttHR_CONC_TUNAM.GRD	see “Results File” on Table 6-1
XUNAM	Exceedance Plot	EXCEED_ASPEC_ttHR_CONC_XUNAM.DAT or EXCEED_ASPEC_ttHR_CONC_XUNAM.GRD	not used
DVISDAT	Visibility Change	DELVIS.DAT	not used
INPUT GROUP: 1 -- General run control parameters			
METRUN	Option to run all periods found in the met. file(s)	0	1
ISYR	Starting date: Year	No default	year of run
ISMO	Starting date: Month	No default	1
ISDY	Starting date: Day	No default	1
ISHR	Starting date: Hour	No default	1
NHRS	Number of hours to process	No default	hours in the year
BTZONE	Identify the Base Time Zone for the CALPUFF simulation	No default	8
NREP	Process every hour of data?	1	1

Table A-3 CALPOST Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
ASPEC	Species to process	No default	see "Series" on Table 6-1
ILAYER	Layer/deposition code	1	1
A	Scaling factors of the form	0.0	0
B	Scaling factors of the form	0.0	0
LBACK	Add Hourly Background Concentrations/Fluxes?	F	F
MSOURCE	Option to process source contributions	0	0
LG	Gridded receptors processed?	F	F
LD	Discrete receptors processed?	F	T
LCT	CTSG Complex terrain receptors processed?	F	F
LDRING	Report results by DISCRETE receptor RING?	F	F
NDRECP	Flag for all receptors after the last one assigned is set to 0	-1	-1
IBGRID	X index of LL corner	-1	-1
JBGRID	Y index of LL corner	-1	-1
IEGRID	X index of UR corner	-1	-1
JEGRID	Y index of UR corner	-1	-1
NGONOFF	Number of gridded receptor rows	0	0
INPUT GROUP: 2 -- Visibility Parameters (ASPEC = VISIB)			
MVISCHECK	Test visibility options specified	1	0
MFRH	Particle growth curve f(RH) for hygroscopic species	2	2
RHMAX	Maximum relative humidity (%) used in particle growth curve	98	98.0
LVSO4	Include SULFATE?	T	T
LVNO3	Include NITRATE?	T	T
LVOC	Include ORGANIC CARBON?	T	F
LVPMC	Include COARSE PARTICLES?	T	F
LVPMF	Include FINE PARTICLES?	T	F
LVEC	Include ELEMENTAL CARBON?	T	F

Table A-3 CALPOST Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
LVBK	When ranking for TOP-N, TOP-50, and Exceedance tables, Include BACKGROUND?	T	T
SPECPMC	Species name used for particulates in MODEL.DAT file (course)	PMC	PMC
SPECPMF	Species name used for particulates in MODEL.DAT file (fine)	PMF	PMF
EEPMC	MODELED particulate species: PM COARSE	0.6	0.6
EEPMF	MODELED particulate species: PM FINE	1.0	1.0
EEPMCBK	BACKGROUND particulate species: PM COARSE	0.6	0.6
EESO4	Other species: AMMONIUM SULFATE	3.0	3.
EENO3	Other species: AMMONIUM NITRATE	3.0	3.
EEOC	Other species: ORGANIC CARBON	4.0	4.
EESOIL	Other species: SOIL	1.0	1.
EEEC	Other species: ELEMENTAL CARBON	10.	10.
EENO2	Other species: NO2 gas	0.1755	0.1755
LAVER	Method used for the 24h-average of percent change of light extinction	F	F
MVISBK	Method used for background light extinction	2	2
BEXTBK RHFRAC	Additional inputs used for MVISBK = 1	No default	not used, MVISBK=2
RHFAC	Additional inputs used for MVISBK = 6	No default	not used, MVISBK=2
IDWSTA TZONE	Additional inputs used for MVISBK = 7	No default	2

Table A-3 CALPOST Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
BKSO4 BKNO3 BKPMC BKOC BKSOIL BKEC	Additional inputs used for MVISBK = 2,3,6,7	No default	0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 (for all variables)
INPUT GROUP: 3 -- Output options			
LDOC	Documentation records contained in the header of the CALPUFF output file may be written to the list file. Print documentation image?	F	F
IPRTU	Units for All Output	1	3
L1PD L1HR L3HR L24HR LRUNL	Averaging time(s) reported	T T T T T	F T F F T
NAVG	User-specified averaging time in hours	0	0
LT50	Top 50 table for each averaging time selected	T	F
LTOPN	Top 'N' table for each averaging time selected	F	T
NTOP	Number of 'Top-N' values at each receptor selected	4	2
ITOP	Specific ranks of 'Top-N' values reported	1,2,3,4	1,2
LEXCD	Threshold exceedance counts for each receptor and each averaging time selected	F	F
THRESH1 THRESH3 THRESH24 THRESHN	Identify the threshold for each averaging time by assigning a non-negative value (output units)	-1.0 -1.0 -1.0 -1.0	-1.0 -1.0 -1.0 -1.0
NDAY	Counts for the shortest averaging period - Accumulation period(Days)	0	0

Table A-3 CALPOST Settings

Variable	Description	IWAQM Value or Default Value	WTP Values
NCOUNT	Counts for the shortest averaging period - Number of exceedances allowed	1	1
LECHO	Echo Option	F	F
LTIME	Timeseries Option	F	F
LPEAK	Peak Value Option	F	F
LPLT	Generate Plot file output	F	T
LGRD	Use GRID format rather than DATA format	F	F
MDVIS	Output file with the visibility change at each receptor?	0	0
LDEBUG	Output selected information to List file for debugging?	F	F
LVEXTHR	Output hourly extinction information to REPORT.HRV?	F	F

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Appendix B

CALMET/CALPUFF/CALPOST Modeling Process

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Appendix B
CALMET/CALPUFF/CALPOST Modeling Process

CALPUFF modeling was performed in a series of steps involving several pre-processing and post-processing programs. Figure B-1 identifies the steps, in the appropriate sequence, required to complete the CALPUFF modeling process. Modeling was performed using the regulatory default version of the model.

To perform the modeling, WTP used BEE-Line Software's (www.beeline-software.com) Professional CALPUFF commercial off-the-shelf software system.

Data Acquisition

The EPA and Ecology require that WTP use 5 years of meteorological data when performing air dispersion modeling for the WTP risk assessment. To develop the wind field in the domain area, output data from a gridded prognostic model, such as the Fifth-Generation Mesoscale Model (MM5), developed by Pennsylvania State University and the National Center for Atmospheric Research, is necessary. The University of Washington ran an operational forecast version of the MM5 model for the Pacific Northwest (years 2002 through 2006), providing both 12 and 4 km grid resolution products. WTP used this data for modeling upper air. WTP also acquired 5 years (2002 through 2006) of surface meteorological station data from PNNL for stations included in the study. Four types of files were acquired: 1) Hanford meteorological station (Station 21) surface files, 2) wind telemetry files for each station, 3) temperature telemetry files for each station, and 4) precipitation files for each station. The information contained in each file and the format of the file is described in Section 5.5.

Next, appropriate surface meteorology data from each of the PNNL raw data files and build CALMET input files was extracted for use. The comma-delimited precipitation files received from PNNL were parsed into rows and columns in Excel. The appropriate columns of information were extracted into a new file location. Each column contained one character or space. Once the Excel file was created, it was saved in the following format: formatted text (space delimited)*.prn file. Once the data was saved as a text file, the appropriate header information, as described in the CALMET Users Manual, was added. Section 5.5 describes the precipitation raw data file format and the CALMET input file content and format.

WTP used SAS to extract the appropriate data from the Hanford meteorological station and wind and temperature telemetry files. Then, also using SAS, the extracted data was inserted into a CD-144 file in the proper column locations and saved as a space-delimited text file. Section 5.5 describes the PNNL raw data file format and the CD-144 file content and format.

The CD-144 files and precipitation data files were subjected to a series of quality control procedures. Missing data was substituted and other corrections were made to each CD-144 and precipitation file as necessary. The data substitution methods are described in Section 5.6.

Geophysical data was also obtained to support modeling. Land use data from the National Land Cover Dataset (file washington.nlcd.bin.gz) was downloaded and extracted from the US Geological Survey web site (http://edcsgs9.cr.usgs.gov/pub/data/landcover/states/). Digital Elevation Model data files (for Ritzville [east], Ritzville [west], Walla Walla [east], Walla Walla [west], Wenatchee [east], and Yakima [east]) were used to model the terrain in the model domain.

Building downwash was modeled using the physical dimensions of the PTF, LAW Facility, and HLW Facility as provided by the WTP Engineering department. These three facilities are the largest structures on the WTP site.

Receptor grids were determined during the development of the *Environmental Risk Assessment Work Plan for the Hanford Tank Waste Treatment and Immobilization Plant* (24590-WTP-RPT-ENS-03-006).

CALMET Modeling

The data described above was loaded into CALPUFF using the graphical user interface provided by the modeling software. The values for starting month, day, and hour for each year modeled were set to 1. The values for ending month, day, and hour were set to 1 for the subsequent year, with the exception of the year 2006, where the values for ending month, day, and hour were set to 12, 31, 23, respectively. Settings were adjusted in the CALMET.INP file (input file), as presented in Table A-1 of Appendix A, as confirmed through model validation against actual weather observations (24590-CM-HC4-HKYM-00001-01-00002, Rev 00A, *Modeling Verification and Methods Report, River Protection Project, Hanford Tank Waste Treatment and Immobilization Plant*). The CALMET modeling was repeated for each year (2002 through 2006). CALMET results were written to designated directories, named according to the year of the corresponding run, for later processing by CALPUFF.

CALPUFF Modeling

The CALPUFF model was run in accordance with settings established by the model verification effort (24590-CM-HC4-HKYM-00001-01-00002). Some non-default settings were used, as shown in Table A-2 of Appendix A. The CALPUFF modeling was repeated for each year (2002 through 2006), for each facility (see Table 6-1). CALMET results were written to designated directories, named according to the year, the model grid (site wide), and the facility (PTF, LAW, or HLW) of the corresponding run.

CALPOST Processing

The CALPOST model was run without adjustment to input settings. The CALPUFF modeling was repeated for each year (2002 through 2006), for each facility and species (see Table 6-1). CALPOST results were written to designated directories, named according to the year, the model grid, facility (PTF, LAW, or HLW), and species of the corresponding run. The number 1 and 2 ranked hourly readings were specified for the CALPOST results summary, along with the average result over the run length.

Figure B-1 CALPUFF Modeling Steps

Steps	Program	Function	WTP Software Version Number	Model Control File	Data Input Files	Output Files
1	**Geophysical Data Processing** Terrel.exe	Combines and grids **terrain** data	v. 3.684 Level: 070327	Terrel.inp	Wall.e, Wall.w, Ritz.e, Ritz.w, Wena.e, Yaki.e	Terrrel.dat
2	CTGProc.exe	Processes and grids **land use** data	v. 2.682 Level: 070430	ctgproc.inp	Washington_NLCD_flat_ 03220.bin	landuse.dat
3	MakeGeo.exe	**Merges land use and terrain data** to produce the geophysical data file for Calmet	v. 2.29 Level: 070327	makegeo.inp	Terrel.dat landuse.dat	Makegeo.dat
4	**Meteorological Processing** Pmerge.exe	Processes and merges **precipitation data** to produce a single file for use in CALMET	Not used, prepared file from raw PNNL meteorological data			HMS_prec.dat
5	Read62.exe	Processes NCDC **upper air** meteorological data to produce upper air files for CALMET	Not used, Calmet setting NOOBS = 1 Use MM5 for upper air data			
6	Smerge.exe	Combines and formats files of **surface meteorological data** to produce a single file for use in CALMET	v. 5.57 Level: 070627	Smerge.inp	00001_02.144 thru 00030_02.144	Surf.dat
7	CALMM5.exe	Processes **MM5** meteorological output data and creates a data file suitable for use in CALMET	Geomatrix, Inc. prepared files from UW MM5 data files			2002.01.4km.m3d 2002.02.4km.m3d 2002.03.4km.m3d 2002.04.4km.m3d 2002.05.4km.m3d 2002.06.4km.m3d 2002.07.4km.m3d 2002.08.4km.m3d 2002.09.4km.m3d 2002.10.4km.m3d 2002.11.4km.m3d 2002.12.4km.m3d 2003.01.4km.m3d

Continued on Page 2

Continued from Page 1

Steps	Program	Function	WTP Software Version Number	Model Control File	Input Files	Output Files
Main Models						
8	CALMET.exe	Meteorological model develops hourly wind & temp fields on a 3 dimensional gridded modeling domain	v. 5.8 Level: 070623	Calmet.inp	Makegeo.dat HMS_prec.dat Surf.dat 2002.01.4km.m3d 2002.02.4km.m3d 2002.03.4km.m3d 2002.04.4km.m3d 2002.05.4km.m3d 2002.06.4km.m3d 2002.07.4km.m3d 2002.08.4km.m3d 2002.09.4km.m3d 2002.10.4km.m3d 2002.11.4km.m3d 2002.12.4km.m3d 2003.01.4km.m3d	Calmet.dat
9	CALPUFF.exe	Transport and dispersion model that advects puffs from modeled sources, simulating dispersion and transformation processes along the way	v. 5.8 Level: 070623	Calpuff.inp	Calmet.dat	Conc.dat DFLX.dat WFLX.dat

Continued on Page 3

Continued from Page 2

Steps	Program	Function	WTP Software Version Number	Model Control File	Input Files	Output Files
Post-processing Models						
10	CALPOST.exe	Produces tabulations that summarize the results of the simulation	v. 5.6394 Level: 070622	Calpost.inp	Conc.dat	Calpost.lst
					DFLX.dat	Calpost.lst
					WFLX.dat	Calpost.lst

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Appendix C

Example CALMET Input File

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Appendix C
Example CALMET Input File

```
WTP Risk Assessment CalMet Results for 2005
CalPuff Pro v. 4.00
CalMet for 2005
---------------- Run title (3 lines) ----------------------------------------

                    CALMET MODEL CONTROL FILE
                    -------------------------

-------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names


Subgroup (a)
------------
Default Name  Type          File Name
------------  ----          ---------
GEO.DAT       input    ! GEODAT = ..\..\Geo\Geo_Hanford\MAKEGEO.dat   !
SURF.DAT      input    ! SRFDAT = ..\..\Met\2005\SURF.DAT      !
CLOUD.DAT     input    * CLDDAT =               *
PRECIP.DAT    input    ! PRCDAT = ..\..\Met\2005\PRECIP.DAT    !
WT.DAT        input    * WTDAT=             *

CALMET.LST    output   ! METLST = calmet.lst    !
CALMET.DAT    output   ! METDAT = calmet.dat    !
PACOUT.DAT    output   * PACDAT=            *

All file names will be converted to lower case if LCFILES = T
Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
         T = lower case      ! LCFILES = T !
         F = UPPER CASE

NUMBER OF UPPER AIR & OVERWATER STATIONS:

    Number of upper air stations (NUSTA)  No default     ! NUSTA =  0  !
    Number of overwater met stations
                                 (NOWSTA) No default     ! NOWSTA =  0  !

NUMBER OF PROGNOSTIC and IGF-CALMET FILEs:

    Number of MM4/MM5/3D.DAT files
                                   (NM3D) No default      ! NM3D =  13  !

    Number of IGF-CALMET.DAT files
                                   (NIGF)   No default    ! NIGF =  0  !


                       !END!
-------------------------------------------------------------------------------
Subgroup (b)
---------------------------------
Upper air files (one per station)
---------------------------------
Default Name  Type       File Name
------------  ----       ---------
UP1.DAT       input     1  * UPDAT = UP1.DAT *    *END*
-------------------------------------------------------------------------------
Subgroup (c)
----------------------------------------
Overwater station files (one per station)
```

```
-----------------------------------------
Default Name  Type       File Name
------------  ----       ---------
SEA1.DAT       input     1  * SEADAT= SEA1.DAT *    *END*
-------------------------------------------------------------------------------
Subgroup (d)
-----------------------------------------
MM4/MM5/3D.DAT files (consecutive or overlapping)
-----------------------------------------
Default Name  Type       File Name
------------  ----       ---------
MM51.DAT       input     1  ! M3DDAT = H:\Calpuff Input Data\MM5 data\2005\0105.dat!
!END!
MM52.DAT       input     2  ! M3DDAT = H:\Calpuff Input Data\MM5 data\2005\0205.dat!
!END!
MM53.DAT       input     3  ! M3DDAT = H:\Calpuff Input Data\MM5 data\2005\0305.dat!
!END!
MM54.DAT       input     4  ! M3DDAT = H:\Calpuff Input Data\MM5 data\2005\0405.dat!
!END!
MM55.DAT       input     5  ! M3DDAT = H:\Calpuff Input Data\MM5 data\2005\0505.dat!
!END!
MM56.DAT       input     6  ! M3DDAT = H:\Calpuff Input Data\MM5 data\2005\0605.dat!
!END!
MM57.DAT       input     7  ! M3DDAT = H:\Calpuff Input Data\MM5 data\2005\0705.dat!
!END!
MM58.DAT       input     8  ! M3DDAT = H:\Calpuff Input Data\MM5 data\2005\0805.dat!
!END!
MM59.DAT       input     9  ! M3DDAT = H:\Calpuff Input Data\MM5 data\2005\0905.dat!
!END!
MM510.DAT       input     10  ! M3DDAT = H:\Calpuff Input Data\MM5
data\2005\1005.dat!    !END!
MM511.DAT       input     11  ! M3DDAT = H:\Calpuff Input Data\MM5
data\2005\1105.dat!    !END!
MM512.DAT       input     12  ! M3DDAT = H:\Calpuff Input Data\MM5
data\2005\1205.dat!    !END!
MM513.DAT       input     13  ! M3DDAT = H:\Calpuff Input Data\MM5
data\2005\0106.dat!    !END!
-------------------------------------------------------------------------------
Subgroup (e)
-------------------------------------------------
IGF-CALMET.DAT files (consecutive or overlapping)
-------------------------------------------------
Default Name  Type       File Name
------------  ----       ---------
IGF1.DAT       input     1  * IGFDAT = CALMET-L.dat*    *END*
-------------------------------------------------------------------------------
Subgroup (f)
----------------
Other file names
----------------

Default Name  Type       File Name
------------  ----       ---------
DIAG.DAT      input      * DIADAT=                  *
PROG.DAT      input      * PRGDAT=                  *

TEST.PRT      output     * TSTPRT=                  *
TEST.OUT      output     * TSTOUT=                  *
TEST.KIN      output     * TSTKIN=                  *
TEST.FRD      output     * TSTFRD=                  *
TEST.SLP      output     * TSTSLP=                  *
DCST.GRD      output     * DCSTGD=                  *

-------------------------------------------------------------------------------
NOTES: (1) File/path names can be up to 70 characters in length
```

```
       (2) Subgroups (a) and (f) must have ONE 'END' (surrounded by
           delimiters) at the end of the group
       (3) Subgroups (b) through (e) are included ONLY if the corresponding
           number of files (NUSTA, NOWSTA, NM3D, NIGF) is not 0, and each must have
           an 'END' (surround by delimiters) at the end of EACH LINE

                        !END!


------------------------------------------------------------------------------

INPUT GROUP: 1 -- General run control parameters
--------------

     Starting date:    Year   (IBYR)  --    No default   ! IBYR  =  2005  !
                       Month  (IBMO)  --    No default   ! IBMO  =  1  !
                       Day    (IBDY)  --    No default   ! IBDY  =  1  !
     Starting time:    Hour   (IBHR)  --    No default   ! IBHR  =  1  !

     Base time zone        (IBTZ) -- No default       ! IBTZ=  8  !
        PST = 08, MST = 07
        CST = 06, EST = 05

     Length of run (hours) (IRLG) -- No default       ! IRLG=  8760  !

     Run type            (IRTYPE) -- Default: 1       ! IRTYPE=  1  !

        0 = Computes wind fields only
        1 = Computes wind fields and micrometeorological variables
            (u*, w*, L, zi, etc.)
        (IRTYPE must be 1 to run CALPUFF or CALGRID)

     Compute special data fields required
     by CALGRID (i.e., 3-D fields of W wind
     components and temperature)
     in additional to regular            Default: T    ! LCALGRD = T !
     fields ? (LCALGRD)
     (LCALGRD must be T to run CALGRID)

      Flag to stop run after
      SETUP phase (ITEST)             Default: 2       ! ITEST=  2   !
      (Used to allow checking
      of the model inputs, files, etc.)
      ITEST = 1 - STOPS program after SETUP phase
      ITEST = 2 - Continues with execution of
                  COMPUTATIONAL phase after SETUP


     Test options specified to see if
     they conform to regulatory
     values? (MREG)                   No Default       ! MREG =  0   !

        0 = NO checks are made
        1 = Technical options must conform to USEPA guidance
                  IMIXH    -1       Maul-Carson convective mixing height
                                    over land; OCD mixing height overwater
                  ICOARE   0        OCD deltaT method for overwater fluxes
                  THRESHL  0.0      Threshold buoyancy flux over land needed
                                    to sustain convective mixing height growth

!END!

------------------------------------------------------------------------------

INPUT GROUP: 2 -- Map Projection and Grid control parameters
```

```
--------------

     Projection for all (X,Y):
     -------------------------

     Map projection
     (PMAP)                     Default: UTM    ! PMAP = UTM !

         UTM :  Universal Transverse Mercator
         TTM :  Tangential Transverse Mercator
         LCC :  Lambert Conformal Conic
          PS :  Polar Stereographic
          EM :  Equatorial Mercator
        LAZA :  Lambert Azimuthal Equal Area

     False Easting and Northing (km) at the projection origin
     (Used only if PMAP= TTM, LCC, or LAZA)
     (FEAST)                    Default=0.0     ! FEAST  = 0  !
     (FNORTH)                   Default=0.0     ! FNORTH = 0  !

     UTM zone (1 to 60)
     (Used only if PMAP=UTM)
     (IUTMZN)                   No Default      ! IUTMZN =  11   !

     Hemisphere for UTM projection?
     (Used only if PMAP=UTM)
     (UTMHEM)                   Default: N      ! UTMHEM = N  !
         N   :  Northern hemisphere projection
         S   :  Southern hemisphere projection

     Latitude and Longitude (decimal degrees) of projection origin
     (Used only if PMAP= TTM, LCC, PS, EM, or LAZA)
      (RLAT0)                    No Default      ! RLAT0 = 46.085913N !
      (RLON0)                    No Default      ! RLON0 = 120.130371W !

         TTM :  RLON0 identifies central (true N/S) meridian of projection
                RLAT0 selected for convenience
         LCC :  RLON0 identifies central (true N/S) meridian of projection
                RLAT0 selected for convenience
         PS  :  RLON0 identifies central (grid N/S) meridian of projection
                RLAT0 selected for convenience
         EM  :  RLON0 identifies central meridian of projection
                RLAT0 is REPLACED by 0.0N (Equator)
         LAZA:  RLON0 identifies longitude of tangent-point of mapping plane
                RLAT0 identifies latitude of tangent-point of mapping plane

     Matching parallel(s) of latitude (decimal degrees) for projection
     (Used only if PMAP= LCC or PS)
      (XLAT1)                    No Default      ! XLAT1 = 30N !
      (XLAT2)                    No Default      ! XLAT2 = 60N !

         LCC :  Projection cone slices through Earth's surface at XLAT1 and XLAT2
         PS  :  Projection plane slices through Earth at XLAT1
                (XLAT2 is not used)

     ----------
     Note:  Latitudes and longitudes should be positive, and include a
            letter N,S,E, or W indicating north or south latitude, and
            east or west longitude.  For example,
            35.9  N Latitude  =  35.9N
            118.7 E Longitude = 118.7E


     Datum-region
     ------------
```

```
     The Datum-Region for the coordinates is identified by a character
     string.  Many mapping products currently available use the model of the
     Earth known as the World Geodetic System 1984 (WGS-84).  Other local
     models may be in use, and their selection in CALMET will make its output
     consistent with local mapping products.  The list of Datum-Regions with
     official transformation parameters is provided by the National Imagery and
     Mapping Agency (NIMA).

     NIMA Datum - Regions(Examples)
     ------------------------------------------------------------------------------
     WGS-84    WGS-84 Reference Ellipsoid and Geoid, Global coverage (WGS84)
     NAS-C     NORTH AMERICAN 1927 Clarke 1866 Spheroid, MEAN FOR CONUS (NAD27)
     NAR-C     NORTH AMERICAN 1983 GRS 80 Spheroid, MEAN FOR CONUS (NAD83)
     NWS-84    NWS 6370KM Radius, Sphere
     ESR-S     ESRI REFERENCE 6371KM Radius, Sphere

     Datum-region for output coordinates
     (DATUM)                    Default: WGS-84     ! DATUM = WGS-84  !


     Horizontal grid definition:
     ---------------------------

     Rectangular grid defined for projection PMAP,
     with X the Easting and Y the Northing coordinate

            No. X grid cells (NX)      No default     ! NX =   100  !
            No. Y grid cells (NY)      No default     ! NY =   100  !

     Grid spacing (DGRIDKM)            No default     ! DGRIDKM = 1 !
                                       Units: km

     Reference grid coordinate of
     SOUTHWEST corner of grid cell (1,1)

        X coordinate (XORIGKM)         No default     ! XORIGKM = 257.988 !
        Y coordinate (YORIGKM)         No default     ! YORIGKM = 5108.358 !
                                       Units: km


     Vertical grid definition:
     -------------------------

        No. of vertical layers (NZ)    No default     ! NZ =  9  !

        Cell face heights in arbitrary
        vertical grid (ZFACE(NZ+1))    No defaults
                                       Units: m
        !  ZFACE = 0., 20, 40, 80, 160, 320, 670, 1400, 2600, 4000 !

!END!


-------------------------------------------------------------------------------

INPUT GROUP: 3 -- Output Options
--------------


    DISK OUTPUT OPTION

       Save met. fields in an unformatted
       output file ?              (LSAVE)  Default: T     ! LSAVE = T !
       (F = Do not save, T = Save)
```

```
   Type of unformatted output file:
   (IFORMO)                              Default: 1    ! IFORMO =  1  !

        1 = CALPUFF/CALGRID type file (CALMET.DAT)
        2 = MESOPUFF-II type file     (PACOUT.DAT)


LINE PRINTER OUTPUT OPTIONS:

   Print met. fields ?  (LPRINT)       Default: F     ! LPRINT = F !
   (F = Do not print, T = Print)
   (NOTE: parameters below control which
          met. variables are printed)

   Print interval
   (IPRINF) in hours                   Default: 1     ! IPRINF =  1  !
   (Meteorological fields are printed
    every  1  hours)


   Specify which layers of U, V wind component
   to print (IUVOUT(NZ)) -- NOTE: NZ values must be entered
   (0=Do not print, 1=Print)
   (used only if LPRINT=T)        Defaults: NZ*0
   * IUVOUT =  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0  *
   ------------------------


   Specify which levels of the W wind component to print
   (NOTE: W defined at TOP cell face --  10  values)
   (IWOUT(NZ)) -- NOTE: NZ values must be entered
   (0=Do not print, 1=Print)
   (used only if LPRINT=T & LCALGRD=T)
   -----------------------------------
                                       Defaults: NZ*0
    * IWOUT =  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0  *


   Specify which levels of the 3-D temperature field to print
   (ITOUT(NZ)) -- NOTE: NZ values must be entered
   (0=Do not print, 1=Print)
   (used only if LPRINT=T & LCALGRD=T)
   -----------------------------------
                                       Defaults: NZ*0
    * ITOUT =  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0  *

   Specify which meteorological fields
   to print
   (used only if LPRINT=T)             Defaults: 0 (all variables)
   -----------------------


     Variable            Print ?
                     (0 = do not print,
                      1 = print)
     --------        ------------------

  !  STABILITY  =          0           ! - PGT stability class
  !  USTAR      =          0           ! - Friction velocity
  !  MONIN      =          0           ! - Monin-Obukhov length
  !  MIXHT      =          0           ! - Mixing height
  !  WSTAR      =          0           ! - Convective velocity scale
  !  PRECIP     =          0           ! - Precipitation rate
  !  SENSHEAT   =          0           ! - Sensible heat flux
```

```
!  CONVZI     =           0           ! - Convective mixing ht.


 Testing and debug print options for micrometeorological module

    Print input meteorological data and
    internal variables (LDB)         Default: F       ! LDB = F !
    (F = Do not print, T = print)
    (NOTE: this option produces large amounts of output)

    First time step for which debug data
    are printed (NN1)                Default: 1       ! NN1 =  1  !

    Last time step for which debug data
    are printed (NN2)                Default: 1       ! NN2 =  1  !

    Print distance to land
    internal variables (LDBCST)      Default: F       ! LDBCST = F !
    (F = Do not print, T = print)
    (Output in .GRD file DCST.GRD, defined in input group 0)

 Testing and debug print options for wind field module
 (all of the following print options control output to
  wind field module's output files: TEST.PRT, TEST.OUT,
  TEST.KIN, TEST.FRD, and TEST.SLP)

    Control variable for writing the test/debug
    wind fields to disk files (IOUTD)
    (0=Do not write, 1=write)        Default: 0       ! IOUTD =  0  !

    Number of levels, starting at the surface,
    to print (NZPRN2)                Default: 1       ! NZPRN2 =  0  !

    Print the INTERPOLATED wind components ?
    (IPR0) (0=no, 1=yes)             Default: 0       !  IPR0 =  0  !

    Print the TERRAIN ADJUSTED surface wind
    components ?
    (IPR1) (0=no, 1=yes)             Default: 0       !  IPR1 =  0  !

    Print the SMOOTHED wind components and
    the INITIAL DIVERGENCE fields ?
    (IPR2) (0=no, 1=yes)             Default: 0       !  IPR2 =  0  !

    Print the FINAL wind speed and direction
    fields ?
    (IPR3) (0=no, 1=yes)             Default: 0       !  IPR3 =  0  !

    Print the FINAL DIVERGENCE fields ?
    (IPR4) (0=no, 1=yes)             Default: 0       !  IPR4 =  0  !

    Print the winds after KINEMATIC effects
    are added ?
    (IPR5) (0=no, 1=yes)             Default: 0       !  IPR5 =  0  !

    Print the winds after the FROUDE NUMBER
    adjustment is made ?
    (IPR6) (0=no, 1=yes)             Default: 0       !  IPR6 =  0  !

    Print the winds after SLOPE FLOWS
    are added ?
    (IPR7) (0=no, 1=yes)             Default: 0       !  IPR7 =  0  !

    Print the FINAL wind field components ?
    (IPR8) (0=no, 1=yes)             Default: 0       !  IPR8 =  0  !
```

```
!END!

------------------------------------------------------------------------------

INPUT GROUP: 4 -- Meteorological data options
--------------

    NO OBSERVATION MODE             (NOOBS)  Default: 0     ! NOOBS =  1    !
          0 = Use surface, overwater, and upper air stations
          1 = Use surface and overwater stations (no upper air observations)
              Use MM4/MM5/3D.DAT for upper air data
          2 = No surface, overwater, or upper air observations
              Use MM4/MM5/3D.DAT for surface, overwater, and upper air data

    NUMBER OF SURFACE & PRECIP. METEOROLOGICAL STATIONS

       Number of surface stations   (NSSTA)  No default     ! NSSTA =  26  !

       Number of precipitation stations
       (NPSTA=-1: flag for use of MM5/M3D precip data)
                                    (NPSTA)  No default     ! NPSTA =  7  !

    CLOUD DATA OPTIONS
       Output option - output a CLOUD.DAT file (yes or no)
       0=no, 1=yes
                                  (ICLOUD)  Default: 999   ! ICLOUD =  0  !

       Method to compute cloud fields:
       *                          (MCLOUD)  Default: 999      MCLOUD =  999 *
       MCLOUD = 1 - Clouds data generated from surface observations
       MCLOUD = 2 - Gridded CLOUD.DAT read from CLOUD.DAT file (no output
                    is possible since already exist)
       MCLOUD = 3 - Gridded cloud cover from Prognostic Rel. Humidity
                    at 850mb (Teixera)
       MCLOUD = 4 - Gridded cloud cover from Prognostic Rel. Humidity
                    at all levels (MM5toGrads algorithm)

    FILE FORMATS

       Surface meteorological data file format
                                  (IFORMS)  Default: 2     ! IFORMS =  2  !
       (1 = unformatted (e.g., SMERGE output))
       (2 = formatted   (free-formatted user input))

       Precipitation data file format
                                  (IFORMP)  Default: 2     ! IFORMP =  2  !
       (1 = unformatted (e.g., PMERGE output))
       (2 = formatted   (free-formatted user input))

       Cloud data file format
                                  (IFORMC)  Default: 2     ! IFORMC =  2  !
       (1 = unformatted - CALMET unformatted output)
       (2 = formatted   - free-formatted CALMET output or user input)

!END!

------------------------------------------------------------------------------

INPUT GROUP: 5 -- Wind Field Options and Parameters
--------------
```

```
WIND FIELD MODEL OPTIONS
   Model selection variable (IWFCOD)     Default: 1      ! IWFCOD =  1  !
      0 = Objective analysis only
      1 = Diagnostic wind module

   Compute Froude number adjustment
   effects ? (IFRADJ)                    Default: 1      ! IFRADJ =  1  !
   (0 = NO, 1 = YES)

   Compute kinematic effects ? (IKINE)   Default: 0      ! IKINE  =  0  !
   (0 = NO, 1 = YES)

   Use O'Brien procedure for adjustment
   of the vertical velocity ? (IOBR)     Default: 0      ! IOBR =  0  !
   (0 = NO, 1 = YES)

   Compute slope flow effects ? (ISLOPE) Default: 1      ! ISLOPE  =  1  !
   (0 = NO, 1 = YES)

   Extrapolate surface wind observations
   to upper layers ? (IEXTRP)            Default: -4     ! IEXTRP = 4  !
   (1 = no extrapolation is done,
    2 = power law extrapolation used,
    3 = user input multiplicative factors
        for layers 2 - NZ used (see FEXTRP array)
    4 = similarity theory used
    -1, -2, -3, -4 = same as above except layer 1 data
        at upper air stations are ignored

   Extrapolate surface winds even
   if calm? (ICALM)                      Default: 0      ! ICALM  =  0  !
   (0 = NO, 1 = YES)

   Layer-dependent biases modifying the weights of
   surface and upper air stations (BIAS(NZ))
     -1<=BIAS<=1
   Negative BIAS reduces the weight of upper air stations
     (e.g. BIAS=-0.1 reduces the weight of upper air stations
   by 10%; BIAS= -1, reduces their weight by 100 %)
   Positive BIAS reduces the weight of surface stations
     (e.g. BIAS= 0.2 reduces the weight of surface stations
   by 20%; BIAS=1 reduces their weight by 100%)
   Zero BIAS leaves weights unchanged (1/R**2 interpolation)
   Default: NZ*0
!  BIAS = 0, 0, 0, 0, 0, 0, 0, 0, 0 !

   Minimum distance from nearest upper air station
   to surface station for which extrapolation
   of surface winds at surface station will be allowed
   (RMIN2: Set to -1 for IEXTRP = 4 or other situations
    where all surface stations should be extrapolated)
                                          Default: 4.     ! RMIN2 = -1 !

   Use gridded prognostic wind field model
   output fields as input to the diagnostic
   wind field model (IPROG)              Default: 0      ! IPROG =  14  !
   (0 = No, [IWFCOD = 0 or 1]
    1 = Yes, use CSUMM prog. winds as Step 1 field, [IWFCOD = 0]
    2 = Yes, use CSUMM prog. winds as initial guess field [IWFCOD = 1]
    3 = Yes, use winds from MM4.DAT file as Step 1 field [IWFCOD = 0]
    4 = Yes, use winds from MM4.DAT file as initial guess field [IWFCOD = 1]
    5 = Yes, use winds from MM4.DAT file as observations [IWFCOD = 1]
    13 = Yes, use winds from MM5/3D.DAT.DAT file as Step 1 field [IWFCOD = 0]
    14 = Yes, use winds from MM5/3D.DAT file as initial guess field [IWFCOD = 1]
    15 = Yes, use winds from MM5/3D.DAT file as observations [IWFCOD = 1]
```

```
   Timestep (hours) of the prognostic
   model input data   (ISTEPPG)          Default: 1      ! ISTEPPG =  1   !

   Use coarse CALMET fields as initial guess fields (IGFMET)
   (overwrites IGF based on prognostic wind fields if any)
                                         Default: 0      * IGFMET =  0  *

RADIUS OF INFLUENCE PARAMETERS

   Use varying radius of influence       Default: F      ! LVARY =  T!
   (if no stations are found within RMAX1,RMAX2,
    or RMAX3, then the closest station will be used)

   Maximum radius of influence over land
   in the surface layer (RMAX1)          No default      ! RMAX1 = 12 !
                                         Units: km
   Maximum radius of influence over land
   aloft (RMAX2)                         No default      ! RMAX2 = 12 !
                                         Units: km
   Maximum radius of influence over water
   (RMAX3)                               No default      ! RMAX3 = 12 !
                                         Units: km


OTHER WIND FIELD INPUT PARAMETERS

   Minimum radius of influence used in
   the wind field interpolation (RMIN)   Default: 0.1    ! RMIN = 0.1 !
                                         Units: km
   Radius of influence of terrain
   features (TERRAD)                     No default      ! TERRAD = 4 !

                                         Units: km
   Relative weighting of the first
   guess field and observations in the
   SURFACE layer (R1)                    No default      ! R1 = 10 !
   (R1 is the distance from an           Units: km
   observational station at which the
   observation and first guess field are
   equally weighted)

   Relative weighting of the first
   guess field and observations in the
   layers ALOFT (R2)                     No default      ! R2 = 12 !
   (R2 is applied in the upper layers    Units: km
   in the same manner as R1 is used in
   the surface layer).

   Relative weighting parameter of the
   prognostic wind field data (RPROG)    No default      ! RPROG = 0 !
   (Used only if IPROG = 1)              Units: km
   ------------------------

   Maximum acceptable divergence in the
   divergence minimization procedure
   (DIVLIM)                              Default: 5.E-6  ! DIVLIM= 5.0E-06 !

   Maximum number of iterations in the
   divergence min. procedure (NITER)     Default: 50     ! NITER =  50  !

   Number of passes in the smoothing
   procedure (NSMTH(NZ))
   NOTE: NZ values must be entered
        Default: 2,(mxnz-1)*4 * NSMTH =
```

```
2 ,  4 ,  4 ,  4 ,  4 ,  4 ,  4 ,  4 ,  4 ,  4  *
!  NSMTH = 1, 2, 2, 3, 3, 4, 4, 4, 4 !

      Maximum number of stations used in
      each layer for the interpolation of
      data to a grid point (NINTR2(NZ))
      NOTE: NZ values must be entered       Default: 99.    * NINTR2 =
99,  99,  99,  99,  99,  99,  99,  99,  99,  99  *
!  NINTR2 = 99, 99, 99, 99, 99, 99, 99, 99, 99 !

      Critical Froude number (CRITFN)       Default: 1.0    ! CRITFN = 1 !

      Empirical factor controlling the
      influence of kinematic effects
      (ALPHA)                               Default: 0.1    ! ALPHA = 0.1 !

      Multiplicative scaling factor for
      extrapolation of surface observations
      to upper layers (FEXTR2(NZ))          Default: NZ*0.0
      * FEXTR2 = 0., 0., 0., 0., 0., 0., 0., 0., 0. *
      (Used only if IEXTRP = 3 or -3)


   BARRIER INFORMATION

      Number of barriers to interpolation
      of the wind fields (NBAR)             Default: 0      ! NBAR =  0  !

      Level (1 to NZ) up to which barriers
      apply (KBAR)                          Default: NZ     * KBAR =  9  *

      THE FOLLOWING 4 VARIABLES ARE INCLUDED
      ONLY IF NBAR > 0
      NOTE: NBAR values must be entered     No defaults
            for each variable               Units: km

         X coordinate of BEGINNING
         of each barrier (XBBAR(NBAR))      * XBBAR =  *
         Y coordinate of BEGINNING
         of each barrier (YBBAR(NBAR))      * YBBAR =  *

         X coordinate of ENDING
         of each barrier (XEBAR(NBAR))      * XEBAR =  *
         Y coordinate of ENDING
         of each barrier (YEBAR(NBAR))      * YEBAR =  *


   DIAGNOSTIC MODULE DATA INPUT OPTIONS

      Surface temperature (IDIOPT1)         Default: 0      ! IDIOPT1 =  0  !
         0 = Compute internally from
             hourly surface observations or prognostic fields
         1 = Read preprocessed values from
             a data file (DIAG.DAT)

         Surface met. station to use for
         the surface temperature (ISURFT)   No default     ! ISURFT =  6  !
         (Must be a value from 1 to NSSTA)
         (Used only if IDIOPT1 = 0)
         --------------------------

      Domain-averaged temperature lapse
      rate (IDIOPT2)                        Default: 0     ! IDIOPT2 =  0  !
         0 = Compute internally from
             twice-daily upper air observations
```

```
   1 = Read hourly preprocessed values
       from a data file (DIAG.DAT)

   Upper air station to use for
   the domain-scale lapse rate (IUPT) No default     ! IUPT   =  1  !
   (Must be a value from 1 to NUSTA)
   (Used only if IDIOPT2 = 0)
   --------------------------

   Depth through which the domain-scale
   lapse rate is computed (ZUPT)      Default: 200.  ! ZUPT = 200 !
   (Used only if IDIOPT2 = 0)         Units: meters
   --------------------------

Domain-averaged wind components
(IDIOPT3)                             Default: 0     ! IDIOPT3 =  0  !
   0 = Compute internally from
       twice-daily upper air observations
   1 = Read hourly preprocessed values
       a data file (DIAG.DAT)

   Upper air station to use for
   the domain-scale winds (IUPWND)    Default: -1    ! IUPWND = -1  !
   (Must be a value from -1 to NUSTA)
   (Used only if IDIOPT3 = 0)
   --------------------------

   Bottom and top of layer through
   which the domain-scale winds
   are computed
   (ZUPWND(1), ZUPWND(2))        Defaults: 1., 1000. ! ZUPWND= 1, 1000 !
   (Used only if IDIOPT3 = 0)    Units: meters
   --------------------------

Observed surface wind components
for wind field module (IDIOPT4)  Default: 0     ! IDIOPT4 =  0  !
   0 = Read WS, WD from a surface
       data file (SURF.DAT)
   1 = Read hourly preprocessed U, V from
       a data file (DIAG.DAT)

Observed upper air wind components
for wind field module (IDIOPT5)  Default: 0     ! IDIOPT5 =  0  !
   0 = Read WS, WD from an upper
       air data file (UP1.DAT, UP2.DAT, etc.)
   1 = Read hourly preprocessed U, V from
       a data file (DIAG.DAT)

LAKE BREEZE INFORMATION

   Use Lake Breeze Module  (LLBREZE)
                                   Default: F      ! LLBREZE = F !

    Number of lake breeze regions (NBOX)           ! NBOX =  0  !

 X Grid line 1 defining the region of interest
                                                   ! XG1 = 0. !
 X Grid line 2 defining the region of interest
                                                   ! XG2 = 0. !
 Y Grid line 1 defining the region of interest
                                                   ! YG1 = 0. !
 Y Grid line 2 defining the region of interest
                                                   ! YG2 = 0. !

  X Point defining the coastline (Straight line)
```

```
                (XBCST)  (KM)   Default: none    ! XBCST = 0. !

      Y Point defining the coastline (Straight line)
                (YBCST)  (KM)   Default: none    ! YBCST = 0. !

      X Point defining the coastline (Straight line)
                (XECST)  (KM)   Default: none    ! XECST = 0. !

      Y Point defining the coastline (Straight line)
                (YECST)  (KM)   Default: none    ! YECST = 0. !


     Number of stations in the region     Default: none ! NLB =  0 !
     (Surface stations + upper air stations)

     Station ID's  in the region   (METBXID(NLB))
     (Surface stations first, then upper air stations)
       ! METBXID =  0 !

!END!


-------------------------------------------------------------------------------

INPUT GROUP: 6 -- Mixing Height, Temperature and Precipitation Parameters
--------------

    EMPIRICAL MIXING HEIGHT CONSTANTS

       Neutral, mechanical equation
       (CONSTB)                            Default: 1.41   ! CONSTB = 1.41 !
       Convective mixing ht. equation
       (CONSTE)                            Default: 0.15   ! CONSTE = 0.15 !
       Stable mixing ht. equation
       (CONSTN)                            Default: 2400.  ! CONSTN = 2400 !
       Overwater mixing ht. equation
       (CONSTW)                            Default: 0.16   ! CONSTW = 0.16 !
       Absolute value of Coriolis
       parameter (FCORIOL)                 Default: 1.E-4  ! FCORIOL = 1.0E-04 !
                                           Units: (1/s)

    SPATIAL AVERAGING OF MIXING HEIGHTS

       Conduct spatial averaging
       (IAVEZI)  (0=no, 1=yes)             Default: 1      ! IAVEZI =  1  !

       Max. search radius in averaging
       process (MNMDAV)                    Default: 1      ! MNMDAV =  1  !
                                           Units: Grid
                                                  cells
       Half-angle of upwind looking cone
       for averaging (HAFANG)              Default: 30.    ! HAFANG = 30 !
                                           Units: deg.
       Layer of winds used in upwind
       averaging (ILEVZI)                  Default: 1      ! ILEVZI =  1  !
       (must be between 1 and NZ)


    CONVECTIVE MIXING HEIGHT OPTIONS:
       Method to compute the convective
       mixing height(IMIXH)               Default: 1      ! IMIXH =  1  !
           1: Maul-Carson for land and water cells
          -1: Maul-Carson for land cells only -
              OCD mixing height overwater
           2: Batchvarova and Gryning for land and water cells
```

```
      -2: Batchvarova and Gryning for land cells only
          OCD mixing height overwater

   Threshold buoyancy flux required to
   sustain convective mixing height growth
   overland (THRESHL)                    Default: 0.05   ! THRESHL = 0.05 !
   (expressed as a heat flux             units: W/m3
    per meter of boundary layer)


   Threshold buoyancy flux required to
   sustain convective mixing height growth
   overwater (THRESHW)                   Default: 0.05   ! THRESHW = 0.05 !
   (expressed as a heat flux             units: W/m3
    per meter of boundary layer)


   Option for overwater lapse rates used
   in convective mixing height growth
   (ITWPROG)                             Default: 0      ! ITWPROG =  0  !
   0 : use SEA.DAT lapse rates and deltaT (or assume neutral
       conditions if missing)
   1 : use prognostic lapse rates (only if IPROG>2)
       and SEA.DAT deltaT (or neutral if missing)
   2 : use prognostic lapse rates and prognostic delta T
       (only if iprog>12 and 3D.DAT version# 2.0 or higher)

   Land Use category ocean in 3D.DAT datasets
   (ILUOC3D)                             Default: 16     ! ILUOC3D =  16  !
   Note: if 3D.DAT from MM5 version 3.0, iluoc3d = 16
         if MM4.DAT,           typically iluoc3d = 7


OTHER MIXING HEIGHT VARIABLES

   Minimum potential temperature lapse
   rate in the stable layer above the
   current convective mixing ht.         Default: 0.001  ! DPTMIN = 0.001 !
   (DPTMIN)                              Units: deg. K/m
   Depth of layer above current conv.
   mixing height through which lapse     Default: 200.   ! DZZI = 200 !
   rate is computed (DZZI)               Units: meters

   Minimum overland mixing height        Default:  50.   ! ZIMIN = 50 !
   (ZIMIN)                               Units: meters
   Maximum overland mixing height        Default: 3000.  ! ZIMAX = 3800 !
   (ZIMAX)                               Units: meters
   Minimum overwater mixing height       Default:   50.  ! ZIMINW = 50 !
   (ZIMINW) -- (Not used if observed     Units: meters
   overwater mixing hts. are used)
   Maximum overwater mixing height       Default: 3000.  ! ZIMAXW = 3800 !
   (ZIMAXW) -- (Not used if observed     Units: meters
   overwater mixing hts. are used)


OVERWATER SURFACE FLUXES METHOD and PARAMETERS
      (ICOARE)                           Default: 10      ! ICOARE =  10   !
       0: original deltaT method (OCD)
      10: COARE with no wave parameterization (jwave=0, Charnock)
      11: COARE with wave option jwave=1 (Oost et al.)
          and default wave properties
     -11: COARE with wave option jwave=1 (Oost et al.)
          and observed wave properties (must be in SEA.DAT files)
      12: COARE with wave option 2 (Taylor and Yelland)
           and default wave properties
```

```
  -12: COARE with wave option 2 (Taylor and Yelland)
       and observed wave properties (must be in SEA.DAT files)

   Coastal/Shallow water length scale (DSHELF)
   (for modified z0 in shallow water)
   ( COARE fluxes only)
                                  Default : 0.        ! DSHELF = 0 !
                                  units: km

    COARE warm layer computation (IWARM)              ! IWARM =  0   !
    1: on - 0: off (must be off if SST measured with
   IR radiometer)                 Default: 0

    COARE cool skin layer computation (ICOOL)         ! ICOOL =  0   !
    1: on - 0: off (must be off if SST measured with
    IR radiometer)                Default: 0


 TEMPERATURE PARAMETERS

    3D temperature from observations or
    from prognostic data? (ITPROG)        Default:0         !ITPROG =  1   !

       0 = Use Surface and upper air stations
           (only if NOOBS = 0)
       1 = Use Surface stations (no upper air observations)
           Use MM5/M3D for upper air data
           (only if NOOBS = 0,1)
       2 = No surface or upper air observations
           Use MM5/M3D for surface and upper air data
           (only if NOOBS = 0,1,2)

    Interpolation type
    (1 = 1/R ; 2 = 1/R**2)                Default:1         ! IRAD =  1  !

    Radius of influence for temperature
    interpolation (TRADKM)                Default: 500.     ! TRADKM = 10 !
                                          Units: km

    Maximum Number of stations to include
    in temperature interpolation (NUMTS)  Default: 5        ! NUMTS = 5  !

    Conduct spatial averaging of temp-
    eratures (IAVET)  (0=no, 1=yes)         Default: 1     ! IAVET =  1  !
    (will use mixing ht MNMDAV,HAFANG
     so make sure they are correct)

    Default temperature gradient        Default: -.0098 ! TGDEFB = -0.0098 !
    below the mixing height over        Units: K/m
    water (TGDEFB)

    Default temperature gradient        Default: -.0045 ! TGDEFA = -0.0045 !
    above the mixing height over        Units: K/m
    water (TGDEFA)

    Beginning (JWAT1) and ending (JWAT2)
    land use categories for temperature                   ! JWAT1 =  55  !
    interpolation over water -- Make                      ! JWAT2 =  55  !
    bigger than largest land use to disable

PRECIP INTERPOLATION PARAMETERS

    Method of interpolation (NFLAGP)      Default = 2    ! NFLAGP =  2  !
     (1=1/R,2=1/R**2,3=EXP/R**2)
    Radius of Influence (km) (SIGMAP)     Default = 100.0  ! SIGMAP = 100 !
```

```
        (0.0 => use half dist. btwn          Units: km
         nearest stns w & w/out
         precip when NFLAGP = 3)
       Minimum Precip. Rate Cutoff (CUTP)    Default = 0.01  ! CUTP = 0.01 !
        (values < CUTP = 0.0 mm/hr)          Units: mm/hr
!END!


-------------------------------------------------------------------------------

INPUT GROUP: 7 -- Surface meteorological station parameters
--------------

     SURFACE STATION VARIABLES
     (One record per station)


             1     2
         Name   ID            X coord.   Y coord.   Time   Anem.
                               (km)       (km)      zone   Ht.(m)
       ------------------------------------------------------------
! SS1  ='PRO1'   000001        314.548     5140.409     8     10  !
! SS2  ='EOC2'   000002        304.948     5140.759     8     10  !
! SS3  ='Arm3'   000003        304.205     5151.58     8     10  !
! SS4  ='RSP4'   000004        292.846     5153.809     8     10  !
! SS5  ='EDN5'   000005        316.335     5162.078     8     10  !
! SS6  ='2006'   000006        306.725     5158.93     8     10  !
! SS7  ='2007'   000007        295.855     5157.795     8     10  !
! SS8  ='FFT8'   000009        318.692     5144.479     8     10  !
! SS9  ='YAK9'   000010        291.116     5161.888     8     10  !
! SS10 ='3010'   000011        324.144     5137.059     8     10  !
! SS11 ='WY11'   000012        316.462     5150.394     8     10  !
! SS12 ='1012'   000013        304.952     5173.749     8     10  !
! SS13 ='WP13'   000014        319.982     5148.957     8     10  !
! SS14 ='FR14'   000015        328.022     5142.851     8     10  !
! SS15 ='GA15'   000016        311.575     5163.482     8     10  !
! SS16 ='RI16'   000017        328.448     5157.029     8     10  !
! SS17 ='RI17'   000018        322.796     5130.034     8     10  !
! SS18 ='PF18'   000019        298.169     5158.014     8     3.05  !
! SS19 ='HM19'   000021        300.794     5159.861     8     10  !
! SS20 ='PA20'   000022        337.050     5124.791     8     10  !
! SS21 ='GA21'   000023        304.132     5165.206     8     10  !
! SS22 ='1022'   000024        312.298     5167.479     8     10  !
! SS23 ='VE23'   000025        291.260     5168.897     8     10  !
! SS24 ='VS24'   000027        330.228     5120.661     8     10  !
! SS25 ='1025'   000029        302.799     5170.313     8     3.05  !
! SS26 ='HA26'   000030        321.068     5136.275     8     10  !
-------------------
      1
        Four character string for station name
        (MUST START IN COLUMN 9)

      2
        Six digit integer for station ID

!END!


-------------------------------------------------------------------------------

INPUT GROUP: 8 -- Upper air meteorological station parameters
--------------

     UPPER AIR STATION VARIABLES
     (One record per station)
```

```
            1     2
         Name    ID      X coord.   Y coord.  Time zone
                           (km)       (km)
        ------------------------------------------------
-------------------
      1
        Four character string for station name
        (MUST START IN COLUMN 9)

      2
        Five digit integer for station ID

!END!


-------------------------------------------------------------------------------

INPUT GROUP: 9 -- Precipitation station parameters
--------------

     PRECIPITATION STATION VARIABLES
     (One record per station)
     (NOT INCLUDED IF NPSTA = 0)

            1          2
         Name   Station    X coord.  Y coord.
                  Code       (km)      (km)
         -------------------------------------

! PS1  ='0001'   450001    314.551   5140.409  !
! PS2  ='0002'   450010    291.117   5161.888  !
! PS3  ='0003'   450011    324.142   5137.059  !
! PS4  ='0004'   450012    316.461   5150.394  !
! PS5  ='0005'   450017    328.449   5157.029  !
! PS6  ='0006'   450021    300.792   5159.861  !
! PS7  ='0007'   450024    312.298   5167.479  !

-------------------
      1
        Four character string for station name
        (MUST START IN COLUMN 9)

      2
        Six digit station code composed of state
        code (first 2 digits) and station ID (last
        4 digits)

!END!
```

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Appendix D

Example CALPUFF Input File

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Appendix D
Example CALPUFF Input File

```
WTP Risk Assessment
2005 Met Data Site Wide Receptor Grids (All grids)
All Facilities
---------------- Run title (3 lines) ----------------------------------------

                    CALPUFF MODEL CONTROL FILE
                    --------------------------

------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names

--------------
Default Name  Type          File Name
------------  ----          ---------
CALMET.DAT    input    ! METDAT = ..\calmet.dat   !
    or
ISCMET.DAT    input    * ISCDAT =             *
    or
PLMMET.DAT    input    * PLMDAT =             *
    or
PROFILE.DAT   input    * PRFDAT =             *
SURFACE.DAT   input    * SFCDAT =             *
RESTARTB.DAT  input    * RSTARTB=             *
------------------------------------------------------------------------------
CALPUFF.LST   output   ! PUFLST =CALPUFF.LST  !
CONC.DAT      output   ! CONDAT =CONC.DAT     !
DFLX.DAT      output   ! DFDAT  =DFLX.DAT     !
WFLX.DAT      output   ! WFDAT  =WFLX.DAT     !

VISB.DAT      output   ! VISDAT =VISB.DAT     !
TK2D.DAT      output   * T2DDAT =             *
RHO2D.DAT     output   * RHODAT =             *
RESTARTE.DAT  output   * RSTARTE=             *
------------------------------------------------------------------------------
Emission Files
--------------
PTEMARB.DAT   input    * PTDAT  =             *
VOLEMARB.DAT  input    * VOLDAT =             *
BAEMARB.DAT   input    * ARDAT  =             *
LNEMARB.DAT   input    * LNDAT  =             *
------------------------------------------------------------------------------
Other Files
-----------
OZONE.DAT     input    * OZDAT  =OZONE.DAT    *
VD.DAT        input    * VDDAT  =             *
CHEM.DAT      input    * CHEMDAT=             *
H2O2.DAT      input    * H2O2DAT=             *
HILL.DAT      input    * HILDAT=             *
HILLRCT.DAT   input    * RCTDAT=             *
COASTLN.DAT   input    * CSTDAT=             *
FLUXBDY.DAT   input    * BDYDAT=             *
BCON.DAT      input    * BCNDAT=             *
DEBUG.DAT     output   ! DEBUG = DEBUG.DAT   !
MASSFLX.DAT   output   * FLXDAT=             *
MASSBAL.DAT   output   * BALDAT=             *
FOG.DAT       output   * FOGDAT=             *
------------------------------------------------------------------------------
All file names will be converted to lower case if LCFILES = T
Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
         T = lower case      ! LCFILES = F !
         F = UPPER CASE
NOTE: (1) file/path names can be up to 70 characters in length


Provision for multiple input files
----------------------------------

     Number of CALMET.DAT files for run (NMETDAT)
                                    Default: 1       ! NMETDAT =   1   !
```

```
     Number of PTEMARB.DAT files for run (NPTDAT)
                                    Default: 0       ! NPTDAT =  0  !

     Number of BAEMARB.DAT files for run (NARDAT)
                                    Default: 0       ! NARDAT =  0  !

     Number of VOLEMARB.DAT files for run (NVOLDAT)
                                    Default: 0       ! NVOLDAT =  0  !

!END!

-------------
Subgroup (0a)
-------------

  The following CALMET.DAT filenames are processed in sequence if NMETDAT>1

Default Name  Type          File Name
------------  ----          ---------
 none         input    * METDAT=     *   *END*
-------------
Subgroup (0b)
-------------

  The following PTEMARB.DAT filenames are processed if NPTDAT>0
  (Each file contains a subset of the sources, for the entire simulation)

Default Name  Type          File Name
------------  ----          ---------
 none         input       * PTDAT=     *   *END*


-------------
Subgroup (0c)
-------------

  The following BAEMARB.DAT filenames are processed if NARDAT>0
  (Each file contains a subset of the sources, for the entire simulation)

Default Name  Type          File Name
------------  ----          ---------
 none         input       * ARDAT=     *   *END*


-------------
Subgroup (0d)
-------------

  The following VOLEMARB.DAT filenames are processed if NVOLDAT>0
  (Each file contains a subset of the sources, for the entire simulation)

Default Name  Type          File Name
------------  ----          ---------
 none         input       * VOLDAT=     *   *END*


--------------------------------------------------------------------------------

INPUT GROUP: 1 -- General run control parameters
--------------

    Option to run all periods found
    in the met. file     (METRUN)   Default: 0       ! METRUN =   0  !

         METRUN = 0 - Run period explicitly defined below
         METRUN = 1 - Run all periods in met. file

     Starting date:   Year (IBYR) -- No default       ! IBYR =  2005  !
     (used only if   Month (IBMO) -- No default       ! IBMO =  1  !
      METRUN = 0)      Day (IBDY) -- No default       ! IBDY =  1  !
                      Hour (IBHR) -- No default       ! IBHR =  1  !

     Note: IBHR is the time at the END of the first hour of the simulation
           (IBHR=1, the first hour of a day, runs from 00:00 to 01:00)

     Base time zone        (XBTZ) -- No default       ! XBTZ = 8  !
     The zone is the number of hours that must be
     ADDED to the time to obtain UTC (or GMT)
```

```
     Examples: PST = 8., MST = 7.
               CST = 6., EST = 5.

     Length of run (hours) (IRLG) -- No default       ! IRLG =  8760  !

     Number of chemical species (NSPEC)
                                   Default: 5       ! NSPEC =  15   !

     Number of chemical species
     to be emitted  (NSE)          Default: 3       ! NSE =  15   !

     Flag to stop run after
     SETUP phase (ITEST)           Default: 2       ! ITEST =  2   !
     (Used to allow checking
     of the model inputs, files, etc.)
           ITEST = 1 - STOPS program after SETUP phase
           ITEST = 2 - Continues with execution of program
                       after SETUP

     Restart Configuration:

        Control flag (MRESTART)    Default: 0       ! MRESTART =  0   !

           0 = Do not read or write a restart file
           1 = Read a restart file at the beginning of
               the run
           2 = Write a restart file during run
           3 = Read a restart file at beginning of run
               and write a restart file during run

        Number of periods in Restart
        output cycle (NRESPD)      Default: 0       ! NRESPD =  0   !

           0 = File written only at last period
          >0 = File updated every NRESPD periods

     Meteorological Data Format (METFM)
                                   Default: 1       ! METFM =  1   !

           METFM = 1 - CALMET binary file (CALMET.MET)
           METFM = 2 - ISC ASCII file (ISCMET.MET)
           METFM = 3 - AUSPLUME ASCII file (PLMMET.MET)
           METFM = 4 - CTDM plus tower file (PROFILE.DAT) and
                       surface parameters file (SURFACE.DAT)
           METFM = 5 - AERMET tower file (PROFILE.DAT) and
                       surface parameters file (SURFACE.DAT)

     Meteorological Profile Data Format (MPRFFM)
            (used only for METFM = 1, 2, 3)
                                   Default: 1       ! MPRFFM =  1   !

           MPRFFM = 1 - CTDM plus tower file (PROFILE.DAT)
           MPRFFM = 2 - AERMET tower file (PROFILE.DAT)

     PG sigma-y is adjusted by the factor (AVET/PGTIME)**0.2
     Averaging Time (minutes) (AVET)
                                   Default: 60.0    ! AVET = 60. !
     PG Averaging Time (minutes) (PGTIME)
                                   Default: 60.0    ! PGTIME = 60. !


!END!


-----------------------------------------------------------------------------

INPUT GROUP: 2 -- Technical options
--------------


     Vertical distribution used in the
     near field (MGAUSS)                   Default: 1     ! MGAUSS =  1   !
        0 = uniform
        1 = Gaussian

     Terrain adjustment method
     (MCTADJ)                              Default: 3     ! MCTADJ =  3   !
        0 = no adjustment
```

```
   1 = ISC-type of terrain adjustment
   2 = simple, CALPUFF-type of terrain
       adjustment
   3 = partial plume path adjustment

Subgrid-scale complex terrain
flag (MCTSG)                          Default: 0     ! MCTSG =  0   !
   0 = not modeled
   1 = modeled

Near-field puffs modeled as
elongated slugs? (MSLUG)              Default: 0     ! MSLUG =  0   !
   0 = no
   1 = yes (slug model used)

Transitional plume rise modeled?
(MTRANS)                              Default: 1     ! MTRANS =  1   !
   0 = no  (i.e., final rise only)
   1 = yes (i.e., transitional rise computed)

Stack tip downwash? (MTIP)            Default: 1     ! MTIP =  1  !
   0 = no  (i.e., no stack tip downwash)
   1 = yes (i.e., use stack tip downwash)

Method used to simulate building
downwash? (MBDW)                      Default: 1     ! MBDW =   1  !
   1 = ISC method
   2 = PRIME method

Vertical wind shear modeled above
stack top? (MSHEAR)                   Default: 0     ! MSHEAR =  0  !
   0 = no  (i.e., vertical wind shear not modeled)
   1 = yes (i.e., vertical wind shear modeled)

Puff splitting allowed? (MSPLIT)      Default: 0     ! MSPLIT =  0  !
   0 = no (i.e., puffs not split)
   1 = yes (i.e., puffs are split)

Chemical mechanism flag (MCHEM)       Default: 1     ! MCHEM =  0   !
   0 = chemical transformation not
       modeled
   1 = transformation rates computed
       internally (MESOPUFF II scheme)
   2 = user-specified transformation
       rates used
   3 = transformation rates computed
       internally (RIVAD/ARM3 scheme)
   4 = secondary organic aerosol formation
       computed (MESOPUFF II scheme for OH)

Aqueous phase transformation flag (MAQCHEM)
(Used only if MCHEM = 1, or 3)        Default: 0     ! MAQCHEM =  0   !
   0 = aqueous phase transformation
       not modeled
   1 = transformation rates adjusted
       for aqueous phase reactions

Wet removal modeled ? (MWET)          Default: 1     ! MWET =  1   !
   0 = no
   1 = yes

Dry deposition modeled ? (MDRY)       Default: 1     ! MDRY =  1   !
   0 = no
   1 = yes
   (dry deposition method specified
    for each species in Input Group 3)


Gravitational settling (plume tilt)
modeled ? (MTILT)                     Default: 0     ! MTILT =  0   !
   0 = no
   1 = yes
   (puff center falls at the gravitational
    settling velocity for 1 particle species)

Restrictions:
    - MDRY  = 1
    - NSPEC = 1  (must be particle species as well)
```

```
    - sg    = 0  GEOMETRIC STANDARD DEVIATION in Group 8 is
                 set to zero for a single particle diameter

Method used to compute dispersion
coefficients (MDISP)                  Default: 3     ! MDISP =  3   !

   1 = dispersion coefficients computed from measured values
       of turbulence, sigma v, sigma w
   2 = dispersion coefficients from internally calculated
       sigma v, sigma w using micrometeorological variables
       (u*, w*, L, etc.)
   3 = PG dispersion coefficients for RURAL areas (computed using
       the ISCST multi-segment approximation) and MP coefficients in
       urban areas
   4 = same as 3 except PG coefficients computed using
       the MESOPUFF II eqns.
   5 = CTDM sigmas used for stable and neutral conditions.
       For unstable conditions, sigmas are computed as in
       MDISP = 3, described above.  MDISP = 5 assumes that
       measured values are read

Sigma-v/sigma-theta, sigma-w measurements used? (MTURBVW)
(Used only if MDISP = 1 or 5)         Default: 3     ! MTURBVW =  3  !
   1 = use sigma-v or sigma-theta measurements
       from PROFILE.DAT to compute sigma-y
       (valid for METFM = 1, 2, 3, 4, 5)
   2 = use sigma-w measurements
       from PROFILE.DAT to compute sigma-z
       (valid for METFM = 1, 2, 3, 4, 5)
   3 = use both sigma-(v/theta) and sigma-w
       from PROFILE.DAT to compute sigma-y and sigma-z
       (valid for METFM = 1, 2, 3, 4, 5)
   4 = use sigma-theta measurements
       from PLMMET.DAT to compute sigma-y
       (valid only if METFM = 3)

Back-up method used to compute dispersion
when measured turbulence data are
missing (MDISP2)                      Default: 3     ! MDISP2 =  3  !
(used only if MDISP = 1 or 5)
   2 = dispersion coefficients from internally calculated
       sigma v, sigma w using micrometeorological variables
       (u*, w*, L, etc.)
   3 = PG dispersion coefficients for RURAL areas (computed using
       the ISCST multi-segment approximation) and MP coefficients in
       urban areas
   4 = same as 3 except PG coefficients computed using
       the MESOPUFF II eqns.

[DIAGNOSTIC FEATURE]
Method used for Lagrangian timescale for Sigma-y
(used only if MDISP=1,2 or MDISP2=1,2)
(MTAULY)                              Default: 0     ! MTAULY =  0  !
   0 = Draxler default 617.284 (s)
   1 = Computed as Lag. Length / (.75 q) -- after SCIPUFF
  10 < Direct user input (s)             -- e.g., 306.9


[DIAGNOSTIC FEATURE]
Method used for Advective-Decay timescale for Turbulence
(used only if MDISP=2 or MDISP2=2)
(MTAUADV)                             Default: 0     ! MTAUADV =  0  !
   0 = No turbulence advection
   1 = Computed (OPTION NOT IMPLEMENTED)
  10 < Direct user input (s)   -- e.g., 800


Method used to compute turbulence sigma-v &
sigma-w using micrometeorological variables
(Used only if MDISP = 2 or MDISP2 = 2)
(MCTURB)                              Default: 1     ! MCTURB =  1  !
   1 = Standard CALPUFF subroutines
   2 = AERMOD subroutines

PG sigma-y,z adj. for roughness?      Default: 0     ! MROUGH =  0  !
(MROUGH)
   0 = no
   1 = yes
```

```
Partial plume penetration of          Default: 1     ! MPARTL =  1  !
elevated inversion?
(MPARTL)
   0 = no
   1 = yes

Strength of temperature inversion     Default: 0     ! MTINV =  0  !
provided in PROFILE.DAT extended records?
(MTINV)
   0 = no (computed from measured/default gradients)
   1 = yes

PDF used for dispersion under convective conditions?
                                      Default: 0     ! MPDF =  0  !
(MPDF)
   0 = no
   1 = yes

Sub-Grid TIBL module used for shore line?
                                      Default: 0     ! MSGTIBL = 0  !
(MSGTIBL)
   0 = no
   1 = yes

Boundary conditions (concentration) modeled?
                                      Default: 0     ! MBCON = 0  !
(MBCON)
   0 = no
   1 = yes, using formatted BCON.DAT file
   2 = yes, using unformatted CONC.DAT file

Note:  MBCON > 0 requires that the last species modeled
       be 'BCON'.  Mass is placed in species BCON when
       generating boundary condition puffs so that clean
       air entering the modeling domain can be simulated
       in the same way as polluted air.  Specify zero
       emission of species BCON for all regular sources.

Individual source contributions saved?
                                      Default: 0     ! MSOURCE = 0  !
(MSOURCE)
   0 = no
   1 = yes


Analyses of fogging and icing impacts due to emissions from
arrays of mechanically-forced cooling towers can be performed
using CALPUFF in conjunction with a cooling tower emissions
processor (CTEMISS) and its associated postprocessors.  Hourly
emissions of water vapor and temperature from each cooling tower
cell are computed for the current cell configuration and ambient
conditions by CTEMISS. CALPUFF models the dispersion of these
emissions and provides cloud information in a specialized format
for further analysis. Output to FOG.DAT is provided in either
'plume mode' or 'receptor mode' format.

Configure for FOG Model output?
                                      Default: 0     ! MFOG =  0   !
(MFOG)
   0 = no
   1 = yes  - report results in PLUME Mode format
   2 = yes  - report results in RECEPTOR Mode format


Test options specified to see if
they conform to regulatory
values? (MREG)                        Default: 1     ! MREG =  0   !

   0 = NO checks are made
   1 = Technical options must conform to USEPA
       Long Range Transport (LRT) guidance
                  METFM    1 or 2
                  AVET     60. (min)
                  PGTIME   60. (min)
                  MGAUSS   1
                  MCTADJ   3
                  MTRANS   1
```

```
                    MTIP     1
                    MCHEM    1 or 3 (if modeling SOx, NOx)
                    MWET     1
                    MDRY     1
                    MDISP    2 or 3
                    MPDF     0 if MDISP=3
                             1 if MDISP=2
                    MROUGH   0
                    MPARTL   1
                    SYTDEP   550. (m)
                    MHFTSZ   0
                    SVMIN    0.5 (m/s)

!END!

-------------------------------------------------------------------------------

INPUT GROUP: 3a, 3b -- Species list
-------------------

------------
Subgroup (3a)
------------

  The following species are modeled:

 ! CSPEC =  PTFV !         !END!
 ! CSPEC =  LAWV !         !END!
 ! CSPEC =  HLWV !         !END!
 ! CSPEC =  EMFV !         !END!
 ! CSPEC =  LABV !         !END!
 ! CSPEC =  PTFP1 !         !END!
 ! CSPEC =  LAWP1 !         !END!
 ! CSPEC =  HLWP1 !         !END!
 ! CSPEC =  EMFP1 !         !END!
 ! CSPEC =  LABP1 !         !END!
 ! CSPEC =  PTFP25 !         !END!
 ! CSPEC =  LAWP25 !         !END!
 ! CSPEC =  HLWP25 !         !END!
 ! CSPEC =  EMFP25 !         !END!
 ! CSPEC =  LABP25 !         !END!

                                                     Dry                 OUTPUT GROUP
    SPECIES          MODELED          EMITTED       DEPOSITED              NUMBER
     NAME         (0=NO, 1=YES)    (0=NO, 1=YES)    (0=NO,                (0=NONE,
   (Limit: 12                                        1=COMPUTED-GAS        1=1st CGRUP,
    Characters                                       2=COMPUTED-PARTICLE   2=2nd CGRUP,
    in length)                                       3=USER-SPECIFIED)     3= etc.)

!          PTFV  =         1,               1,           1,                 0   !
!          LAWV  =         1,               1,           1,                 0   !
!          HLWV  =         1,               1,           1,                 0   !
!          EMFV  =         1,               1,           1,                 0   !
!          LABV  =         1,               1,           1,                 0   !
!          PTFP1  =         1,               1,           2,                 0   !
!          LAWP1  =         1,               1,           2,                 0   !
!          HLWP1  =         1,               1,           2,                 0   !
!          EMFP1  =         1,               1,           2,                 0   !
!          LABP1  =         1,               1,           2,                 0   !
!          PTFP25  =         1,               1,           2,                 0   !
!          LAWP25  =         1,               1,           2,                 0   !
!          HLWP25  =         1,               1,           2,                 0   !
!          EMFP25  =         1,               1,           2,                 0   !
!          LABP25  =         1,               1,           2,                 0   !

!END!

  Note:  The last species in (3a) must be 'BCON' when using the
         boundary condition option (MBCON > 0).  Species BCON should
         typically be modeled as inert (no chem transformation or
         removal).


-------------
Subgroup (3b)
-------------
```

```
  The following names are used for Species-Groups in which results
  for certain species are combined (added) prior to output.  The
  CGRUP name will be used as the species name in output files.
  Use this feature to model specific particle-size distributions
  by treating each size-range as a separate species.
  Order must be consistent with 3(a) above.


-------------------------------------------------------------------------------


INPUT GROUP: 4 -- Map Projection and Grid control parameters
--------------

     Projection for all (X,Y):
     -------------------------

     Map projection
     (PMAP)                     Default: UTM    ! PMAP = UTM !

         UTM :  Universal Transverse Mercator
         TTM :  Tangential Transverse Mercator
         LCC :  Lambert Conformal Conic
          PS :  Polar Stereographic
          EM :  Equatorial Mercator
        LAZA :  Lambert Azimuthal Equal Area

     False Easting and Northing (km) at the projection origin
     (Used only if PMAP= TTM, LCC, or LAZA)
     (FEAST)                    Default=0.0     ! FEAST  = 0  !
     (FNORTH)                   Default=0.0     ! FNORTH = 0  !

     UTM zone (1 to 60)
     (Used only if PMAP=UTM)
     (IUTMZN)                   No Default      ! IUTMZN =  11   !

     Hemisphere for UTM projection?
     (Used only if PMAP=UTM)
     (UTMHEM)                   Default: N      ! UTMHEM = N  !
         N   :  Northern hemisphere projection
         S   :  Southern hemisphere projection

     Latitude and Longitude (decimal degrees) of projection origin
     (Used only if PMAP= TTM, LCC, PS, EM, or LAZA)
      (RLAT0)                    No Default      ! RLAT0 = 46.085913N !
      (RLON0)                    No Default      ! RLON0 = 120.130371W !

         TTM :  RLON0 identifies central (true N/S) meridian of projection
                RLAT0 selected for convenience
         LCC :  RLON0 identifies central (true N/S) meridian of projection
                RLAT0 selected for convenience
         PS  :  RLON0 identifies central (grid N/S) meridian of projection
                RLAT0 selected for convenience
         EM  :  RLON0 identifies central meridian of projection
                RLAT0 is REPLACED by 0.0N (Equator)
         LAZA:  RLON0 identifies longitude of tangent-point of mapping plane
                RLAT0 identifies latitude of tangent-point of mapping plane

     Matching parallel(s) of latitude (decimal degrees) for projection
     (Used only if PMAP= LCC or PS)
      (XLAT1)                    No Default      ! XLAT1 = 30N !
      (XLAT2)                    No Default      ! XLAT2 = 60N !

         LCC :  Projection cone slices through Earth's surface at XLAT1 and XLAT2
         PS  :  Projection plane slices through Earth at XLAT1
                (XLAT2 is not used)

     ----------
     Note:  Latitudes and longitudes should be positive, and include a
            letter N,S,E, or W indicating north or south latitude, and
            east or west longitude.  For example,
            35.9  N Latitude  =  35.9N
            118.7 E Longitude = 118.7E


     Datum-region
     ------------
```

```
     The Datum-Region for the coordinates is identified by a character
     string.  Many mapping products currently available use the model of the
     Earth known as the World Geodetic System 1984 (WGS-84).  Other local
     models may be in use, and their selection in CALMET will make its output
     consistent with local mapping products.  The list of Datum-Regions with
     official transformation parameters is provided by the National Imagery and
     Mapping Agency (NIMA).

     NIMA Datum - Regions(Examples)
     ------------------------------------------------------------------------------
     WGS-84    WGS-84 Reference Ellipsoid and Geoid, Global coverage (WGS84)
     NAS-C     NORTH AMERICAN 1927 Clarke 1866 Spheroid, MEAN FOR CONUS (NAD27)
     NAR-C     NORTH AMERICAN 1983 GRS 80 Spheroid, MEAN FOR CONUS (NAD83)
     NWS-84    NWS 6370KM Radius, Sphere
     ESR-S     ESRI REFERENCE 6371KM Radius, Sphere

     Datum-region for output coordinates
     (DATUM)                    Default: WGS-84     ! DATUM = WGS-84  !


METEOROLOGICAL Grid:

     Rectangular grid defined for projection PMAP,
     with X the Easting and Y the Northing coordinate

            No. X grid cells (NX)      No default     ! NX =  100   !
            No. Y grid cells (NY)      No default     ! NY =  100  !
        No. vertical layers (NZ)       No default     ! NZ =  9   !

          Grid spacing (DGRIDKM)       No default     ! DGRIDKM = 1 !
                                       Units: km

                Cell face heights
                    (ZFACE(nz+1))      No defaults
                                       Units: m
 !  ZFACE = 0., 20, 40, 80, 160, 320, 670, 1400, 2600, 4000 !

            Reference Coordinates
          of SOUTHWEST corner of
                grid cell(1, 1):

        X coordinate (XORIGKM)         No default     ! XORIGKM = 257.988 !
        Y coordinate (YORIGKM)         No default     ! YORIGKM = 5108.358 !
                                      Units: km


COMPUTATIONAL Grid:

     The computational grid is identical to or a subset of the MET. grid.
     The lower left (LL) corner of the computational grid is at grid point
     (IBCOMP, JBCOMP) of the MET. grid.  The upper right (UR) corner of the
     computational grid is at grid point (IECOMP, JECOMP) of the MET. grid.
     The grid spacing of the computational grid is the same as the MET. grid.

        X index of LL corner (IBCOMP)      No default     ! IBCOMP =  1   !
                  (1 <= IBCOMP <= NX)

        Y index of LL corner (JBCOMP)      No default     ! JBCOMP =  1   !
                  (1 <= JBCOMP <= NY)


        X index of UR corner (IECOMP)      No default     ! IECOMP =  100   !
                  (1 <= IECOMP <= NX)

        Y index of UR corner (JECOMP)      No default     ! JECOMP =  100   !
                  (1 <= JECOMP <= NY)


SAMPLING Grid (GRIDDED RECEPTORS):

     The lower left (LL) corner of the sampling grid is at grid point
     (IBSAMP, JBSAMP) of the MET. grid.  The upper right (UR) corner of the
     sampling grid is at grid point (IESAMP, JESAMP) of the MET. grid.
     The sampling grid must be identical to or a subset of the computational
     grid.  It may be a nested grid inside the computational grid.
     The grid spacing of the sampling grid is DGRIDKM/MESHDN.
```

```
        Logical flag indicating if gridded
        receptors are used (LSAMP)         Default: T     ! LSAMP = F !
        (T=yes, F=no)

        X index of LL corner (IBSAMP)      No default     ! IBSAMP =  1   !
         (IBCOMP <= IBSAMP <= IECOMP)

        Y index of LL corner (JBSAMP)      No default     ! JBSAMP =  1   !
         (JBCOMP <= JBSAMP <= JECOMP)


        X index of UR corner (IESAMP)      No default     ! IESAMP =  100   !
         (IBCOMP <= IESAMP <= IECOMP)

        Y index of UR corner (JESAMP)      No default     ! JESAMP =  100   !
         (JBCOMP <= JESAMP <= JECOMP)


       Nesting factor of the sampling
        grid (MESHDN)                      Default: 1     ! MESHDN =  1  !
        (MESHDN is an integer >= 1)

!END!


-------------------------------------------------------------------------------


INPUT GROUP: 5 -- Output Options
--------------
                                          *                           *
     FILE                        DEFAULT VALUE             VALUE THIS RUN
     ----                        -------------             --------------

   Concentrations (ICON)              1                    !  ICON =  1   !
   Dry Fluxes (IDRY)                  1                    !  IDRY =  1   !
   Wet Fluxes (IWET)                  1                    !  IWET =  1   !
   2D Temperature (IT2D)              0                    !  IT2D =  0   !
   2D Density (IRHO)                  0                    !  IRHO =  0   !
   Relative Humidity (IVIS)           1                    !  IVIS =  1   !
    (relative humidity file is
     required for visibility
     analysis)
   Use data compression option in output file?
   (LCOMPRS)                           Default: T         ! LCOMPRS = T !

   *
    0 = Do not create file, 1 = create file


    QA PLOT FILE OUTPUT OPTION:

       Create a standard series of output files (e.g.
       locations of sources, receptors, grids ...)
       suitable for plotting?
       (IQAPLOT)                       Default: 1         !  IQAPLOT =  1   !
         0 = no
         1 = yes

    DIAGNOSTIC MASS FLUX OUTPUT OPTIONS:

       Mass flux across specified boundaries
       for selected species reported?
       (IMFLX)                         Default: 0         ! IMFLX =  0  !
         0 = no
         1 = yes (FLUXBDY.DAT and MASSFLX.DAT filenames
                  are specified in Input Group 0)

       Mass balance for each species
       reported?
       (IMBAL)                         Default: 0         ! IMBAL =  0  !
         0 = no
         1 = yes (MASSBAL.DAT filename is
              specified in Input Group 0)


    LINE PRINTER OUTPUT OPTIONS:
```

```
      Print concentrations (ICPRT)    Default: 0         ! ICPRT =  0   !
      Print dry fluxes (IDPRT)        Default: 0         ! IDPRT =  0   !
      Print wet fluxes (IWPRT)        Default: 0         ! IWPRT =  0   !
      (0 = Do not print, 1 = Print)

      Concentration print interval
      (ICFRQ) in timesteps            Default: 1         ! ICFRQ =  1   !
      Dry flux print interval
      (IDFRQ) in timesteps            Default: 1         ! IDFRQ =  1   !
      Wet flux print interval
      (IWFRQ) in timesteps            Default: 1         ! IWFRQ =  1   !

      Units for Line Printer Output
      (IPRTU)                         Default: 1         ! IPRTU =  1   !
                     for            for
                Concentration    Deposition
          1 =       g/m**3         g/m**2/s
          2 =      mg/m**3        mg/m**2/s
          3 =      ug/m**3        ug/m**2/s
          4 =      ng/m**3        ng/m**2/s
          5 =     Odour Units

      Messages tracking progress of run
      written to the screen ?
      (IMESG)                         Default: 2         ! IMESG =  2   !
        0 = no
        1 = yes (advection step, puff ID)
        2 = yes (YYYYJJJHH, # old puffs, # emitted puffs)


    SPECIES (or GROUP for combined species) LIST FOR OUTPUT OPTIONS

                  ---- CONCENTRATIONS ----   ------ DRY FLUXES ------   ------ WET FLUXES ------   -- MASS
FLUX --
   SPECIES
   /GROUP         PRINTED?  SAVED ON DISK?   PRINTED?  SAVED ON DISK?   PRINTED?  SAVED ON DISK?   SAVED ON
DISK?
   -------        ------------------------   ------------------------   ------------------------   ---------
------
!          PTFV =     0,           1,           0,           1,           0,           1,           0   !
!          LAWV =     0,           1,           0,           1,           0,           1,           0   !
!          HLWV =     0,           1,           0,           1,           0,           1,           0   !
!          EMFV =     0,           1,           0,           1,           0,           1,           0   !
!          LABV =     0,           1,           0,           1,           0,           1,           0   !
!          PTFP1 =     0,           1,           0,           1,           0,           1,           0   !
!          LAWP1 =     0,           1,           0,           1,           0,           1,           0   !
!          HLWP1 =     0,           1,           0,           1,           0,           1,           0   !
!          EMFP1 =     0,           1,           0,           1,           0,           1,           0   !
!          LABP1 =     0,           1,           0,           1,           0,           1,           0   !
!          PTFP25 =     0,           1,           0,           1,           0,           1,           0   !
!          LAWP25 =     0,           1,           0,           1,           0,           1,           0   !
!          HLWP25 =     0,           1,           0,           1,           0,           1,           0   !
!          EMFP25 =     0,           1,           0,           1,           0,           1,           0   !
!          LABP25 =     0,           1,           0,           1,           0,           1,           0   !

  Note:  Species BCON (for MBCON > 0) does not need to be saved on disk.


    OPTIONS FOR PRINTING DEBUG QUANTITIES (much output)

      Logical for debug output
      (LDEBUG)                                Default: F     ! LDEBUG = F !

      First puff to track
      (IPFDEB)                                Default: 1     ! IPFDEB =  1  !

      Number of puffs to track
      (NPFDEB)                                Default: 1     ! NPFDEB =  1000  !

      Met. period to start output
      (NN1)                                   Default: 1     ! NN1 =  1   !

      Met. period to end output
      (NN2)                                   Default: 10    ! NN2 =  8760  !

!END!
```

```
------------------------------------------------------------------------------


INPUT GROUP: 6a, 6b, & 6c -- Subgrid scale complex terrain inputs
-------------------------

---------------
Subgroup (6a)
---------------
       Number of terrain features (NHILL)       Default: 0     ! NHILL =  0   !

       Number of special complex terrain
       receptors  (NCTREC)                      Default: 0     ! NCTREC =  0   !

       Terrain and CTSG Receptor data for
       CTSG hills input in CTDM format ?
       (MHILL)                                  No Default     ! MHILL =  2   !
       1 = Hill and Receptor data created
           by CTDM processors & read from
           HILL.DAT and HILLRCT.DAT files
       2 = Hill data created by OPTHILL &
           input below in Subgroup (6b);
           Receptor data in Subgroup (6c)

       Factor to convert horizontal dimensions  Default: 1.0   ! XHILL2M = 1. !
       to meters (MHILL=1)

       Factor to convert vertical dimensions    Default: 1.0   ! ZHILL2M = 1. !
       to meters (MHILL=1)

       X-origin of CTDM system relative to      No Default     ! XCTDMKM = 0.0E00 !
       CALPUFF coordinate system, in Kilometers (MHILL=1)

       Y-origin of CTDM system relative to      No Default     ! YCTDMKM = 0.0E00 !
       CALPUFF coordinate system, in Kilometers (MHILL=1)

! END !

---------------
Subgroup (6b)
---------------

                      1 **
     HILL information


HILL           XC        YC       THETAH  ZGRID  RELIEF    EXPO 1    EXPO 2   SCALE 1    SCALE 2    AMAX1
AMAX2
 NO.          (km)      (km)      (deg.)   (m)     (m)      (m)       (m)       (m)        (m)       (m)
(m)
----          ----      ----      ------  -----  ------    ------    ------   -------    -------    -----
-----

---------------
Subgroup (6c)
---------------

    COMPLEX TERRAIN RECEPTOR INFORMATION

                      XRCT         YRCT        ZRCT          XHH
                      (km)         (km)         (m)
                     ------        -----      ------         ----


-------------------
1
     Description of Complex Terrain Variables:
          XC, YC  = Coordinates of center of hill
          THETAH  = Orientation of major axis of hill (clockwise from
                    North)
          ZGRID   = Height of the  0  of the grid above mean sea
                    level
          RELIEF  = Height of the crest of the hill above the grid elevation
          EXPO 1  = Hill-shape exponent for the major axis
          EXPO 2  = Hill-shape exponent for the major axis
          SCALE 1 = Horizontal length scale along the major axis
          SCALE 2 = Horizontal length scale along the minor axis
```

```
          AMAX    = Maximum allowed axis length for the major axis
          BMAX    = Maximum allowed axis length for the major axis

          XRCT, YRCT = Coordinates of the complex terrain receptors
          ZRCT    = Height of the ground (MSL) at the complex terrain
                    Receptor
          XHH     = Hill number associated with each complex terrain receptor
                    (NOTE: MUST BE ENTERED AS A REAL NUMBER)

   **
     NOTE: DATA for each hill and CTSG receptor are treated as a separate
           input subgroup and therefore must end with an input group terminator.

-------------------------------------------------------------------------------


INPUT GROUP: 7 -- Chemical parameters for dry deposition of gases
--------------

      SPECIES     DIFFUSIVITY      ALPHA STAR      REACTIVITY    MESOPHYLL RESISTANCE     HENRY'S LAW
COEFFICIENT
       NAME        (cm**2/s)                                            (s/cm)
(dimensionless)
      -------     -----------      ----------      ----------    --------------------     -----------------
------

!          PTFV  =     0.1509,         1,            8,                0,                   0.04 !
!          LAWV  =     0.1509,         1,            8,                0,                   0.04 !
!          HLWV  =     0.1509,         1,            8,                0,                   0.04 !
!          EMFV  =     0.1509,         1,            8,                0,                   0.04 !
!          LABV  =     0.1509,         1,            8,                0,                   0.04 !

!END!


-------------------------------------------------------------------------------


INPUT GROUP: 8 -- Size parameters for dry deposition of particles
--------------

     For SINGLE SPECIES, the mean and standard deviation are used to
     compute a deposition velocity for NINT (see group 9) size-ranges,
     and these are then averaged to obtain a mean deposition velocity.

     For GROUPED SPECIES, the size distribution should be explicitly
     specified (by the 'species' in the group), and the standard deviation
     for each should be entered as 0.  The model will then use the
     deposition velocity for the stated mean diameter.

      SPECIES      GEOMETRIC MASS MEAN        GEOMETRIC STANDARD
       NAME             DIAMETER                  DEVIATION
                        (microns)                 (microns)
      -------      -------------------        ------------------
!          PTFP1  =          1,                       0 !
!          LAWP1  =          1,                       0 !
!          HLWP1  =          1,                       0 !
!          EMFP1  =          1,                       0 !
!          LABP1  =          1,                       0 !
!          PTFP25  =          2.5,                       0 !
!          LAWP25  =          2.5,                       0 !
!          HLWP25  =          2.5,                       0 !
!          EMFP25  =          2.5,                       0 !
!          LABP25  =          2.5,                       0 !

!END!


-------------------------------------------------------------------------------


INPUT GROUP: 9 -- Miscellaneous dry deposition parameters
--------------

     Reference cuticle resistance (s/cm)
     (RCUTR)                          Default: 30    !  RCUTR = 30.0 !
     Reference ground resistance  (s/cm)
     (RGR)                            Default: 10    !    RGR = 10.0 !
```

```
     Reference pollutant reactivity
     (REACTR)                          Default: 8     ! REACTR = 8.0 !

     Number of particle-size intervals used to
     evaluate effective particle deposition velocity
     (NINT)                            Default: 9     !   NINT =  9  !

     Vegetation state in unirrigated areas
     (IVEG)                            Default: 1     !   IVEG =  1   !
        IVEG=1 for active and unstressed vegetation
        IVEG=2 for active and stressed vegetation
        IVEG=3 for inactive vegetation

!END!


-------------------------------------------------------------------------------


INPUT GROUP: 10 -- Wet Deposition Parameters
---------------


                      Scavenging Coefficient -- Units: (sec)**(-1)

       Pollutant      Liquid Precip.       Frozen Precip.
       ---------      --------------       --------------
!          PTFV  =         0.00017,              0.00006 !
!          LAWV  =         0.00017,              0.00006 !
!          HLWV  =         0.00017,              0.00006 !
!          EMFV  =         0.00017,              0.00006 !
!          LABV  =         0.00017,              0.00006 !
!          PTFP1  =         0.00005,              0.000017 !
!          LAWP1  =         0.00005,              0.000017 !
!          HLWP1  =         0.00005,              0.000017 !
!          EMFP1  =         0.00005,              0.000017 !
!          LABP1  =         0.00005,              0.000017 !
!          PTFP25  =         0.00005,              0.000017 !
!          LAWP25  =         0.00005,              0.000017 !
!          HLWP25  =         0.00005,              0.000017 !
!          EMFP25  =         0.00005,              0.000017 !
!          LABP25  =         0.00005,              0.000017 !

!END!


-------------------------------------------------------------------------------


INPUT GROUP: 11 -- Chemistry Parameters
---------------

     Ozone data input option (MOZ)     Default: 1            ! MOZ =     0    !
     (Used only if MCHEM = 1, 3, 4, 6, or 7)
        0 = use a monthly background ozone value
        1 = read hourly ozone concentrations from
            the OZONE.DAT data file

     Monthly ozone concentrations (BCKO3)
     (Used only if MCHEM = 1, 3, or 4 and
      MOZ = 0 or MOZ = 1 and all hourly O3 data missing)
     (BCKO3) in ppb                    Default: 12*80.
     *  BCKO3 = 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00 *

     Monthly ammonia concentrations
     (Used only if MCHEM = 1, or 3)
     (BCKNH3) in ppb                   Default: 12*10.
     *  BCKNH3 = 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00 *

     Nighttime SO2 loss rate (RNITE1)
     in percent/hour                   Default: 0.2          ! RNITE1 = 0.2 !

     Nighttime NOx loss rate (RNITE2)
     in percent/hour                   Default: 2.0          ! RNITE2 = 2.0 !

     Nighttime HNO3 formation rate (RNITE3)
     in percent/hour                   Default: 2.0          ! RNITE3 = 2.0 !
```

```
     H2O2 data input option (MH2O2)    Default: 1            ! MH2O2 =  1   !
     (Used only if MAQCHEM = 1)
        0 = use a monthly background H2O2 value
        1 = read hourly H2O2 concentrations from
            the H2O2.DAT data file

     Monthly H2O2 concentrations
     (Used only if MQACHEM = 1 and
      MH2O2 = 0 or MH2O2 = 1 and all hourly H2O2 data missing)
     (BCKH2O2) in ppb                  Default: 12*1.
     !  BCKH2O2 = 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00 !


 --- Data for SECONDARY ORGANIC AEROSOL (SOA) Option
     (used only if MCHEM = 4)

     The SOA module uses monthly values of:
          Fine particulate concentration in ug/m^3 (BCKPMF)
          Organic fraction of fine particulate     (OFRAC)
          VOC / NOX ratio (after reaction)         (VCNX)
     to characterize the air mass when computing
     the formation of SOA from VOC emissions.
     Typical values for several distinct air mass types are:

        Month    1    2    3    4    5    6    7    8    9   10   11   12
                Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sep  Oct  Nov  Dec

     Clean Continental
        BCKPMF   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.
        OFRAC  .15  .15  .20  .20  .20  .20  .20  .20  .20  .20  .20  .15
        VCNX    50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.

     Clean Marine (surface)
        BCKPMF  .5   .5   .5   .5   .5   .5   .5   .5   .5   .5   .5   .5
        OFRAC  .25  .25  .30  .30  .30  .30  .30  .30  .30  .30  .30  .25
        VCNX    50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.

     Urban - low biogenic (controls present)
        BCKPMF  30.  30.  30.  30.  30.  30.  30.  30.  30.  30.  30.  30.
        OFRAC  .20  .20  .25  .25  .25  .25  .25  .25  .20  .20  .20  .20
        VCNX     4.   4.   4.   4.   4.   4.   4.   4.   4.   4.   4.   4.

     Urban - high biogenic (controls present)
        BCKPMF  60.  60.  60.  60.  60.  60.  60.  60.  60.  60.  60.  60.
        OFRAC  .25  .25  .30  .30  .30  .55  .55  .55  .35  .35  .35  .25
        VCNX    15.  15.  15.  15.  15.  15.  15.  15.  15.  15.  15.  15.

     Regional Plume
        BCKPMF  20.  20.  20.  20.  20.  20.  20.  20.  20.  20.  20.  20.
        OFRAC  .20  .20  .25  .35  .25  .40  .40  .40  .30  .30  .30  .20
        VCNX    15.  15.  15.  15.  15.  15.  15.  15.  15.  15.  15.  15.

     Urban - no controls present
        BCKPMF 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
        OFRAC  .30  .30  .35  .35  .35  .55  .55  .55  .35  .35  .35  .30
        VCNX     2.   2.   2.   2.   2.   2.   2.   2.   2.   2.   2.   2.

     Default: Clean Continental
 !  BCKPMF = 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00 !
 !  OFRAC = 0.15, 0.15, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.15 !
 !  VCNX = 50.0, 50.0, 50.0, 50.0, 50.0, 50.0, 50.0, 50.0, 50.0, 50.0, 50.0, 50.0 !

!END!

-------------------------------------------------------------------------------


INPUT GROUP: 12 -- Misc. Dispersion and Computational Parameters
---------------

     Horizontal size of puff (m) beyond which
     time-dependent dispersion equations (Heffter)
     are used to determine sigma-y and
     sigma-z (SYTDEP)                          Default: 550.   ! SYTDEP = 5.5E02 !

     Switch for using Heffter equation for sigma z
     as above (0 = Not use Heffter; 1 = use Heffter
     (MHFTSZ)                                  Default: 0      ! MHFTSZ =  0   !
```

```
Stability class used to determine plume
growth rates for puffs above the boundary
layer (JSUP)                              Default: 5      ! JSUP =  5   !

Vertical dispersion constant for stable
conditions (k1 in Eqn. 2.7-3)  (CONK1)    Default: 0.01   ! CONK1 = 0.01 !

Vertical dispersion constant for neutral/
unstable conditions (k2 in Eqn. 2.7-4)
(CONK2)                                   Default: 0.1    ! CONK2 = 0.1 !

Factor for determining Transition-point from
Schulman-Scire to Huber-Snyder Building Downwash
scheme (SS used for Hs < Hb + TBD * HL)
(TBD)                                     Default: 0.5    ! TBD = 0.5 !
   TBD < 0   ==> always use Huber-Snyder
   TBD = 1.5 ==> always use Schulman-Scire
   TBD = 0.5 ==> ISC Transition-point

Range of land use categories for which
urban dispersion is assumed
(IURB1, IURB2)                            Default: 10     ! IURB1 =  10  !
                                                   19     ! IURB2 =  19  !

Site characterization parameters for single-point Met data files ---------
(needed for METFM = 2,3,4,5)

   Land use category for modeling domain
   (ILANDUIN)                             Default: 20     ! ILANDUIN =  20  !

   Roughness length (m) for modeling domain
   (Z0IN)                                 Default: 0.25   ! Z0IN = 0.25 !

   Leaf area index for modeling domain
   (XLAIIN)                               Default: 3.0    ! XLAIIN = 3.0 !

   Elevation above sea level (m)
   (ELEVIN)                               Default: 0.0    ! ELEVIN = 0.0 !

   Latitude (degrees) for met location
   (XLATIN)                               Default: -999.  ! XLATIN = -999. !

   Longitude (degrees) for met location
   (XLONIN)                               Default: -999.  ! XLONIN = -999. !

Specialized information for interpreting single-point Met data files -----

   Anemometer height (m) (Used only if METFM = 2,3)
   (ANEMHT)                               Default: 10.    ! ANEMHT = 10. !

   Form of lateral turbulance data in PROFILE.DAT file
   (Used only if METFM = 4,5 or MTURBVW = 1 or 3)
   (ISIGMAV)                              Default: 1      ! ISIGMAV =  1  !
       0 = read sigma-theta
       1 = read sigma-v

   Choice of mixing heights (Used only if METFM = 4)
   (IMIXCTDM)                             Default: 0      ! IMIXCTDM =  0  !
       0 = read PREDICTED mixing heights
       1 = read OBSERVED mixing heights

Maximum length of a slug (met. grid units)
(XMXLEN)                                  Default: 1.0    ! XMXLEN = 1. !

Maximum travel distance of a puff/slug (in
grid units) during one sampling step
(XSAMLEN)                                 Default: 1.0    ! XSAMLEN = 1. !

Maximum Number of slugs/puffs release from
one source during one time step
(MXNEW)                                   Default: 99     ! MXNEW =  99   !

Maximum Number of sampling steps for
one puff/slug during one time step
(MXSAM)                                   Default: 99     ! MXSAM =  99   !

Number of iterations used when computing
```

```
the transport wind for a sampling step
that includes gradual rise (for CALMET
and PROFILE winds)
(NCOUNT)                                  Default: 2      ! NCOUNT =  2   !

Minimum sigma y for a new puff/slug (m)
(SYMIN)                                   Default: 1.0    ! SYMIN = 1.  !

Minimum sigma z for a new puff/slug (m)
(SZMIN)                                   Default: 1.0    ! SZMIN = 1.  !

Default minimum turbulence velocities sigma-v and sigma-w
for each stability class over land and over water (m/s)
(SVMIN(12) and SWMIN(12))

                ----------  LAND  ----------       ---------  WATER  ----------
   Stab Class :  A    B    C    D    E    F         A    B    C    D    E    F
                ---  ---  ---  ---  ---  ---       ---  ---  ---  ---  ---  ---
Default SVMIN : .50, .50, .50, .50, .50, .50,      .37, .37, .37, .37, .37, .37
Default SWMIN : .20, .12, .08, .06, .03, .016,     .20, .12, .08, .06, .03, .016

      ! SVMIN = 0.500, 0.500, 0.500, 0.500, 0.500, 0.500, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5 !
      ! SWMIN = 0.200, 0.120, 0.080, 0.060, 0.030, 0.016, 0.200, 0.120, 0.080, 0.060, 0.030, 0.016 !

Divergence criterion for dw/dz across puff
used to initiate adjustment for horizontal
convergence (1/s)
Partial adjustment starts at CDIV(1), and
full adjustment is reached at CDIV(2)
(CDIV(2))                                 Default: 0.0,0.0  ! CDIV = 0., 0. !

Minimum wind speed (m/s) allowed for
non-calm conditions. Also used as minimum
speed returned when using power-law
extrapolation toward surface
(WSCALM)                                  Default: 0.5    ! WSCALM = 0.5 !

Maximum mixing height (m)
(XMAXZI)                                  Default: 3000.  ! XMAXZI = 3000. !

Minimum mixing height (m)
(XMINZI)                                  Default: 50.    ! XMINZI = 50.0 !

Default wind speed classes --
5 upper bounds (m/s) are entered;
the 6th class has no upper limit
(WSCAT(5))                      Default   :
                                ISC RURAL : 1.54, 3.09, 5.14, 8.23, 10.8 (10.8+)

                           Wind Speed Class :  1     2     3     4     5
                                               ---   ---   ---   ---   ---
!  WSCAT = 1.54, 3.09, 5.14, 8.23, 10.80 !

Default wind speed profile power-law
exponents for stabilities 1-6
(PLX0(6))                       Default   : ISC RURAL values
                                ISC RURAL : .07, .07, .10, .15, .35, .55
                                ISC URBAN : .15, .15, .20, .25, .30, .30

                            Stability Class :  A     B     C     D     E     F
                                               ---   ---   ---   ---   ---   ---
!  PLX0 = 0.07, 0.07, 0.10, 0.15, 0.35, 0.55 !

Default potential temperature gradient
for stable classes E, F (degK/m)
(PTG0(2))                       Default: 0.020, 0.035
                                   ! PTG0 = 0.020, 0.035 !

Default plume path coefficients for
each stability class (used when option
for partial plume height terrain adjustment
is selected -- MCTADJ=3)
(PPC(6))                    Stability Class :  A     B     C     D     E     F
                               Default  PPC : .50,  .50,  .50,  .50,  .35,  .35
                                               ---   ---   ---   ---   ---   ---
!  PPC = 0.50, 0.50, 0.50, 0.50, 0.35, 0.35 !

Slug-to-puff transition criterion factor
```

```
    equal to sigma-y/length of slug
    (SL2PF)                              Default: 10.        ! SL2PF = 10.0 !

    Puff-splitting control variables ------------------------

      VERTICAL SPLIT
      --------------

      Number of puffs that result every time a puff
      is split - nsplit=2 means that 1 puff splits
      into 2
      (NSPLIT)                           Default:   3        ! NSPLIT =  3  !

      Time(s) of a day when split puffs are eligible to
      be split once again; this is typically set once
      per day, around sunset before nocturnal shear develops.
      24 values: 0 is midnight (00:00) and 23 is 11 PM (23:00)
      0=do not re-split    1=eligible for re-split
      (IRESPLIT(24))                     Default:  Hour 17 = 1
!  IRESPLIT = 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0 !

      Split is allowed only if last hour's mixing
      height (m) exceeds a minimum value
      (ZISPLIT)                          Default: 100.       ! ZISPLIT = 100.0 !

      Split is allowed only if ratio of last hour's
      mixing ht to the maximum mixing ht experienced
      by the puff is less than a maximum value (this
      postpones a split until a nocturnal layer develops)
      (ROLDMAX)                          Default: 0.25       ! ROLDMAX = 0.25 !


      HORIZONTAL SPLIT
      ----------------

      Number of puffs that result every time a puff
      is split - nsplith=5 means that 1 puff splits
      into 5
      (NSPLITH)                          Default:   5        ! NSPLITH =  5  !

      Minimum sigma-y (Grid Cells Units) of puff
      before it may be split
      (SYSPLITH)                         Default:  1.0       ! SYSPLITH = 1.0 !

      Minimum puff elongation rate (SYSPLITH/hr) due to
      wind shear, before it may be split
      (SHSPLITH)                         Default:  2.        ! SHSPLITH = 2.0 !

      Minimum concentration (g/m^3) of each
      species in puff before it may be split
      Enter array of NSPEC values; if a single value is
      entered, it will be used for ALL species
      (CNSPLITH)                         Default:  1.0E-07   ! CNSPLITH = 1.0E-07 !

    Integration control variables ------------------------

      Fractional convergence criterion for numerical SLUG
      sampling integration
      (EPSSLUG)                          Default:   1.0e-04  ! EPSSLUG = 1.0E-04 !

      Fractional convergence criterion for numerical AREA
      source integration
      (EPSAREA)                          Default:   1.0e-06  ! EPSAREA = 1.0E-06 !

      Trajectory step-length (m) used for numerical rise
      integration
      (DSRISE)                           Default:   1.0      ! DSRISE = 1.0 !

      Boundary Condition (BC) Puff control variables ------------------------

      Minimum height (m) to which BC puffs are mixed as they are emitted
      (MBCON=2 ONLY).  Actual height is reset to the current mixing height
      at the release point if greater than this minimum.
      (HTMINBC)                          Default:   500.     ! HTMINBC = 500.0 !

      Search radius (km) about a receptor for sampling nearest BC puff.
      BC puffs are typically emitted with a spacing of one grid cell
      length, so the search radius should be greater than DGRIDKM.
```

```
       (RSAMPBC)                           Default:   10.      ! RSAMPBC = 10.0 !
       Near-Surface depletion adjustment to concentration profile used when
       sampling BC puffs?
       (MDEPBC)                            Default:   1        ! MDEPBC =  1  !
          0 = Concentration is NOT adjusted for depletion
          1 = Adjust Concentration for depletion

!END!


-------------------------------------------------------------------------------


INPUT GROUPS: 13a, 13b, 13c, 13d -- Point source parameters
-------------------------------

---------------
Subgroup (13a)
---------------

     Number of point sources with
     parameters provided below      (NPT1)  No default  !  NPT1 =  5  !

     Units used for point source
     emissions below                (IPTU)  Default: 1  !  IPTU =   1  !
           1 =        g/s
           2 =       kg/hr
           3 =       lb/hr
           4 =     tons/yr
           5 =     Odour Unit * m**3/s  (vol. flux of odour compound)
           6 =     Odour Unit * m**3/min
           7 =     metric tons/yr

     Number of source-species
     combinations with variable
     emissions scaling factors
     provided below in (13d)        (NSPT1) Default: 0  !  NSPT1 =  0  !

     Number of point sources with
     variable emission parameters
     provided in external file      (NPT2)  No default  !  NPT2 =  0  !

     (If NPT2 > 0, these point
     source emissions are read from
     the file: PTEMARB.DAT)

!END!

---------------
Subgroup (13b)
---------------
                                     a
          POINT SOURCE: CONSTANT DATA
          ----------------------------
                                                                          b          c
  Source       X         Y       Stack    Base     Stack    Exit  Exit    Bldg.  Emission
   No.     Coordinate Coordinate Height Elevation Diameter  Vel.  Temp.   Dwash   Rates
              (km)      (km)       (m)      (m)       (m)  (m/s) (deg. K)
  ------   ---------- ---------- ------  ------   -------- ----- -------- ----- --------
 1 ! SRCNAM = PTF !
   1 ! X =    307.9682,   5158.3613,    60.96, 206.6544,       2.8448,   21.6408,  308.16,   1.,
     1,   0,   0,   0,   0,   1,   0,   0,   0,   0,   1,   0,   0,   0,   0!
 1 ! SIGYZI =   0, 0 !
 1 ! ZPLTFM =   .0 !
 1 ! FMFAC =   1 !   !END!
 2 ! SRCNAM = LAW !
   2 ! X =    308.0493,   5158.2515,    60.5028, 207.5688,       2.0066,   19.5072,  332.6044,   1.,
     0,   1,   0,   0,   0,   0,   1,   0,   0,   0,   0,   1,   0,   0,   0!
 2 ! SIGYZI =   0, 0 !
 2 ! ZPLTFM =   .0 !
 2 ! FMFAC =   1 !   !END!
 3 ! SRCNAM = HLW !
   3 ! X =    307.8631,   5158.2171,    60.96, 207.8736,       2.032,   20.7264,  314.8267,   1.,
     0,   0,   1,   0,   0,   0,   0,   1,   0,   0,   0,   0,   1,   0,   0!
 3 ! SIGYZI =   0, 0 !
 3 ! ZPLTFM =   .0 !
 3 ! FMFAC =   1 !   !END!
 4 ! SRCNAM = EMF !
```

```
  4 ! X =    308.1654,   5158.5001,    45.72, 204.5,       0.9652,   20.1168,  308.16,   1.,
    0,   0,   0,   1,   0,   0,   0,   0,   1,   0,   0,   0,   0,   1,   0!
 4 ! SIGYZI =   0, 0 !
 4 ! ZPLTFM =   .0 !
 4 ! FMFAC =   1 !   !END!
 5 ! SRCNAM = LAB !
  5 ! X =    308.0961,   5158.4397,    35.9664, 206.35,       2.0828,   18.8976,  305.9378,   1.,
    0,   0,   0,   0,   1,   0,   0,   0,   0,   1,   0,   0,   0,   0,   1!
 5 ! SIGYZI =   0, 0 !
 5 ! ZPLTFM =   .0 !
 5 ! FMFAC =   1 !   !END!

--------

    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.

     SRCNAM  is a 12-character name for a source
             (No default)
     X       is an array holding the source data listed by the column headings
             (No default)
     SIGYZI  is an array holding the initial sigma-y and sigma-z (m)
             (Default: 0.,0.)
     FMFAC   is a vertical momentum flux factor (0. or 1.0) used to represent
             the effect of rain-caps or other physical configurations that
             reduce momentum rise associated with the actual exit velocity.
             (Default: 1.0  -- full momentum used)
     ZPLTFM  is the platform height (m) for sources influenced by an isolated
             structure that has a significant open area between the surface
             and the bulk of the structure, such as an offshore oil platform.
             The Base Elevation is that of the surface (ground or ocean),
             and the Stack Height is the release height above the Base (not
             above the platform).  Building heights entered in Subgroup 13c
             must be those of the buildings on the platform, measured from
             the platform deck.  ZPLTFM is used only with MBDW=1 (ISC
             downwash method) for sources with building downwash.
             (Default: 0.0)

    b
     0. = No building downwash modeled
     1. = Downwash modeled for buildings resting on the surface
     2. = Downwash modeled for buildings raised above the surface (ZPLTFM > 0.)
     NOTE: must be entered as a REAL number (i.e., with decimal point)

    c
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by IPTU
     (e.g. 1 for g/s).

---------------
Subgroup (13c)
---------------

           BUILDING DIMENSION DATA FOR SOURCES SUBJECT TO DOWNWASH
           -------------------------------------------------------
Source                                                                    a
 No.       Effective building height, width, length and X/Y offset (in meters)
           every 10 degrees.  LENGTH, XBADJ, and YBADJ are only needed for
           MBDW=2 (PRIME downwash option)
------     ---------------------------------------------------------------------
 1 ! SRCNAM = PTF !
 1 ! HEIGHT = 36.27,   36.27,   36.27,   36.27,   36.27,   36.27,
              36.27,   36.27,   36.27,   36.27,   36.27,   36.27,
              36.27,   36.27,   36.27,   36.27,   36.27,   36.27,
              36.27,   36.27,   36.27,   36.27,   36.27,   36.27,
              36.27,   36.27,   36.27,   36.27,   36.27,   36.27,
              36.27,   36.27,   36.27,   36.27,   36.27,   36.27 !
 1 ! WIDTH = 183.67,   188.02,   186.66,   179.64,   167.15,   149.58,
             127.47,   101.49,   76.08,   99.63,   125.64,   147.83,
             165.53,   178.2,   185.46,   187.08,   183.01,   173.73,
             183.67,   188.02,   186.66,   179.64,   167.15,   149.58,
             127.47,   101.49,   76.08,   99.63,   125.64,   147.83,
             165.53,   178.2,   185.46,   187.08,   183.01,   173.73 !
    !END!
 2 ! SRCNAM = LAW !
 2 ! HEIGHT = 20.73,   20.73,   20.73,   20.73,   20.73,   25.3,
```

```
              25.3,   25.3,   25.3,   25.3,   25.3,   36.27,
              36.27,   36.27,   36.27,   36.27,   36.27,   20.73,
              20.73,   20.73,   20.73,   20.73,   20.73,   20.73,
              20.73,   20.73,   20.73,   20.73,   20.73,   20.73,
              20.73,   20.73,   20.73,   20.73,   20.73,   20.73 !
 2 ! WIDTH = 101.03,   105.11,   105.99,   103.66,   98.17,   115.91,
             106.23,   94.78,   84.57,   94.5,   105.54,   147.83,
             165.53,   178.2,   185.46,   187.08,   183.01,   93.88,
             101.03,   105.11,   105.99,   103.66,   98.17,   89.7,
             78.51,   64.93,   49.38,   64.93,   78.51,   89.7,
             98.17,   103.66,   105.99,   105.11,   101.03,   93.88 !
    !END!
 3 ! SRCNAM = HLW !
 3 ! HEIGHT = 25.3,   25.3,   25.3,   25.3,   36.27,   25.3,
              25.3,   25.3,   25.3,   25.3,   25.3,   25.3,
              25.3,   25.3,   25.3,   36.27,   36.27,   36.27,
              36.27,   36.27,   36.27,   36.27,   36.27,   25.3,
              25.3,   25.3,   25.3,   25.3,   25.3,   25.3,
              25.3,   25.3,   25.3,   25.3,   25.3,   25.3 !
 3 ! WIDTH = 119.04,   123.99,   125.16,   124.53,   167.15,   115.91,
             106.23,   94.78,   84.57,   94.5,   105.54,   115.28,
             121.52,   124.47,   124.19,   187.08,   183.01,   173.73,
             183.67,   188.02,   186.66,   179.64,   167.15,   115.91,
             106.23,   94.78,   84.57,   94.5,   105.54,   115.28,
             121.52,   124.47,   124.19,   122.52,   118.3,   110.48 !
    !END!
 4 ! SRCNAM = EMF !
 4 ! HEIGHT = 4.27,   4.27,   4.27,   4.27,   36.27,   36.27,
              36.27,   4.27,   4.27,   18.29,   18.29,   18.29,
              18.29,   11.28,   11.28,   11.28,   0,   0,
              4.27,   4.27,   4.27,   4.27,   4.27,   4.27,
              4.27,   4.27,   4.27,   4.27,   4.27,   4.27,
              4.27,   4.27,   4.27,   0,   0,   0 !
 4 ! WIDTH = 38.56,   40.76,   41.73,   41.43,   167.15,   149.58,
             127.47,   28.3,   22.53,   22.66,   24.82,   26.22,
             26.83,   58.59,   58.5,   56.64,   0,   0,
             38.56,   40.76,   41.73,   41.43,   39.87,   37.1,
             33.2,   28.3,   22.53,   28.3,   33.2,   37.1,
             39.87,   41.43,   41.73,   0,   0,   0 !
    !END!
 5 ! SRCNAM = LAB !
 5 ! HEIGHT = 12.19,   12.19,   12.19,   36.27,   36.27,   36.27,
              36.27,   36.27,   36.27,   12.19,   12.19,   12.19,
              12.19,   12.19,   12.19,   12.19,   12.19,   18.29,
              18.29,   12.19,   12.19,   36.27,   12.19,   12.19,
              12.19,   12.19,   12.19,   12.19,   12.19,   12.19,
              12.19,   12.19,   12.19,   12.19,   12.19,   12.19 !
 5 ! WIDTH = 74.37,   86.73,   96.47,   179.64,   167.15,   149.58,
             127.47,   101.49,   76.08,   102.15,   104.35,   103.38,
             99.27,   92.14,   82.21,   73.55,   67.67,   18.13,
             21.29,   86.73,   96.47,   179.64,   106.93,   107.34,
             104.5,   98.55,   96.85,   102.15,   104.35,   103.38,
             99.27,   92.14,   82.21,   73.55,   67.67,   59.74 !
    !END!
```

---

[a] Building height, width, length, and X/Y offset from the source are treated as a separate input subgroup for each source and therefore must end with an input group terminator. The X/Y offset is the position, relative to the stack, of the center of the upwind face of the projected building, with the x-axis pointing along the flow direction.

Subgroup (13d)

POINT SOURCE: VARIABLE EMISSIONS DATA [a]

Use this subgroup to describe temporal variations in the emission rates given in 13b. Factors entered multiply the rates in 13b. Skip sources here that have constant emissions. For more elaborate variation in source parameters, use PTEMARB.DAT and NPT2 > 0.

IVARY determines the type of variation, and is source-specific:
(IVARY) Default: 0

```
          0 =       Constant
          1 =       Diurnal cycle (24 scaling factors: hours 1-24)
          2 =       Monthly cycle (12 scaling factors: months 1-12)
          3 =       Hour & Season (4 groups of 24 hourly scaling factors,
                                   where first group is DEC-JAN-FEB)
          4 =       Speed & Stab. (6 groups of 6 scaling factors, where
                                   first group is Stability Class A,
                                   and the speed classes have upper
                                   bounds (m/s) defined in Group 12
          5 =       Temperature   (12 scaling factors, where temperature
                                   classes have upper bounds (C) of:
                                   0, 5, 10, 15, 20, 25, 30, 35, 40,
                                   45, 50, 50+)


--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.


-------------------------------------------------------------------------------


INPUT GROUPS: 14a, 14b, 14c, 14d -- Area source parameters
--------------------------------

---------------
Subgroup (14a)
---------------

     Number of polygon area sources with
     parameters specified below (NAR1)       No default  !  NAR1 =  0   !

     Units used for area source
     emissions below           (IARU)       Default: 1  !  IARU =   1  !
          1 =        g/m**2/s
          2 =       kg/m**2/hr
          3 =       lb/m**2/hr
          4 =     tons/m**2/yr
          5 =     Odour Unit * m/s  (vol. flux/m**2 of odour compound)
          6 =     Odour Unit * m/min
          7 =     metric tons/m**2/yr

     Number of source-species
     combinations with variable
     emissions scaling factors
     provided below in (14d)        (NSAR1) Default: 0  !  NSAR1 =  0  !

     Number of buoyant polygon area sources
     with variable location and emission
     parameters (NAR2)                      No default  !  NAR2 =  0   !
     (If NAR2 > 0, ALL parameter data for
     these sources are read from the file: BAEMARB.DAT)

!END!

---------------
Subgroup (14b)
---------------
                                   a
          AREA SOURCE: CONSTANT DATA
          ----------------------------
                                                          b
Source           Effect.    Base      Initial    Emission
 No.             Height   Elevation   Sigma z     Rates
                   (m)       (m)        (m)
-------          ------    ------     --------   ---------


--------
    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.
    b
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
```

```
     modeled, but not emitted.  Units are specified by IARU
     (e.g. 1 for g/m**2/s).

---------------
Subgroup (14c)
---------------

           COORDINATES (km) FOR EACH VERTEX(4) OF EACH POLYGON
           ---------------------------------------------------------
Source                                                          a
 No.       Ordered list of X followed by list of Y, grouped by source
------     ------------------------------------------------------------


--------
    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.


---------------
Subgroup (14d)
---------------
                                                a
          AREA SOURCE: VARIABLE EMISSIONS DATA
          ------------------------------------

     Use this subgroup to describe temporal variations in the emission
     rates given in 14b.  Factors entered multiply the rates in 14b.
     Skip sources here that have constant emissions.  For more elaborate
     variation in source parameters, use BAEMARB.DAT and NAR2 > 0.

     IVARY determines the type of variation, and is source-specific:
     (IVARY)                              Default: 0
           0 =       Constant
           1 =       Diurnal cycle (24 scaling factors: hours 1-24)
           2 =       Monthly cycle (12 scaling factors: months 1-12)
           3 =       Hour & Season (4 groups of 24 hourly scaling factors,
                                    where first group is DEC-JAN-FEB)
           4 =       Speed & Stab. (6 groups of 6 scaling factors, where
                                    first group is Stability Class A,
                                    and the speed classes have upper
                                    bounds (m/s) defined in Group 12
           5 =       Temperature   (12 scaling factors, where temperature
                                    classes have upper bounds (C) of:
                                    0, 5, 10, 15, 20, 25, 30, 35, 40,
                                    45, 50, 50+)



--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.


-------------------------------------------------------------------------------

INPUT GROUPS: 15a, 15b, 15c -- Line source parameters
---------------------------

---------------
Subgroup (15a)
---------------

     Number of buoyant line sources
     with variable location and emission
     parameters (NLN2)                              No default  !  NLN2 =  0   !

     (If NLN2 > 0, ALL parameter data for
      these sources are read from the file: LNEMARB.DAT)

     Number of buoyant line sources (NLINES)        No default   ! NLINES =  0  !

     Units used for line source
     emissions below                (ILNU)          Default: 1  !  ILNU =   1  !
           1 =        g/s
           2 =       kg/hr
```

```
          3 =       lb/hr
          4 =     tons/yr
          5 =     Odour Unit * m**3/s  (vol. flux of odour compound)
          6 =     Odour Unit * m**3/min
          7 =     metric tons/yr

     Number of source-species
     combinations with variable
     emissions scaling factors
     provided below in (15c)        (NSLN1) Default: 0  !  NSLN1 =  0  !

     Maximum number of segments used to model
     each line (MXNSEG)                             Default: 7   ! MXNSEG =  7  !

     The following variables are required only if NLINES > 0.  They are
     used in the buoyant line source plume rise calculations.

        Number of distances at which                Default: 6   ! NLRISE =  6  !
        transitional rise is computed

        Average building length (XL)                No default   ! XL = 0. !
                                                    (in meters)

        Average building height (HBL)               No default   ! HBL = 0. !
                                                    (in meters)

        Average building width (WBL)                No default   ! WBL = 0. !
                                                    (in meters)

        Average line source width (WML)             No default   ! WML = 0. !
                                                    (in meters)

        Average separation between buildings (DXL)  No default   ! DXL = 0. !
                                                    (in meters)

        Average buoyancy parameter (FPRIMEL)        No default   ! FPRIMEL = 0. !
                                                    (in m**4/s**3)

!END!

---------------
Subgroup (15b)
---------------

          BUOYANT LINE SOURCE: CONSTANT DATA
          ----------------------------------
                                                                                a
Source     Beg. X      Beg. Y      End. X    End. Y     Release    Base        Emission
 No.     Coordinate  Coordinate  Coordinate Coordinate  Height    Elevation      Rates
            (km)        (km)        (km)       (km)       (m)       (m)
------   ----------  ----------  ---------  ----------  -------   ---------    ---------

--------

    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.

    b
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by ILNTU
     (e.g. 1 for g/s).

---------------
Subgroup (15c)
---------------
                                                   a
          BUOYANT LINE SOURCE: VARIABLE EMISSIONS DATA
          --------------------------------------------

     Use this subgroup to describe temporal variations in the emission
     rates given in 15b.  Factors entered multiply the rates in 15b.
     Skip sources here that have constant emissions.

     IVARY determines the type of variation, and is source-specific:
     (IVARY)                                Default: 0
          0 =       Constant
```

```
          1 =       Diurnal cycle (24 scaling factors: hours 1-24)
          2 =       Monthly cycle (12 scaling factors: months 1-12)
          3 =       Hour & Season (4 groups of 24 hourly scaling factors,
                                   where first group is DEC-JAN-FEB)
          4 =       Speed & Stab. (6 groups of 6 scaling factors, where
                                   first group is Stability Class A,
                                   and the speed classes have upper
                                   bounds (m/s) defined in Group 12
          5 =       Temperature   (12 scaling factors, where temperature
                                   classes have upper bounds (C) of:
                                   0, 5, 10, 15, 20, 25, 30, 35, 40,
                                   45, 50, 50+)


--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.


-------------------------------------------------------------------------------


INPUT GROUPS: 16a, 16b, 16c -- Volume source parameters
---------------------------

---------------
Subgroup (16a)
---------------

     Number of volume sources with
     parameters provided in 16b,c (NVL1)     No default  !  NVL1 =  0   !

     Units used for volume source
     emissions below in 16b       (IVLU)     Default: 1  !  IVLU =   1  !
          1 =        g/s
          2 =       kg/hr
          3 =       lb/hr
          4 =     tons/yr
          5 =     Odour Unit * m**3/s  (vol. flux of odour compound)
          6 =     Odour Unit * m**3/min
          7 =     metric tons/yr

     Number of source-species
     combinations with variable
     emissions scaling factors
     provided below in (16c)      (NSVL1)    Default: 0  !  NSVL1 =  0  !

     Number of volume sources with
     variable location and emission
     parameters                   (NVL2)     No default  !  NVL2 =   0   !

     (If NVL2 > 0, ALL parameter data for
      these sources are read from the VOLEMARB.DAT file(s) )

!END!

---------------
Subgroup (16b)
---------------
                                        a
          VOLUME SOURCE: CONSTANT DATA
          ----------------------------
                                                                      b
         X           Y        Effect.    Base     Initial    Initial    Emission
     Coordinate  Coordinate   Height   Elevation  Sigma y    Sigma z     Rates
        (km)       (km)        (m)       (m)        (m)        (m)
     ----------  ----------   ------    ------    --------   --------   --------


--------
    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.

    b
     An emission rate must be entered for every pollutant modeled.
```

```
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by IVLU
     (e.g. 1 for g/s).

---------------
Subgroup (16c)
---------------
                                                  a
          VOLUME SOURCE: VARIABLE EMISSIONS DATA
          --------------------------------------

     Use this subgroup to describe temporal variations in the emission
     rates given in 16b.  Factors entered multiply the rates in 16b.
     Skip sources here that have constant emissions.  For more elaborate
     variation in source parameters, use VOLEMARB.DAT and NVL2 > 0.

     IVARY determines the type of variation, and is source-specific:
     (IVARY)                                Default: 0
           0 =       Constant
           1 =       Diurnal cycle (24 scaling factors: hours 1-24)
           2 =       Monthly cycle (12 scaling factors: months 1-12)
           3 =       Hour & Season (4 groups of 24 hourly scaling factors,
                                    where first group is DEC-JAN-FEB)
           4 =       Speed & Stab. (6 groups of 6 scaling factors, where
                                    first group is Stability Class A,
                                    and the speed classes have upper
                                    bounds (m/s) defined in Group 12
           5 =       Temperature   (12 scaling factors, where temperature
                                    classes have upper bounds (C) of:
                                    0, 5, 10, 15, 20, 25, 30, 35, 40,
                                    45, 50, 50+)



--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.


-------------------------------------------------------------------------------

INPUT GROUPS: 17a & 17b -- Non-gridded (discrete) receptor information
-----------------------

---------------
Subgroup (17a)
---------------

     Number of non-gridded receptors (NREC)  No default  !  NREC =  4890   !

!END!

---------------
Subgroup (17b)
---------------
                                                  a
           NON-GRIDDED (DISCRETE) RECEPTOR DATA
           ------------------------------------

                    X            Y          Ground        Height   b
Receptor       Coordinate   Coordinate    Elevation   Above Ground
  No.             (km)         (km)          (m)           (m)
--------       ----------   ----------    ---------   ------------

 1 ! X =       311.5080,     5171.952,     122,       0 ! !END!
 2 ! X =       311.6510,     5171.444,     122,       0 ! !END!
 3 ! X =       312.0310,     5171.095,     119,       0 ! !END!
 4 ! X =       312.4280,     5170.754,     122,       0 ! !END!
 5 ! X =       312.9040,     5170.492,     121,       0 ! !END!
 6 ! X =       313.3650,     5170.206,     118,       0 ! !END!
 7 ! X =       313.7460,     5170,     117,       0 ! !END!
 8 ! X =       314.3960,     5169.825,     116,       0 ! !END!
 9 ! X =       314.7610,     5169.444,     116,       0 ! !END!
 10 ! X =       315.0470,     5169.016,     116,       0 ! !END!
 11 ! X =       315.2380,     5168.476,     116,       0 ! !END!
 12 ! X =       315.3170,     5167.936,     116,       0 ! !END!
 13 ! X =       315.3490,     5167.446,     116,       0 ! !END!
```

```
14 ! X =       315.2530,     5166.956,     116,       0 ! !END!
15 ! X =       315.2590,     5166.456,     116,       0 ! !END!
16 ! X =       315.3170,     5165.967,     116,       0 ! !END!
17 ! X =       315.4440,     5165.501,     116,       0 ! !END!
18 ! X =       315.6340,     5165.204,     116,       0 ! !END!
19 ! X =       316.0070,     5164.809,     116,       0 ! !END!
20 ! X =       316.3960,     5164.38,     116,       0 ! !END!
21 ! X =       316.7770,     5164.025,     116,       0 ! !END!
22 ! X =       317.1110,     5163.571,     116,       0 ! !END!
23 ! X =       317.4920,     5163.179,     117,       0 ! !END!
24 ! X =       317.8410,     5162.794,     116,       0 ! !END!
25 ! X =       318.1420,     5162.389,     115,       0 ! !END!
26 ! X =       318.5390,     5162.054,     115,       0 ! !END!
27 ! X =       318.9360,     5161.428,     113,       0 ! !END!
28 ! X =       319.4100,     5161.021,     112,       0 ! !END!
29 ! X =       319.8040,     5160.682,     112,       0 ! !END!
30 ! X =       320.3330,     5160.269,     112,       0 ! !END!
31 ! X =       320.7730,     5159.971,     112,       0 ! !END!
32 ! X =       321.2490,     5159.714,     113,       0 ! !END!
33 ! X =       321.6660,     5159.333,     112,       0 ! !END!
34 ! X =       322.0030,     5158.897,     112,       0 ! !END!
35 ! X =       322.3800,     5158.54,     114,       0 ! !END!
36 ! X =       322.6670,     5157.904,     112,       0 ! !END!
37 ! X =       322.9040,     5157.58,     112,       0 ! !END!
38 ! X =       323.1420,     5157.118,     113,       0 ! !END!
39 ! X =       323.4790,     5156.657,     113,       0 ! !END!
40 ! X =       323.8530,     5156.281,     112,       0 ! !END!
41 ! X =       324.2850,     5156.031,     113,       0 ! !END!
42 ! X =       324.7610,     5155.714,     113,       0 ! !END!
43 ! X =       325.2380,     5155.38,     112,       0 ! !END!
44 ! X =       325.6190,     5155.031,     113,       0 ! !END!
45 ! X =       325.8730,     5154.603,     112,       0 ! !END!
46 ! X =       326.0310,     5153.968,     112,       0 ! !END!
47 ! X =       326.1900,     5153.444,     112,       0 ! !END!
48 ! X =       326.3800,     5152.857,     112,       0 ! !END!
49 ! X =       326.5870,     5152.317,     113,       0 ! !END!
50 ! X =       326.6270,     5151.872,     113,       0 ! !END!
51 ! X =       326.6670,     5151.428,     113,       0 ! !END!
52 ! X =       326.7460,     5150.952,     113,       0 ! !END!
53 ! X =       326.7420,     5150.452,     112,       0 ! !END!
54 ! X =       326.4760,     5150.031,     112,       0 ! !END!
55 ! X =       326.2690,     5149.571,     112,       0 ! !END!
56 ! X =       326.3650,     5149.175,     112,       0 ! !END!
57 ! X =       326.4600,     5148.714,     112,       0 ! !END!
58 ! X =       326.4760,     5148.206,     112,       0 ! !END!
59 ! X =       326.4040,     5147.714,     112,       0 ! !END!
60 ! X =       326.3730,     5147.254,     112,       0 ! !END!
61 ! X =       326.2380,     5146.73,     112,       0 ! !END!
62 ! X =       326.3170,     5146.238,     112,       0 ! !END!
63 ! X =       326.3490,     5145.714,     111,       0 ! !END!
64 ! X =       326.4280,     5145.286,     112,       0 ! !END!
65 ! X =       326.5230,     5144.762,     110,       0 ! !END!
66 ! X =       326.4760,     5144.27,     109,       0 ! !END!
67 ! X =       326.4120,     5143.746,     109,       0 ! !END!
68 ! X =       326.2060,     5142.81,     109,       0 ! !END!
69 ! X =       326.0790,     5142.286,     109,       0 ! !END!
70 ! X =       325.9680,     5141.825,     109,       0 ! !END!
71 ! X =       325.8730,     5141.333,     109,       0 ! !END!
72 ! X =       325.8410,     5140.825,     109,       0 ! !END!
73 ! X =       325.9040,     5140.333,     109,       0 ! !END!
74 ! X =       325.9360,     5139.794,     111,       0 ! !END!
75 ! X =       325.9200,     5139.325,     111,       0 ! !END!
76 ! X =       325.8880,     5138.841,     111,       0 ! !END!
77 ! X =       325.7780,     5138.333,     109,       0 ! !END!
78 ! X =       325.5390,     5137.905,     109,       0 ! !END!
79 ! X =       325.5560,     5137.365,     109,       0 ! !END!
80 ! X =       325.6980,     5136.873,     109,       0 ! !END!
81 ! X =       325.7780,     5136.349,     109,       0 ! !END!
82 ! X =       325.8730,     5135.857,     109,       0 ! !END!
83 ! X =       326.0000,     5135.397,     109,       0 ! !END!
84 ! X =       312.9350,     5161.13,     174,       0 ! !END!
85 ! X =       311.9580,     5161.674,     173,       0 ! !END!
86 ! X =       312.4580,     5161.652,     177,       0 ! !END!
87 ! X =       312.9570,     5161.63,     183,       0 ! !END!
88 ! X =       309.4820,     5162.285,     166,       0 ! !END!
89 ! X =       309.9820,     5162.262,     172,       0 ! !END!
90 ! X =       310.4810,     5162.24,     175,       0 ! !END!
91 ! X =       310.9810,     5162.218,     177,       0 ! !END!
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92 ! X =       311.4810,     5162.196,     180,       0 ! !END!
93 ! X =       311.9800,     5162.174,     182,       0 ! !END!
94 ! X =       312.4800,     5162.152,     183,       0 ! !END!
95 ! X =       308.0060,     5162.851,     154,       0 ! !END!
96 ! X =       308.5050,     5162.829,     170,       0 ! !END!
97 ! X =       309.0050,     5162.806,     178,       0 ! !END!
98 ! X =       309.5050,     5162.784,     182,       0 ! !END!
99 ! X =       310.0040,     5162.762,     186,       0 ! !END!
100 ! X =       310.5040,     5162.74,     192,       0 ! !END!
101 ! X =       311.0030,     5162.718,     201,       0 ! !END!
102 ! X =       311.5030,     5162.695,     209,       0 ! !END!
103 ! X =       312.0020,     5162.673,     215,       0 ! !END!
104 ! X =       306.0300,     5163.439,     171,       0 ! !END!
105 ! X =       306.5290,     5163.417,     152,       0 ! !END!
106 ! X =       307.0290,     5163.395,     155,       0 ! !END!
107 ! X =       307.5280,     5163.373,     166,       0 ! !END!
108 ! X =       308.0280,     5163.35,     182,       0 ! !END!
109 ! X =       308.5280,     5163.328,     221,       0 ! !END!
110 ! X =       309.0270,     5163.306,     213,       0 ! !END!
111 ! X =       309.5270,     5163.284,     221,       0 ! !END!
112 ! X =       310.0260,     5163.262,     236,       0 ! !END!
113 ! X =       310.5260,     5163.239,     242,       0 ! !END!
114 ! X =       311.0250,     5163.217,     249,       0 ! !END!
115 ! X =       311.5250,     5163.195,     299,       0 ! !END!
116 ! X =       305.0530,     5163.983,     152,       0 ! !END!
117 ! X =       305.5520,     5163.961,     179,       0 ! !END!
118 ! X =       306.0520,     5163.939,     183,       0 ! !END!
119 ! X =       306.5510,     5163.917,     232,       0 ! !END!
120 ! X =       307.0510,     5163.894,     288,       0 ! !END!
121 ! X =       307.5510,     5163.872,     255,       0 ! !END!
122 ! X =       308.0500,     5163.85,     244,       0 ! !END!
123 ! X =       308.5500,     5163.828,     227,       0 ! !END!
124 ! X =       309.0490,     5163.806,     223,       0 ! !END!
125 ! X =       309.5490,     5163.783,     240,       0 ! !END!
126 ! X =       310.0480,     5163.761,     244,       0 ! !END!
127 ! X =       310.5480,     5163.739,     244,       0 ! !END!
128 ! X =       311.0480,     5163.717,     287,       0 ! !END!
129 ! X =       304.5750,     5164.505,     165,       0 ! !END!
130 ! X =       305.0750,     5164.483,     171,       0 ! !END!
131 ! X =       305.5740,     5164.46,     244,       0 ! !END!
132 ! X =       306.0740,     5164.438,     244,       0 ! !END!
133 ! X =       306.5740,     5164.416,     253,       0 ! !END!
134 ! X =       307.0730,     5164.394,     248,       0 ! !END!
135 ! X =       307.5730,     5164.372,     238,       0 ! !END!
136 ! X =       308.0720,     5164.35,     243,       0 ! !END!
137 ! X =       306.9810,     5159.69,     185.77,       0 ! !END!
138 ! X =       306.9780,     5159.63,     184.2,       0 ! !END!
139 ! X =       306.9760,     5159.57,     184.44,       0 ! !END!
140 ! X =       306.9730,     5159.51,     186.9,       0 ! !END!
141 ! X =       306.9700,     5159.45,     189,       0 ! !END!
142 ! X =       306.9680,     5159.39,     190,       0 ! !END!
143 ! X =       306.9650,     5159.33,     190.33,       0 ! !END!
144 ! X =       306.9620,     5159.27,     191,       0 ! !END!
145 ! X =       306.9600,     5159.21,     192.33,       0 ! !END!
146 ! X =       306.9570,     5159.151,     194.13,       0 ! !END!
147 ! X =       306.9540,     5159.091,     195.5,       0 ! !END!
148 ! X =       306.9520,     5159.031,     196.27,       0 ! !END!
149 ! X =       306.9490,     5158.971,     198.67,       0 ! !END!
150 ! X =       306.9460,     5158.911,     201.6,       0 ! !END!
151 ! X =       306.9440,     5158.851,     204.3,       0 ! !END!
152 ! X =       306.9410,     5158.791,     206.19,       0 ! !END!
153 ! X =       306.9380,     5158.731,     207.55,       0 ! !END!
154 ! X =       306.9360,     5158.671,     209.04,       0 ! !END!
155 ! X =       306.9330,     5158.611,     210.83,       0 ! !END!
156 ! X =       306.9300,     5158.551,     214.3,       0 ! !END!
157 ! X =       306.9280,     5158.491,     216.3,       0 ! !END!
158 ! X =       306.9250,     5158.431,     217,       0 ! !END!
159 ! X =       306.9220,     5158.371,     217,       0 ! !END!
160 ! X =       306.9190,     5158.311,     216.89,       0 ! !END!
161 ! X =       306.9170,     5158.251,     216.57,       0 ! !END!
162 ! X =       306.9140,     5158.191,     216,       0 ! !END!
163 ! X =       306.9110,     5158.132,     215.27,       0 ! !END!
164 ! X =       306.9090,     5158.072,     215.27,       0 ! !END!
165 ! X =       306.9060,     5158.012,     217.27,       0 ! !END!
166 ! X =       306.9030,     5157.952,     219.53,       0 ! !END!
167 ! X =       306.9010,     5157.892,     222,       0 ! !END!
168 ! X =       306.8980,     5157.832,     221,       0 ! !END!
169 ! X =       306.8950,     5157.772,     220,       0 ! !END!
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170 ! X =       306.8930,     5157.712,     219,       0 ! !END!
171 ! X =       306.8900,     5157.652,     220,       0 ! !END!
172 ! X =       306.8870,     5157.592,     221.15,       0 ! !END!
173 ! X =       306.8850,     5157.532,     222.13,       0 ! !END!
174 ! X =       306.8820,     5157.472,     226.09,       0 ! !END!
175 ! X =       306.8790,     5157.412,     231.61,       0 ! !END!
176 ! X =       306.8770,     5157.352,     236.8,       0 ! !END!
177 ! X =       306.8740,     5157.292,     238.2,       0 ! !END!
178 ! X =       307.0410,     5159.687,     183.56,       0 ! !END!
179 ! X =       307.0380,     5159.627,     181.63,       0 ! !END!
180 ! X =       307.0360,     5159.567,     181.6,       0 ! !END!
181 ! X =       307.0330,     5159.508,     184.37,       0 ! !END!
182 ! X =       307.0300,     5159.448,     187.2,       0 ! !END!
183 ! X =       307.0280,     5159.388,     188.4,       0 ! !END!
184 ! X =       307.0250,     5159.328,     189.33,       0 ! !END!
185 ! X =       307.0220,     5159.268,     189.53,       0 ! !END!
186 ! X =       307.0200,     5159.208,     189.4,       0 ! !END!
187 ! X =       307.0170,     5159.148,     189.7,       0 ! !END!
188 ! X =       307.0140,     5159.088,     191.8,       0 ! !END!
189 ! X =       307.0120,     5159.028,     193.83,       0 ! !END!
190 ! X =       307.0090,     5158.968,     196.17,       0 ! !END!
191 ! X =       307.0060,     5158.908,     200.27,       0 ! !END!
192 ! X =       307.0030,     5158.848,     203.23,       0 ! !END!
193 ! X =       307.0010,     5158.788,     204.78,       0 ! !END!
194 ! X =       306.9980,     5158.728,     206.11,       0 ! !END!
195 ! X =       306.9950,     5158.668,     207.4,       0 ! !END!
196 ! X =       306.9930,     5158.608,     209.4,       0 ! !END!
197 ! X =       306.9900,     5158.548,     213.4,       0 ! !END!
198 ! X =       306.9870,     5158.489,     215.8,       0 ! !END!
199 ! X =       306.9850,     5158.429,     217,       0 ! !END!
200 ! X =       306.9820,     5158.369,     217,       0 ! !END!
201 ! X =       306.9790,     5158.309,     217,       0 ! !END!
202 ! X =       306.9770,     5158.249,     216.63,       0 ! !END!
203 ! X =       306.9740,     5158.189,     214.36,       0 ! !END!
204 ! X =       306.9710,     5158.129,     212.9,       0 ! !END!
205 ! X =       306.9690,     5158.069,     212.58,       0 ! !END!
206 ! X =       306.9660,     5158.009,     215.84,       0 ! !END!
207 ! X =       306.9630,     5157.949,     218.63,       0 ! !END!
208 ! X =       306.9610,     5157.889,     221.37,       0 ! !END!
209 ! X =       306.9580,     5157.829,     221,       0 ! !END!
210 ! X =       306.9550,     5157.769,     219.69,       0 ! !END!
211 ! X =       306.9530,     5157.709,     219,       0 ! !END!
212 ! X =       306.9500,     5157.649,     219.58,       0 ! !END!
213 ! X =       306.9470,     5157.589,     221.16,       0 ! !END!
214 ! X =       306.9450,     5157.529,     222.37,       0 ! !END!
215 ! X =       306.9420,     5157.47,     224.73,       0 ! !END!
216 ! X =       306.9390,     5157.41,     227.97,       0 ! !END!
217 ! X =       306.9370,     5157.35,     231.41,       0 ! !END!
218 ! X =       306.9340,     5157.289,     232.9,       0 ! !END!
219 ! X =       307.1010,     5159.685,     182.5,       0 ! !END!
220 ! X =       307.0980,     5159.625,     180.3,       0 ! !END!
221 ! X =       307.0960,     5159.565,     180,       0 ! !END!
222 ! X =       307.0930,     5159.505,     183.72,       0 ! !END!
223 ! X =       307.0900,     5159.445,     187.33,       0 ! !END!
224 ! X =       307.0880,     5159.385,     188.63,       0 ! !END!
225 ! X =       307.0850,     5159.325,     189,       0 ! !END!
226 ! X =       307.0820,     5159.265,     188.5,       0 ! !END!
227 ! X =       307.0790,     5159.205,     188.5,       0 ! !END!
228 ! X =       307.0770,     5159.145,     189,       0 ! !END!
229 ! X =       307.0740,     5159.085,     190.1,       0 ! !END!
230 ! X =       307.0710,     5159.025,     191.5,       0 ! !END!
231 ! X =       307.0690,     5158.965,     194.37,       0 ! !END!
232 ! X =       307.0660,     5158.905,     198.97,       0 ! !END!
233 ! X =       307.0630,     5158.845,     203.07,       0 ! !END!
234 ! X =       307.0610,     5158.786,     204.8,       0 ! !END!
235 ! X =       307.0580,     5158.726,     206.61,       0 ! !END!
236 ! X =       307.0550,     5158.666,     207.56,       0 ! !END!
237 ! X =       307.0530,     5158.606,     209.57,       0 ! !END!
238 ! X =       307.0500,     5158.546,     210.93,       0 ! !END!
239 ! X =       307.0470,     5158.486,     215.03,       0 ! !END!
240 ! X =       307.0450,     5158.426,     217,       0 ! !END!
241 ! X =       307.0420,     5158.366,     217,       0 ! !END!
242 ! X =       307.0390,     5158.306,     217,       0 ! !END!
243 ! X =       307.0370,     5158.246,     216.33,       0 ! !END!
244 ! X =       307.0340,     5158.186,     214.22,       0 ! !END!
245 ! X =       307.0310,     5158.126,     211.63,       0 ! !END!
246 ! X =       307.0290,     5158.066,     210.99,       0 ! !END!
247 ! X =       307.0260,     5158.006,     214.44,       0 ! !END!
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248 ! X =       307.0230,     5157.946,     218.09,       0 ! !END!
249 ! X =       307.0210,     5157.886,     221,       0 ! !END!
250 ! X =       307.0180,     5157.826,     220.04,       0 ! !END!
251 ! X =       307.0150,     5157.767,     218.57,       0 ! !END!
252 ! X =       307.0130,     5157.707,     216.8,       0 ! !END!
253 ! X =       307.0100,     5157.647,     217.77,       0 ! !END!
254 ! X =       307.0070,     5157.587,     220.11,       0 ! !END!
255 ! X =       307.0050,     5157.527,     222.43,       0 ! !END!
256 ! X =       307.0020,     5157.467,     223,       0 ! !END!
257 ! X =       306.9990,     5157.407,     223.43,       0 ! !END!
258 ! X =       306.9970,     5157.347,     224,       0 ! !END!
259 ! X =       306.9940,     5157.287,     224,       0 ! !END!
260 ! X =       307.1610,     5159.682,     183.28,       0 ! !END!
261 ! X =       307.1580,     5159.622,     182,       0 ! !END!
262 ! X =       307.1550,     5159.562,     182.7,       0 ! !END!
263 ! X =       307.1530,     5159.502,     185.63,       0 ! !END!
264 ! X =       307.1500,     5159.442,     189.2,       0 ! !END!
265 ! X =       307.1470,     5159.382,     189.09,       0 ! !END!
266 ! X =       307.1450,     5159.322,     188.23,       0 ! !END!
267 ! X =       307.1420,     5159.262,     187.93,       0 ! !END!
268 ! X =       307.1390,     5159.202,     187.03,       0 ! !END!
269 ! X =       307.1370,     5159.143,     188.1,       0 ! !END!
270 ! X =       307.1340,     5159.083,     189.11,       0 ! !END!
271 ! X =       307.1310,     5159.023,     190.17,       0 ! !END!
272 ! X =       307.1290,     5158.963,     193.5,       0 ! !END!
273 ! X =       307.1260,     5158.903,     197.4,       0 ! !END!
274 ! X =       307.1230,     5158.843,     201.45,       0 ! !END!
275 ! X =       307.1210,     5158.783,     204.41,       0 ! !END!
276 ! X =       307.1180,     5158.723,     207.72,       0 ! !END!
277 ! X =       307.1150,     5158.663,     209.83,       0 ! !END!
278 ! X =       307.1130,     5158.603,     212.16,       0 ! !END!
279 ! X =       307.1100,     5158.543,     211.57,       0 ! !END!
280 ! X =       307.1070,     5158.483,     214.52,       0 ! !END!
281 ! X =       307.1050,     5158.423,     215.09,       0 ! !END!
282 ! X =       307.1020,     5158.363,     216,       0 ! !END!
283 ! X =       307.0990,     5158.303,     216.57,       0 ! !END!
284 ! X =       307.0970,     5158.243,     216.43,       0 ! !END!
285 ! X =       307.0940,     5158.183,     215.43,       0 ! !END!
286 ! X =       307.0910,     5158.124,     214.8,       0 ! !END!
287 ! X =       307.0890,     5158.064,     214.53,       0 ! !END!
288 ! X =       307.0860,     5158.004,     216.43,       0 ! !END!
289 ! X =       307.0830,     5157.944,     218.43,       0 ! !END!
290 ! X =       307.0810,     5157.884,     219.97,       0 ! !END!
291 ! X =       307.0780,     5157.824,     218.53,       0 ! !END!
292 ! X =       307.0750,     5157.764,     217.08,       0 ! !END!
293 ! X =       307.0730,     5157.704,     215.47,       0 ! !END!
294 ! X =       307.0700,     5157.644,     217.07,       0 ! !END!
295 ! X =       307.0670,     5157.584,     219.53,       0 ! !END!
296 ! X =       307.0650,     5157.524,     222.3,       0 ! !END!
297 ! X =       307.0620,     5157.464,     223,       0 ! !END!
298 ! X =       307.0590,     5157.404,     223.53,       0 ! !END!
299 ! X =       307.0570,     5157.344,     224,       0 ! !END!
300 ! X =       307.0540,     5157.284,     224,       0 ! !END!
301 ! X =       307.2210,     5159.679,     185.21,       0 ! !END!
302 ! X =       307.2180,     5159.619,     184.18,       0 ! !END!
303 ! X =       307.2150,     5159.559,     184.55,       0 ! !END!
304 ! X =       307.2130,     5159.499,     187.53,       0 ! !END!
305 ! X =       307.2100,     5159.44,     189.67,       0 ! !END!
306 ! X =       307.2070,     5159.38,     189.26,       0 ! !END!
307 ! X =       307.2050,     5159.32,     187.33,       0 ! !END!
308 ! X =       307.2020,     5159.26,     185.33,       0 ! !END!
309 ! X =       307.1990,     5159.2,     184.71,       0 ! !END!
310 ! X =       307.1970,     5159.14,     186.77,       0 ! !END!
311 ! X =       307.1940,     5159.08,     187.73,       0 ! !END!
312 ! X =       307.1910,     5159.02,     189.67,       0 ! !END!
313 ! X =       307.1890,     5158.96,     191.91,       0 ! !END!
314 ! X =       307.1860,     5158.9,     195.8,       0 ! !END!
315 ! X =       307.1830,     5158.84,     199.47,       0 ! !END!
316 ! X =       307.1810,     5158.78,     203.97,       0 ! !END!
317 ! X =       307.1780,     5158.72,     208.33,       0 ! !END!
318 ! X =       307.1750,     5158.66,     211.78,       0 ! !END!
319 ! X =       307.1730,     5158.6,     213.67,       0 ! !END!
320 ! X =       307.1700,     5158.54,     212.67,       0 ! !END!
321 ! X =       307.1670,     5158.48,     213.1,       0 ! !END!
322 ! X =       307.1650,     5158.421,     214.17,       0 ! !END!
323 ! X =       307.1620,     5158.361,     214.73,       0 ! !END!
324 ! X =       307.1590,     5158.301,     215.77,       0 ! !END!
325 ! X =       307.1570,     5158.241,     216,       0 ! !END!
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326 ! X =       307.1540,     5158.181,     215,       0 ! !END!
327 ! X =       307.1510,     5158.121,     214.37,       0 ! !END!
328 ! X =       307.1490,     5158.061,     214.63,       0 ! !END!
329 ! X =       307.1460,     5158.001,     215.63,       0 ! !END!
330 ! X =       307.1430,     5157.941,     217.63,       0 ! !END!
331 ! X =       307.1410,     5157.881,     219,       0 ! !END!
332 ! X =       307.1380,     5157.821,     217.41,       0 ! !END!
333 ! X =       307.1350,     5157.761,     215.53,       0 ! !END!
334 ! X =       307.1330,     5157.701,     214.6,       0 ! !END!
335 ! X =       307.1300,     5157.641,     216.6,       0 ! !END!
336 ! X =       307.1270,     5157.581,     219.07,       0 ! !END!
337 ! X =       307.1240,     5157.521,     221.8,       0 ! !END!
338 ! X =       307.1220,     5157.462,     223,       0 ! !END!
339 ! X =       307.1190,     5157.402,     224.18,       0 ! !END!
340 ! X =       307.1160,     5157.342,     225.12,       0 ! !END!
341 ! X =       307.1140,     5157.281,     225.13,       0 ! !END!
342 ! X =       307.2810,     5159.677,     185.23,       0 ! !END!
343 ! X =       307.2780,     5159.617,     184.23,       0 ! !END!
344 ! X =       307.2750,     5159.557,     184.77,       0 ! !END!
345 ! X =       307.2730,     5159.497,     186.77,       0 ! !END!
346 ! X =       307.2700,     5159.437,     188.92,       0 ! !END!
347 ! X =       307.2670,     5159.377,     188.05,       0 ! !END!
348 ! X =       307.2650,     5159.317,     186.9,       0 ! !END!
349 ! X =       307.2620,     5159.257,     185.15,       0 ! !END!
350 ! X =       307.2590,     5159.197,     184.77,       0 ! !END!
351 ! X =       307.2570,     5159.137,     185.02,       0 ! !END!
352 ! X =       307.2540,     5159.077,     186.97,       0 ! !END!
353 ! X =       307.2510,     5159.017,     188.77,       0 ! !END!
354 ! X =       307.2490,     5158.957,     191.53,       0 ! !END!
355 ! X =       307.2460,     5158.897,     194.12,       0 ! !END!
356 ! X =       307.2430,     5158.837,     198.53,       0 ! !END!
357 ! X =       307.2410,     5158.778,     202.83,       0 ! !END!
358 ! X =       307.2380,     5158.718,     207.74,       0 ! !END!
359 ! X =       307.2350,     5158.658,     211.18,       0 ! !END!
360 ! X =       307.2330,     5158.598,     212.95,       0 ! !END!
361 ! X =       307.2300,     5158.538,     212,       0 ! !END!
362 ! X =       307.2270,     5158.478,     212.1,       0 ! !END!
363 ! X =       307.2250,     5158.418,     212.9,       0 ! !END!
364 ! X =       307.2220,     5158.358,     214.2,       0 ! !END!
365 ! X =       307.2190,     5158.298,     215.27,       0 ! !END!
366 ! X =       307.2170,     5158.238,     216,       0 ! !END!
367 ! X =       307.2140,     5158.178,     215,       0 ! !END!
368 ! X =       307.2110,     5158.118,     214.27,       0 ! !END!
369 ! X =       307.2080,     5158.058,     214.73,       0 ! !END!
370 ! X =       307.2060,     5157.998,     215.73,       0 ! !END!
371 ! X =       307.2030,     5157.938,     217.66,       0 ! !END!
372 ! X =       307.2000,     5157.878,     219,       0 ! !END!
373 ! X =       307.1980,     5157.818,     217.27,       0 ! !END!
374 ! X =       307.1950,     5157.759,     216,       0 ! !END!
375 ! X =       307.1920,     5157.699,     214.3,       0 ! !END!
376 ! X =       307.1900,     5157.639,     216.4,       0 ! !END!
377 ! X =       307.1870,     5157.579,     218.7,       0 ! !END!
378 ! X =       307.1840,     5157.519,     221.4,       0 ! !END!
379 ! X =       307.1820,     5157.459,     223.7,       0 ! !END!
380 ! X =       307.1790,     5157.399,     226,       0 ! !END!
381 ! X =       307.1760,     5157.339,     228.66,       0 ! !END!
382 ! X =       307.1740,     5157.279,     229.08,       0 ! !END!
383 ! X =       307.3410,     5159.674,     184.13,       0 ! !END!
384 ! X =       307.3380,     5159.614,     183.48,       0 ! !END!
385 ! X =       307.3350,     5159.554,     183.87,       0 ! !END!
386 ! X =       307.3330,     5159.494,     186.79,       0 ! !END!
387 ! X =       307.3300,     5159.434,     188.78,       0 ! !END!
388 ! X =       307.3270,     5159.374,     187.13,       0 ! !END!
389 ! X =       307.3250,     5159.314,     184.27,       0 ! !END!
390 ! X =       307.3220,     5159.254,     183,       0 ! !END!
391 ! X =       307.3190,     5159.194,     183.03,       0 ! !END!
392 ! X =       307.3170,     5159.134,     184.1,       0 ! !END!
393 ! X =       307.3140,     5159.075,     185.2,       0 ! !END!
394 ! X =       307.3110,     5159.015,     186.18,       0 ! !END!
395 ! X =       307.3090,     5158.955,     189.56,       0 ! !END!
396 ! X =       307.3060,     5158.895,     193.67,       0 ! !END!
397 ! X =       307.3030,     5158.835,     197.67,       0 ! !END!
398 ! X =       307.3010,     5158.775,     200.77,       0 ! !END!
399 ! X =       307.2980,     5158.715,     204.18,       0 ! !END!
400 ! X =       307.2950,     5158.655,     206.5,       0 ! !END!
401 ! X =       307.2920,     5158.595,     208.64,       0 ! !END!
402 ! X =       307.2900,     5158.535,     207.83,       0 ! !END!
403 ! X =       307.2870,     5158.475,     209.05,       0 ! !END!
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404 ! X =       307.2840,     5158.415,     211.23,       0 ! !END!
405 ! X =       307.2820,     5158.355,     212.49,       0 ! !END!
406 ! X =       307.2790,     5158.295,     214.26,       0 ! !END!
407 ! X =       307.2760,     5158.235,     215.47,       0 ! !END!
408 ! X =       307.2740,     5158.175,     215,       0 ! !END!
409 ! X =       307.2710,     5158.115,     214.11,       0 ! !END!
410 ! X =       307.2680,     5158.056,     214,       0 ! !END!
411 ! X =       307.2660,     5157.996,     215.8,       0 ! !END!
412 ! X =       307.2630,     5157.936,     216.8,       0 ! !END!
413 ! X =       307.2600,     5157.876,     218,       0 ! !END!
414 ! X =       307.2580,     5157.816,     217,       0 ! !END!
415 ! X =       307.2550,     5157.756,     215.2,       0 ! !END!
416 ! X =       307.2520,     5157.696,     214.2,       0 ! !END!
417 ! X =       307.2500,     5157.636,     216.07,       0 ! !END!
418 ! X =       307.2470,     5157.576,     218.8,       0 ! !END!
419 ! X =       307.2440,     5157.516,     221.23,       0 ! !END!
420 ! X =       307.2420,     5157.456,     223.4,       0 ! !END!
421 ! X =       307.2390,     5157.396,     226.5,       0 ! !END!
422 ! X =       307.2360,     5157.336,     229.24,       0 ! !END!
423 ! X =       307.2340,     5157.276,     228.93,       0 ! !END!
424 ! X =       307.4010,     5159.671,     184,       0 ! !END!
425 ! X =       307.3980,     5159.611,     183,       0 ! !END!
426 ! X =       307.3950,     5159.551,     183.97,       0 ! !END!
427 ! X =       307.3930,     5159.491,     186.95,       0 ! !END!
428 ! X =       307.3900,     5159.432,     188.93,       0 ! !END!
429 ! X =       307.3870,     5159.372,     187.12,       0 ! !END!
430 ! X =       307.3850,     5159.312,     185.07,       0 ! !END!
431 ! X =       307.3820,     5159.252,     183,       0 ! !END!
432 ! X =       307.3790,     5159.192,     183,       0 ! !END!
433 ! X =       307.3770,     5159.132,     183.84,       0 ! !END!
434 ! X =       307.3740,     5159.072,     184.93,       0 ! !END!
435 ! X =       307.3710,     5159.012,     185.98,       0 ! !END!
436 ! X =       307.3680,     5158.952,     189.87,       0 ! !END!
437 ! X =       307.3660,     5158.892,     194.8,       0 ! !END!
438 ! X =       307.3630,     5158.832,     198.46,       0 ! !END!
439 ! X =       307.3600,     5158.772,     199.93,       0 ! !END!
440 ! X =       307.3580,     5158.712,     201.67,       0 ! !END!
441 ! X =       307.3550,     5158.652,     202.83,       0 ! !END!
442 ! X =       307.3520,     5158.592,     204.87,       0 ! !END!
443 ! X =       307.3500,     5158.532,     203.93,       0 ! !END!
444 ! X =       307.3470,     5158.472,     205.94,       0 ! !END!
445 ! X =       307.3440,     5158.413,     207.82,       0 ! !END!
446 ! X =       307.3420,     5158.353,     210.17,       0 ! !END!
447 ! X =       307.3390,     5158.293,     213.17,       0 ! !END!
448 ! X =       307.3360,     5158.233,     214.47,       0 ! !END!
449 ! X =       307.3340,     5158.173,     213.59,       0 ! !END!
450 ! X =       307.3310,     5158.113,     213.63,       0 ! !END!
451 ! X =       307.3280,     5158.053,     213.73,       0 ! !END!
452 ! X =       307.3260,     5157.993,     214.8,       0 ! !END!
453 ! X =       307.3230,     5157.933,     215.99,       0 ! !END!
454 ! X =       307.3200,     5157.873,     217,       0 ! !END!
455 ! X =       307.3180,     5157.813,     216.1,       0 ! !END!
456 ! X =       307.3150,     5157.753,     215.1,       0 ! !END!
457 ! X =       307.3120,     5157.693,     214.1,       0 ! !END!
458 ! X =       307.3100,     5157.633,     215.9,       0 ! !END!
459 ! X =       307.3070,     5157.573,     217.33,       0 ! !END!
460 ! X =       307.3040,     5157.513,     219.43,       0 ! !END!
461 ! X =       307.3020,     5157.453,     220.56,       0 ! !END!
462 ! X =       307.2990,     5157.394,     222.31,       0 ! !END!
463 ! X =       307.2960,     5157.334,     223.49,       0 ! !END!
464 ! X =       307.2940,     5157.273,     223.75,       0 ! !END!
465 ! X =       307.4610,     5159.669,     183.97,       0 ! !END!
466 ! X =       307.4580,     5159.609,     183,       0 ! !END!
467 ! X =       307.4550,     5159.549,     184.03,       0 ! !END!
468 ! X =       307.4520,     5159.489,     187.03,       0 ! !END!
469 ! X =       307.4500,     5159.429,     188.97,       0 ! !END!
470 ! X =       307.4470,     5159.369,     186.97,       0 ! !END!
471 ! X =       307.4440,     5159.309,     184.93,       0 ! !END!
472 ! X =       307.4420,     5159.249,     183,       0 ! !END!
473 ! X =       307.4390,     5159.189,     183,       0 ! !END!
474 ! X =       307.4360,     5159.129,     184,       0 ! !END!
475 ! X =       307.4340,     5159.069,     184.2,       0 ! !END!
476 ! X =       307.4310,     5159.009,     185.33,       0 ! !END!
477 ! X =       307.4280,     5158.949,     189.07,       0 ! !END!
478 ! X =       307.4260,     5158.889,     194.1,       0 ! !END!
479 ! X =       307.4230,     5158.829,     198.02,       0 ! !END!
480 ! X =       307.4200,     5158.769,     199.03,       0 ! !END!
481 ! X =       307.4180,     5158.71,     200,       0 ! !END!
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482 ! X =       307.4150,     5158.65,     202,       0 ! !END!
483 ! X =       307.4120,     5158.59,     203,       0 ! !END!
484 ! X =       307.4100,     5158.53,     203,       0 ! !END!
485 ! X =       307.4070,     5158.47,     204,       0 ! !END!
486 ! X =       307.4040,     5158.41,     206,       0 ! !END!
487 ! X =       307.4020,     5158.35,     208.27,       0 ! !END!
488 ! X =       307.3990,     5158.29,     210.37,       0 ! !END!
489 ! X =       307.3960,     5158.23,     211.47,       0 ! !END!
490 ! X =       307.3940,     5158.17,     211.07,       0 ! !END!
491 ! X =       307.3910,     5158.11,     210.27,       0 ! !END!
492 ! X =       307.3880,     5158.05,     211.2,       0 ! !END!
493 ! X =       307.3860,     5157.99,     213.4,       0 ! !END!
494 ! X =       307.3830,     5157.93,     214.9,       0 ! !END!
495 ! X =       307.3800,     5157.87,     217,       0 ! !END!
496 ! X =       307.3780,     5157.81,     216,       0 ! !END!
497 ! X =       307.3750,     5157.751,     215.01,       0 ! !END!
498 ! X =       307.3720,     5157.691,     214.01,       0 ! !END!
499 ! X =       307.3700,     5157.631,     214.98,       0 ! !END!
500 ! X =       307.3670,     5157.571,     215.98,       0 ! !END!
501 ! X =       307.3640,     5157.511,     217.5,       0 ! !END!
502 ! X =       307.3620,     5157.451,     218.57,       0 ! !END!
503 ! X =       307.3590,     5157.391,     219.67,       0 ! !END!
504 ! X =       307.3560,     5157.331,     220.79,       0 ! !END!
505 ! X =       307.3540,     5157.271,     220.9,       0 ! !END!
506 ! X =       307.5200,     5159.666,     183.87,       0 ! !END!
507 ! X =       307.5180,     5159.606,     183,       0 ! !END!
508 ! X =       307.5150,     5159.546,     184.13,       0 ! !END!
509 ! X =       307.5120,     5159.486,     187.08,       0 ! !END!
510 ! X =       307.5100,     5159.426,     188.87,       0 ! !END!
511 ! X =       307.5070,     5159.366,     186.63,       0 ! !END!
512 ! X =       307.5040,     5159.306,     183.62,       0 ! !END!
513 ! X =       307.5020,     5159.246,     182.12,       0 ! !END!
514 ! X =       307.4990,     5159.186,     183,       0 ! !END!
515 ! X =       307.4960,     5159.126,     183.02,       0 ! !END!
516 ! X =       307.4940,     5159.067,     183.28,       0 ! !END!
517 ! X =       307.4910,     5159.007,     184.13,       0 ! !END!
518 ! X =       307.4880,     5158.947,     188.24,       0 ! !END!
519 ! X =       307.4860,     5158.887,     193.72,       0 ! !END!
520 ! X =       307.4830,     5158.827,     198,       0 ! !END!
521 ! X =       307.4800,     5158.767,     199.07,       0 ! !END!
522 ! X =       307.4780,     5158.707,     200.1,       0 ! !END!
523 ! X =       307.4750,     5158.647,     202,       0 ! !END!
524 ! X =       307.4720,     5158.587,     203,       0 ! !END!
525 ! X =       307.4700,     5158.527,     202,       0 ! !END!
526 ! X =       307.4670,     5158.467,     203.01,       0 ! !END!
527 ! X =       307.4640,     5158.407,     204.3,       0 ! !END!
528 ! X =       307.4620,     5158.347,     207.1,       0 ! !END!
529 ! X =       307.4590,     5158.287,     209.1,       0 ! !END!
530 ! X =       307.4560,     5158.227,     210,       0 ! !END!
531 ! X =       307.4540,     5158.167,     210.05,       0 ! !END!
532 ! X =       307.4510,     5158.107,     210.37,       0 ! !END!
533 ! X =       307.4480,     5158.048,     210.58,       0 ! !END!
534 ! X =       307.4460,     5157.988,     212.27,       0 ! !END!
535 ! X =       307.4430,     5157.928,     214.07,       0 ! !END!
536 ! X =       307.4400,     5157.868,     215,       0 ! !END!
537 ! X =       307.4380,     5157.808,     215,       0 ! !END!
538 ! X =       307.4350,     5157.748,     214.16,       0 ! !END!
539 ! X =       307.4320,     5157.688,     214,       0 ! !END!
540 ! X =       307.4300,     5157.628,     215.04,       0 ! !END!
541 ! X =       307.4270,     5157.568,     216.04,       0 ! !END!
542 ! X =       307.4240,     5157.508,     217.47,       0 ! !END!
543 ! X =       307.4220,     5157.448,     217.44,       0 ! !END!
544 ! X =       307.4190,     5157.388,     217.7,       0 ! !END!
545 ! X =       307.4160,     5157.328,     217.8,       0 ! !END!
546 ! X =       307.4130,     5157.268,     217.97,       0 ! !END!
547 ! X =       307.5800,     5159.663,     183.26,       0 ! !END!
548 ! X =       307.5780,     5159.603,     183,       0 ! !END!
549 ! X =       307.5750,     5159.543,     184.23,       0 ! !END!
550 ! X =       307.5720,     5159.483,     185.83,       0 ! !END!
551 ! X =       307.5700,     5159.423,     187.43,       0 ! !END!
552 ! X =       307.5670,     5159.364,     185.57,       0 ! !END!
553 ! X =       307.5640,     5159.304,     182.8,       0 ! !END!
554 ! X =       307.5620,     5159.244,     181.81,       0 ! !END!
555 ! X =       307.5590,     5159.184,     182,       0 ! !END!
556 ! X =       307.5560,     5159.124,     182.2,       0 ! !END!
557 ! X =       307.5540,     5159.064,     182.36,       0 ! !END!
558 ! X =       307.5510,     5159.004,     183.2,       0 ! !END!
559 ! X =       307.5480,     5158.944,     187.6,       0 ! !END!
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560 ! X =       307.5460,     5158.884,     192.97,       0 ! !END!
561 ! X =       307.5430,     5158.824,     196.68,       0 ! !END!
562 ! X =       307.5400,     5158.764,     197.87,       0 ! !END!
563 ! X =       307.5380,     5158.704,     198.93,       0 ! !END!
564 ! X =       307.5350,     5158.644,     201.03,       0 ! !END!
565 ! X =       307.5320,     5158.584,     202.95,       0 ! !END!
566 ! X =       307.5300,     5158.524,     202,       0 ! !END!
567 ! X =       307.5270,     5158.464,     203,       0 ! !END!
568 ! X =       307.5240,     5158.404,     204.2,       0 ! !END!
569 ! X =       307.5220,     5158.345,     206.17,       0 ! !END!
570 ! X =       307.5190,     5158.285,     207.53,       0 ! !END!
571 ! X =       307.5160,     5158.225,     209.08,       0 ! !END!
572 ! X =       307.5140,     5158.165,     209.61,       0 ! !END!
573 ! X =       307.5110,     5158.105,     210.69,       0 ! !END!
574 ! X =       307.5080,     5158.045,     211.12,       0 ! !END!
575 ! X =       307.5060,     5157.985,     212.13,       0 ! !END!
576 ! X =       307.5030,     5157.925,     213.15,       0 ! !END!
577 ! X =       307.5000,     5157.865,     214,       0 ! !END!
578 ! X =       307.4970,     5157.805,     214.1,       0 ! !END!
579 ! X =       307.4950,     5157.745,     214,       0 ! !END!
580 ! X =       307.4920,     5157.685,     214,       0 ! !END!
581 ! X =       307.4890,     5157.625,     215,       0 ! !END!
582 ! X =       307.4870,     5157.565,     216,       0 ! !END!
583 ! X =       307.4840,     5157.505,     217,       0 ! !END!
584 ! X =       307.4810,     5157.445,     215.94,       0 ! !END!
585 ! X =       307.4790,     5157.386,     215.57,       0 ! !END!
586 ! X =       307.4760,     5157.326,     214.47,       0 ! !END!
587 ! X =       307.4730,     5157.265,     214.82,       0 ! !END!
588 ! X =       307.6400,     5159.661,     183,       0 ! !END!
589 ! X =       307.6380,     5159.601,     183,       0 ! !END!
590 ! X =       307.6350,     5159.541,     184.3,       0 ! !END!
591 ! X =       307.6320,     5159.481,     185.58,       0 ! !END!
592 ! X =       307.6300,     5159.421,     186.37,       0 ! !END!
593 ! X =       307.6270,     5159.361,     184.54,       0 ! !END!
594 ! X =       307.6240,     5159.301,     182.7,       0 ! !END!
595 ! X =       307.6220,     5159.241,     182,       0 ! !END!
596 ! X =       307.6190,     5159.181,     182.29,       0 ! !END!
597 ! X =       307.6160,     5159.121,     182.74,       0 ! !END!
598 ! X =       307.6140,     5159.061,     182,       0 ! !END!
599 ! X =       307.6110,     5159.001,     182.3,       0 ! !END!
600 ! X =       307.6080,     5158.941,     186.9,       0 ! !END!
601 ! X =       307.6060,     5158.881,     192.23,       0 ! !END!
602 ! X =       307.6030,     5158.821,     196,       0 ! !END!
603 ! X =       307.6000,     5158.761,     196.3,       0 ! !END!
604 ! X =       307.5980,     5158.702,     197.27,       0 ! !END!
605 ! X =       307.5950,     5158.642,     199.53,       0 ! !END!
606 ! X =       307.5920,     5158.582,     202.27,       0 ! !END!
607 ! X =       307.5900,     5158.522,     202,       0 ! !END!
608 ! X =       307.5870,     5158.462,     203,       0 ! !END!
609 ! X =       307.5840,     5158.402,     204.05,       0 ! !END!
610 ! X =       307.5820,     5158.342,     205.46,       0 ! !END!
611 ! X =       307.5790,     5158.282,     206.63,       0 ! !END!
612 ! X =       307.5760,     5158.222,     207.73,       0 ! !END!
613 ! X =       307.5730,     5158.162,     208.83,       0 ! !END!
614 ! X =       307.5710,     5158.102,     209.9,       0 ! !END!
615 ! X =       307.5680,     5158.042,     211,       0 ! !END!
616 ! X =       307.5650,     5157.982,     212.1,       0 ! !END!
617 ! X =       307.5630,     5157.922,     213.17,       0 ! !END!
618 ! X =       307.5600,     5157.862,     214,       0 ! !END!
619 ! X =       307.5570,     5157.802,     213,       0 ! !END!
620 ! X =       307.5550,     5157.742,     213,       0 ! !END!
621 ! X =       307.5520,     5157.683,     212.44,       0 ! !END!
622 ! X =       307.5490,     5157.623,     213.51,       0 ! !END!
623 ! X =       307.5470,     5157.563,     214.57,       0 ! !END!
624 ! X =       307.5440,     5157.503,     216,       0 ! !END!
625 ! X =       307.5410,     5157.443,     215,       0 ! !END!
626 ! X =       307.5390,     5157.383,     213.77,       0 ! !END!
627 ! X =       307.5360,     5157.323,     212.77,       0 ! !END!
628 ! X =       307.5330,     5157.263,     213.23,       0 ! !END!
629 ! X =       307.7000,     5159.658,     183,       0 ! !END!
630 ! X =       307.6980,     5159.598,     183,       0 ! !END!
631 ! X =       307.6950,     5159.538,     183.9,       0 ! !END!
632 ! X =       307.6920,     5159.478,     185.76,       0 ! !END!
633 ! X =       307.6900,     5159.418,     185.6,       0 ! !END!
634 ! X =       307.6870,     5159.358,     184.6,       0 ! !END!
635 ! X =       307.6840,     5159.298,     182.6,       0 ! !END!
636 ! X =       307.6820,     5159.238,     182,       0 ! !END!
637 ! X =       307.6790,     5159.178,     182,       0 ! !END!
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638 ! X =       307.6760,     5159.118,     181.6,       0 ! !END!
639 ! X =       307.6740,     5159.058,     181,       0 ! !END!
640 ! X =       307.6710,     5158.999,     181.67,       0 ! !END!
641 ! X =       307.6680,     5158.939,     184.73,       0 ! !END!
642 ! X =       307.6660,     5158.879,     189.77,       0 ! !END!
643 ! X =       307.6630,     5158.819,     192.09,       0 ! !END!
644 ! X =       307.6600,     5158.759,     194.37,       0 ! !END!
645 ! X =       307.6570,     5158.699,     196.85,       0 ! !END!
646 ! X =       307.6550,     5158.639,     199.37,       0 ! !END!
647 ! X =       307.6520,     5158.579,     202.37,       0 ! !END!
648 ! X =       307.6490,     5158.519,     202.35,       0 ! !END!
649 ! X =       307.6470,     5158.459,     203.33,       0 ! !END!
650 ! X =       307.6330,     5158.159,     207,       0 ! !END!
651 ! X =       307.6310,     5158.099,     207.77,       0 ! !END!
652 ! X =       307.6280,     5158.04,     208.82,       0 ! !END!
653 ! X =       307.6250,     5157.98,     210.17,       0 ! !END!
654 ! X =       307.6230,     5157.92,     211.3,       0 ! !END!
655 ! X =       307.6200,     5157.86,     213,       0 ! !END!
656 ! X =       307.6170,     5157.8,     212.7,       0 ! !END!
657 ! X =       307.6150,     5157.74,     212,       0 ! !END!
658 ! X =       307.6120,     5157.68,     212,       0 ! !END!
659 ! X =       307.6090,     5157.62,     213,       0 ! !END!
660 ! X =       307.6070,     5157.56,     213.43,       0 ! !END!
661 ! X =       307.6040,     5157.5,     214.53,       0 ! !END!
662 ! X =       307.6010,     5157.44,     213.88,       0 ! !END!
663 ! X =       307.5990,     5157.38,     213,       0 ! !END!
664 ! X =       307.5960,     5157.32,     212,       0 ! !END!
665 ! X =       307.5930,     5157.26,     213.67,       0 ! !END!
666 ! X =       307.7600,     5159.655,     182.33,       0 ! !END!
667 ! X =       307.7580,     5159.595,     182.4,       0 ! !END!
668 ! X =       307.7550,     5159.535,     183.25,       0 ! !END!
669 ! X =       307.7520,     5159.475,     185.1,       0 ! !END!
670 ! X =       307.7500,     5159.415,     185.33,       0 ! !END!
671 ! X =       307.7470,     5159.356,     184.41,       0 ! !END!
672 ! X =       307.7440,     5159.296,     182.4,       0 ! !END!
673 ! X =       307.7420,     5159.236,     181.5,       0 ! !END!
674 ! X =       307.7390,     5159.176,     181.55,       0 ! !END!
675 ! X =       307.7360,     5159.116,     180.6,       0 ! !END!
676 ! X =       307.7330,     5159.056,     180.59,       0 ! !END!
677 ! X =       307.7310,     5158.996,     181.47,       0 ! !END!
678 ! X =       307.7280,     5158.936,     184.93,       0 ! !END!
679 ! X =       307.7250,     5158.876,     188.93,       0 ! !END!
680 ! X =       307.7230,     5158.816,     192.24,       0 ! !END!
681 ! X =       307.7200,     5158.756,     194.29,       0 ! !END!
682 ! X =       307.7170,     5158.696,     196.47,       0 ! !END!
683 ! X =       307.7150,     5158.636,     199.47,       0 ! !END!
684 ! X =       307.7120,     5158.576,     201.9,       0 ! !END!
685 ! X =       307.7090,     5158.516,     201.03,       0 ! !END!
686 ! X =       307.6930,     5158.157,     207,       0 ! !END!
687 ! X =       307.6910,     5158.097,     207.27,       0 ! !END!
688 ! X =       307.6880,     5158.037,     208.32,       0 ! !END!
689 ! X =       307.6850,     5157.977,     208.91,       0 ! !END!
690 ! X =       307.6830,     5157.917,     209.94,       0 ! !END!
691 ! X =       307.6800,     5157.857,     210.43,       0 ! !END!
692 ! X =       307.6770,     5157.797,     211.1,       0 ! !END!
693 ! X =       307.6750,     5157.737,     211.53,       0 ! !END!
694 ! X =       307.6720,     5157.677,     212,       0 ! !END!
695 ! X =       307.6690,     5157.617,     212.16,       0 ! !END!
696 ! X =       307.6670,     5157.557,     213,       0 ! !END!
697 ! X =       307.6640,     5157.497,     213,       0 ! !END!
698 ! X =       307.6610,     5157.437,     213,       0 ! !END!
699 ! X =       307.6590,     5157.377,     212.4,       0 ! !END!
700 ! X =       307.6560,     5157.318,     212,       0 ! !END!
701 ! X =       307.6530,     5157.257,     213.43,       0 ! !END!
702 ! X =       307.8200,     5159.653,     182,       0 ! !END!
703 ! X =       307.8170,     5159.593,     182,       0 ! !END!
704 ! X =       307.8150,     5159.533,     183,       0 ! !END!
705 ! X =       307.8120,     5159.473,     184.57,       0 ! !END!
706 ! X =       307.8090,     5159.413,     185,       0 ! !END!
707 ! X =       307.8070,     5159.353,     183.3,       0 ! !END!
708 ! X =       307.8040,     5159.293,     181.43,       0 ! !END!
709 ! X =       307.8010,     5159.233,     179.98,       0 ! !END!
710 ! X =       307.7990,     5159.173,     180,       0 ! !END!
711 ! X =       307.7960,     5159.113,     178.57,       0 ! !END!
712 ! X =       307.7930,     5159.053,     179,       0 ! !END!
713 ! X =       307.7910,     5158.993,     179.7,       0 ! !END!
714 ! X =       307.7880,     5158.933,     184.36,       0 ! !END!
715 ! X =       307.7850,     5158.873,     188.42,       0 ! !END!
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716 ! X =       307.7830,     5158.813,     192.38,       0 ! !END!
717 ! X =       307.7800,     5158.753,     194.57,       0 ! !END!
718 ! X =       307.7770,     5158.693,     196.57,       0 ! !END!
719 ! X =       307.7750,     5158.634,     199.53,       0 ! !END!
720 ! X =       307.7720,     5158.574,     202.5,       0 ! !END!
721 ! X =       307.7690,     5158.514,     200.03,       0 ! !END!
722 ! X =       307.7510,     5158.094,     205.63,       0 ! !END!
723 ! X =       307.7480,     5158.034,     206.27,       0 ! !END!
724 ! X =       307.7450,     5157.974,     207.44,       0 ! !END!
725 ! X =       307.7430,     5157.914,     208.53,       0 ! !END!
726 ! X =       307.7400,     5157.854,     209,       0 ! !END!
727 ! X =       307.7370,     5157.794,     210.05,       0 ! !END!
728 ! X =       307.7350,     5157.734,     210.61,       0 ! !END!
729 ! X =       307.7320,     5157.675,     211,       0 ! !END!
730 ! X =       307.7290,     5157.615,     211.82,       0 ! !END!
731 ! X =       307.7270,     5157.555,     212.28,       0 ! !END!
732 ! X =       307.7240,     5157.495,     213,       0 ! !END!
733 ! X =       307.7210,     5157.435,     213,       0 ! !END!
734 ! X =       307.7190,     5157.375,     212.15,       0 ! !END!
735 ! X =       307.7160,     5157.315,     212,       0 ! !END!
736 ! X =       307.7130,     5157.255,     213.45,       0 ! !END!
737 ! X =       307.8800,     5159.65,     182,       0 ! !END!
738 ! X =       307.8770,     5159.59,     182,       0 ! !END!
739 ! X =       307.8750,     5159.53,     183,       0 ! !END!
740 ! X =       307.8720,     5159.47,     184.67,       0 ! !END!
741 ! X =       307.8690,     5159.41,     185,       0 ! !END!
742 ! X =       307.8670,     5159.35,     182.67,       0 ! !END!
743 ! X =       307.8640,     5159.29,     181.29,       0 ! !END!
744 ! X =       307.8610,     5159.23,     179.33,       0 ! !END!
745 ! X =       307.8590,     5159.17,     179.33,       0 ! !END!
746 ! X =       307.8560,     5159.11,     179,       0 ! !END!
747 ! X =       307.8530,     5159.05,     179,       0 ! !END!
748 ! X =       307.8510,     5158.991,     179.63,       0 ! !END!
749 ! X =       307.8480,     5158.931,     183.52,       0 ! !END!
750 ! X =       307.8450,     5158.871,     188.27,       0 ! !END!
751 ! X =       307.8430,     5158.811,     191.99,       0 ! !END!
752 ! X =       307.8400,     5158.751,     194.3,       0 ! !END!
753 ! X =       307.8370,     5158.691,     196.63,       0 ! !END!
754 ! X =       307.8350,     5158.631,     200.1,       0 ! !END!
755 ! X =       307.8110,     5158.091,     205,       0 ! !END!
756 ! X =       307.8080,     5158.031,     205.63,       0 ! !END!
757 ! X =       307.8050,     5157.972,     206.6,       0 ! !END!
758 ! X =       307.8030,     5157.912,     208,       0 ! !END!
759 ! X =       307.8000,     5157.852,     209,       0 ! !END!
760 ! X =       307.7970,     5157.792,     210.06,       0 ! !END!
761 ! X =       307.7950,     5157.732,     211,       0 ! !END!
762 ! X =       307.7920,     5157.672,     212,       0 ! !END!
763 ! X =       307.7890,     5157.612,     212,       0 ! !END!
764 ! X =       307.7860,     5157.552,     213,       0 ! !END!
765 ! X =       307.7840,     5157.492,     213,       0 ! !END!
766 ! X =       307.7810,     5157.432,     213,       0 ! !END!
767 ! X =       307.7780,     5157.372,     212.29,       0 ! !END!
768 ! X =       307.7760,     5157.312,     212,       0 ! !END!
769 ! X =       307.7730,     5157.252,     212.6,       0 ! !END!
770 ! X =       307.9400,     5159.647,     182,       0 ! !END!
771 ! X =       307.9370,     5159.587,     182,       0 ! !END!
772 ! X =       307.9350,     5159.527,     182.77,       0 ! !END!
773 ! X =       307.9320,     5159.467,     184,       0 ! !END!
774 ! X =       307.9290,     5159.407,     185,       0 ! !END!
775 ! X =       307.9270,     5159.347,     183.18,       0 ! !END!
776 ! X =       307.9240,     5159.288,     180.27,       0 ! !END!
777 ! X =       307.9210,     5159.228,     179,       0 ! !END!
778 ! X =       307.9190,     5159.168,     179,       0 ! !END!
779 ! X =       307.9160,     5159.108,     178.36,       0 ! !END!
780 ! X =       307.9130,     5159.048,     178.8,       0 ! !END!
781 ! X =       307.9110,     5158.988,     179.73,       0 ! !END!
782 ! X =       307.9080,     5158.928,     183.03,       0 ! !END!
783 ! X =       307.9050,     5158.868,     187.97,       0 ! !END!
784 ! X =       307.9030,     5158.808,     190.57,       0 ! !END!
785 ! X =       307.9000,     5158.748,     193.22,       0 ! !END!
786 ! X =       307.8680,     5158.029,     205.7,       0 ! !END!
787 ! X =       307.8650,     5157.969,     206.7,       0 ! !END!
788 ! X =       307.8620,     5157.909,     208,       0 ! !END!
789 ! X =       307.8600,     5157.849,     209,       0 ! !END!
790 ! X =       307.8570,     5157.789,     210,       0 ! !END!
791 ! X =       307.8540,     5157.729,     210.7,       0 ! !END!
792 ! X =       307.8520,     5157.669,     211,       0 ! !END!
793 ! X =       307.8490,     5157.609,     211.89,       0 ! !END!
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794 ! X =       307.8460,     5157.549,     212.37,       0 ! !END!
795 ! X =       307.8440,     5157.489,     213,       0 ! !END!
796 ! X =       307.8410,     5157.429,     212.3,       0 ! !END!
797 ! X =       307.8380,     5157.369,     211.22,       0 ! !END!
798 ! X =       307.8360,     5157.31,     210.67,       0 ! !END!
799 ! X =       307.8330,     5157.249,     211.5,       0 ! !END!
800 ! X =       308.0000,     5159.645,     182,       0 ! !END!
801 ! X =       307.9970,     5159.585,     182,       0 ! !END!
802 ! X =       307.9950,     5159.525,     182.83,       0 ! !END!
803 ! X =       307.9920,     5159.465,     184,       0 ! !END!
804 ! X =       307.9890,     5159.405,     184.75,       0 ! !END!
805 ! X =       307.9870,     5159.345,     182.17,       0 ! !END!
806 ! X =       307.9840,     5159.285,     180.17,       0 ! !END!
807 ! X =       307.9810,     5159.225,     179.13,       0 ! !END!
808 ! X =       307.9790,     5159.165,     178.17,       0 ! !END!
809 ! X =       307.9760,     5159.105,     178,       0 ! !END!
810 ! X =       307.9730,     5159.045,     178.83,       0 ! !END!
811 ! X =       307.9710,     5158.985,     179.95,       0 ! !END!
812 ! X =       307.9680,     5158.925,     182.83,       0 ! !END!
813 ! X =       307.9650,     5158.865,     187.17,       0 ! !END!
814 ! X =       307.9630,     5158.805,     189.83,       0 ! !END!
815 ! X =       307.9280,     5158.026,     205.8,       0 ! !END!
816 ! X =       307.9250,     5157.966,     206.8,       0 ! !END!
817 ! X =       307.9220,     5157.906,     208,       0 ! !END!
818 ! X =       307.9200,     5157.846,     209,       0 ! !END!
819 ! X =       307.9170,     5157.786,     210,       0 ! !END!
820 ! X =       307.9140,     5157.726,     210.16,       0 ! !END!
821 ! X =       307.9120,     5157.666,     211,       0 ! !END!
822 ! X =       307.9090,     5157.607,     212,       0 ! !END!
823 ! X =       307.9060,     5157.547,     213.77,       0 ! !END!
824 ! X =       307.9040,     5157.487,     214.77,       0 ! !END!
825 ! X =       307.9010,     5157.427,     213.23,       0 ! !END!
826 ! X =       307.8980,     5157.367,     211.23,       0 ! !END!
827 ! X =       307.8960,     5157.307,     208.43,       0 ! !END!
828 ! X =       307.8930,     5157.247,     209.77,       0 ! !END!
829 ! X =       308.0600,     5159.642,     182.93,       0 ! !END!
830 ! X =       308.0570,     5159.582,     182,       0 ! !END!
831 ! X =       308.0550,     5159.522,     182,       0 ! !END!
832 ! X =       308.0520,     5159.462,     183,       0 ! !END!
833 ! X =       308.0490,     5159.402,     183.7,       0 ! !END!
834 ! X =       308.0470,     5159.342,     182.07,       0 ! !END!
835 ! X =       308.0440,     5159.282,     180.07,       0 ! !END!
836 ! X =       308.0410,     5159.222,     178.1,       0 ! !END!
837 ! X =       308.0390,     5159.162,     178,       0 ! !END!
838 ! X =       308.0360,     5159.102,     177.88,       0 ! !END!
839 ! X =       308.0330,     5159.042,     178.93,       0 ! !END!
840 ! X =       308.0310,     5158.982,     180,       0 ! !END!
841 ! X =       308.0280,     5158.923,     182.84,       0 ! !END!
842 ! X =       308.0250,     5158.863,     185.9,       0 ! !END!
843 ! X =       307.9880,     5158.023,     205.9,       0 ! !END!
844 ! X =       307.9850,     5157.964,     206.87,       0 ! !END!
845 ! X =       307.9820,     5157.904,     208,       0 ! !END!
846 ! X =       307.9800,     5157.844,     209,       0 ! !END!
847 ! X =       307.9770,     5157.784,     210,       0 ! !END!
848 ! X =       307.9740,     5157.724,     210,       0 ! !END!
849 ! X =       307.9720,     5157.664,     211,       0 ! !END!
850 ! X =       307.9690,     5157.604,     212,       0 ! !END!
851 ! X =       307.9660,     5157.544,     213.4,       0 ! !END!
852 ! X =       307.9640,     5157.484,     214.46,       0 ! !END!
853 ! X =       307.9610,     5157.424,     213.13,       0 ! !END!
854 ! X =       307.9580,     5157.364,     211.13,       0 ! !END!
855 ! X =       307.9560,     5157.304,     209.13,       0 ! !END!
856 ! X =       307.9530,     5157.244,     209,       0 ! !END!
857 ! X =       308.1200,     5159.639,     183,       0 ! !END!
858 ! X =       308.1170,     5159.579,     182,       0 ! !END!
859 ! X =       308.1150,     5159.519,     182.02,       0 ! !END!
860 ! X =       308.1120,     5159.459,     182.99,       0 ! !END!
861 ! X =       308.1090,     5159.399,     182.99,       0 ! !END!
862 ! X =       308.1060,     5159.339,     181.77,       0 ! !END!
863 ! X =       308.1040,     5159.28,     180,       0 ! !END!
864 ! X =       308.1010,     5159.22,     179,       0 ! !END!
865 ! X =       308.0980,     5159.16,     178,       0 ! !END!
866 ! X =       308.0960,     5159.1,     178,       0 ! !END!
867 ! X =       308.0930,     5159.04,     179,       0 ! !END!
868 ! X =       308.0900,     5158.98,     180,       0 ! !END!
869 ! X =       308.0880,     5158.92,     184,       0 ! !END!
870 ! X =       308.0850,     5158.86,     187,       0 ! !END!
871 ! X =       308.0450,     5157.961,     206.97,       0 ! !END!
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872 ! X =       308.0420,     5157.901,     208,       0 ! !END!
873 ! X =       308.0400,     5157.841,     209,       0 ! !END!
874 ! X =       308.0370,     5157.781,     210,       0 ! !END!
875 ! X =       308.0340,     5157.721,     210.8,       0 ! !END!
876 ! X =       308.0320,     5157.661,     211.71,       0 ! !END!
877 ! X =       308.0290,     5157.601,     211.99,       0 ! !END!
878 ! X =       308.0260,     5157.541,     212.45,       0 ! !END!
879 ! X =       308.0240,     5157.481,     212.53,       0 ! !END!
880 ! X =       308.0210,     5157.421,     211.67,       0 ! !END!
881 ! X =       308.0180,     5157.361,     210.74,       0 ! !END!
882 ! X =       308.0160,     5157.301,     209.03,       0 ! !END!
883 ! X =       308.0130,     5157.241,     209,       0 ! !END!
884 ! X =       308.1800,     5159.636,     183,       0 ! !END!
885 ! X =       308.1770,     5159.577,     181.94,       0 ! !END!
886 ! X =       308.1740,     5159.517,     181.58,       0 ! !END!
887 ! X =       308.1720,     5159.457,     182,       0 ! !END!
888 ! X =       308.1690,     5159.397,     182.63,       0 ! !END!
889 ! X =       308.1660,     5159.337,     180.98,       0 ! !END!
890 ! X =       308.1640,     5159.277,     179.91,       0 ! !END!
891 ! X =       308.1610,     5159.217,     179,       0 ! !END!
892 ! X =       308.1580,     5159.157,     178.1,       0 ! !END!
893 ! X =       308.1560,     5159.097,     177.91,       0 ! !END!
894 ! X =       308.1530,     5159.037,     179.1,       0 ! !END!
895 ! X =       308.1500,     5158.977,     180.2,       0 ! !END!
896 ! X =       308.1480,     5158.917,     183.56,       0 ! !END!
897 ! X =       308.1450,     5158.857,     187.05,       0 ! !END!
898 ! X =       308.1050,     5157.958,     206.06,       0 ! !END!
899 ! X =       308.1020,     5157.898,     208,       0 ! !END!
900 ! X =       308.1000,     5157.838,     209,       0 ! !END!
901 ! X =       308.0970,     5157.778,     210.01,       0 ! !END!
902 ! X =       308.0940,     5157.718,     210.27,       0 ! !END!
903 ! X =       308.0920,     5157.658,     211.27,       0 ! !END!
904 ! X =       308.0890,     5157.599,     211.39,       0 ! !END!
905 ! X =       308.0860,     5157.539,     212,       0 ! !END!
906 ! X =       308.0840,     5157.479,     212,       0 ! !END!
907 ! X =       308.0810,     5157.419,     211,       0 ! !END!
908 ! X =       308.0780,     5157.359,     210,       0 ! !END!
909 ! X =       308.0750,     5157.299,     209,       0 ! !END!
910 ! X =       308.0730,     5157.239,     209,       0 ! !END!
911 ! X =       308.2400,     5159.634,     183,       0 ! !END!
912 ! X =       308.2370,     5159.574,     181.8,       0 ! !END!
913 ! X =       308.2340,     5159.514,     181,       0 ! !END!
914 ! X =       308.2320,     5159.454,     181.52,       0 ! !END!
915 ! X =       308.2290,     5159.394,     181.56,       0 ! !END!
916 ! X =       308.2260,     5159.334,     180.64,       0 ! !END!
917 ! X =       308.2240,     5159.274,     178.8,       0 ! !END!
918 ! X =       308.2210,     5159.214,     178.97,       0 ! !END!
919 ! X =       308.2180,     5159.154,     178.25,       0 ! !END!
920 ! X =       308.2160,     5159.094,     178,       0 ! !END!
921 ! X =       308.2130,     5159.034,     179.05,       0 ! !END!
922 ! X =       308.2100,     5158.974,     180.27,       0 ! !END!
923 ! X =       308.2080,     5158.915,     182.73,       0 ! !END!
924 ! X =       308.2050,     5158.855,     186.17,       0 ! !END!
925 ! X =       308.1620,     5157.896,     205,       0 ! !END!
926 ! X =       308.1600,     5157.836,     206.13,       0 ! !END!
927 ! X =       308.1570,     5157.776,     207.32,       0 ! !END!
928 ! X =       308.1540,     5157.716,     209.31,       0 ! !END!
929 ! X =       308.1510,     5157.656,     210.3,       0 ! !END!
930 ! X =       308.1490,     5157.596,     211.05,       0 ! !END!
931 ! X =       308.1460,     5157.536,     211.54,       0 ! !END!
932 ! X =       308.1430,     5157.476,     212,       0 ! !END!
933 ! X =       308.1410,     5157.416,     211,       0 ! !END!
934 ! X =       308.1380,     5157.356,     210,       0 ! !END!
935 ! X =       308.1350,     5157.296,     209.17,       0 ! !END!
936 ! X =       308.1330,     5157.236,     209.22,       0 ! !END!
937 ! X =       308.3000,     5159.631,     182.7,       0 ! !END!
938 ! X =       308.2970,     5159.571,     181.7,       0 ! !END!
939 ! X =       308.2940,     5159.511,     181,       0 ! !END!
940 ! X =       308.2920,     5159.451,     181.7,       0 ! !END!
941 ! X =       308.2890,     5159.391,     181.49,       0 ! !END!
942 ! X =       308.2860,     5159.331,     179.7,       0 ! !END!
943 ! X =       308.2840,     5159.271,     177.7,       0 ! !END!
944 ! X =       308.2810,     5159.212,     177.27,       0 ! !END!
945 ! X =       308.2780,     5159.152,     178.27,       0 ! !END!
946 ! X =       308.2760,     5159.092,     178.23,       0 ! !END!
947 ! X =       308.2730,     5159.032,     178.62,       0 ! !END!
948 ! X =       308.2700,     5158.972,     179.36,       0 ! !END!
949 ! X =       308.2680,     5158.912,     181.77,       0 ! !END!
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950 ! X =       308.2650,     5158.852,     184.77,       0 ! !END!
951 ! X =       308.2220,     5157.893,     205,       0 ! !END!
952 ! X =       308.2190,     5157.833,     205.23,       0 ! !END!
953 ! X =       308.2170,     5157.773,     207,       0 ! !END!
954 ! X =       308.2140,     5157.713,     208,       0 ! !END!
955 ! X =       308.2110,     5157.653,     209.23,       0 ! !END!
956 ! X =       308.2090,     5157.593,     210,       0 ! !END!
957 ! X =       308.2060,     5157.533,     211,       0 ! !END!
958 ! X =       308.2030,     5157.473,     212,       0 ! !END!
959 ! X =       308.2010,     5157.413,     212,       0 ! !END!
960 ! X =       308.1980,     5157.353,     212,       0 ! !END!
961 ! X =       308.1950,     5157.293,     212,       0 ! !END!
962 ! X =       308.1930,     5157.233,     212,       0 ! !END!
963 ! X =       308.3600,     5159.628,     182.6,       0 ! !END!
964 ! X =       308.3570,     5159.569,     181.63,       0 ! !END!
965 ! X =       308.3540,     5159.509,     181,       0 ! !END!
966 ! X =       308.3520,     5159.449,     181,       0 ! !END!
967 ! X =       308.3490,     5159.389,     180.63,       0 ! !END!
968 ! X =       308.3460,     5159.329,     178.83,       0 ! !END!
969 ! X =       308.3440,     5159.269,     177.77,       0 ! !END!
970 ! X =       308.3410,     5159.209,     177.67,       0 ! !END!
971 ! X =       308.3380,     5159.149,     178.02,       0 ! !END!
972 ! X =       308.3360,     5159.089,     178,       0 ! !END!
973 ! X =       308.3330,     5159.029,     177.87,       0 ! !END!
974 ! X =       308.3300,     5158.969,     178.37,       0 ! !END!
975 ! X =       308.3280,     5158.909,     180.51,       0 ! !END!
976 ! X =       308.3250,     5158.849,     182.87,       0 ! !END!
977 ! X =       308.2820,     5157.89,     205,       0 ! !END!
978 ! X =       308.2790,     5157.83,     205.33,       0 ! !END!
979 ! X =       308.2770,     5157.77,     207,       0 ! !END!
980 ! X =       308.2740,     5157.71,     208,       0 ! !END!
981 ! X =       308.2710,     5157.65,     209.1,       0 ! !END!
982 ! X =       308.2690,     5157.59,     210,       0 ! !END!
983 ! X =       308.2660,     5157.531,     211,       0 ! !END!
984 ! X =       308.2630,     5157.471,     212,       0 ! !END!
985 ! X =       308.2610,     5157.411,     212,       0 ! !END!
986 ! X =       308.2580,     5157.351,     211.73,       0 ! !END!
987 ! X =       308.2550,     5157.291,     211.83,       0 ! !END!
988 ! X =       308.2530,     5157.23,     211.93,       0 ! !END!
989 ! X =       308.4200,     5159.626,     183.53,       0 ! !END!
990 ! X =       308.4170,     5159.566,     182.53,       0 ! !END!
991 ! X =       308.4140,     5159.506,     181.53,       0 ! !END!
992 ! X =       308.4120,     5159.446,     181,       0 ! !END!
993 ! X =       308.4090,     5159.386,     180.51,       0 ! !END!
994 ! X =       308.4060,     5159.326,     179.63,       0 ! !END!
995 ! X =       308.4040,     5159.266,     178.6,       0 ! !END!
996 ! X =       308.4010,     5159.206,     177.48,       0 ! !END!
997 ! X =       308.3980,     5159.146,     177,       0 ! !END!
998 ! X =       308.3950,     5159.086,     178,       0 ! !END!
999 ! X =       308.3930,     5159.026,     179.47,       0 ! !END!
1000 ! X =       308.3900,     5158.966,     180,       0 ! !END!
1001 ! X =       308.3870,     5158.906,     181,       0 ! !END!
1002 ! X =       308.3850,     5158.847,     181,       0 ! !END!
1003 ! X =       308.3420,     5157.888,     208,       0 ! !END!
1004 ! X =       308.3390,     5157.828,     208,       0 ! !END!
1005 ! X =       308.3370,     5157.768,     208,       0 ! !END!
1006 ! X =       308.3340,     5157.708,     208.4,       0 ! !END!
1007 ! X =       308.3310,     5157.648,     209,       0 ! !END!
1008 ! X =       308.3290,     5157.588,     210,       0 ! !END!
1009 ! X =       308.3260,     5157.528,     211,       0 ! !END!
1010 ! X =       308.3230,     5157.468,     212,       0 ! !END!
1011 ! X =       308.3210,     5157.408,     212,       0 ! !END!
1012 ! X =       308.3180,     5157.348,     211,       0 ! !END!
1013 ! X =       308.3150,     5157.288,     211,       0 ! !END!
1014 ! X =       308.3130,     5157.228,     212,       0 ! !END!
1015 ! X =       308.4800,     5159.623,     182.48,       0 ! !END!
1016 ! X =       308.4770,     5159.563,     181.62,       0 ! !END!
1017 ! X =       308.4740,     5159.503,     180.74,       0 ! !END!
1018 ! X =       308.4710,     5159.443,     180.63,       0 ! !END!
1019 ! X =       308.4690,     5159.383,     180,       0 ! !END!
1020 ! X =       308.4660,     5159.323,     179.8,       0 ! !END!
1021 ! X =       308.4630,     5159.263,     178.9,       0 ! !END!
1022 ! X =       308.4610,     5159.204,     178,       0 ! !END!
1023 ! X =       308.4580,     5159.144,     178,       0 ! !END!
1024 ! X =       308.4550,     5159.084,     178,       0 ! !END!
1025 ! X =       308.4530,     5159.024,     178.23,       0 ! !END!
1026 ! X =       308.4500,     5158.964,     178.33,       0 ! !END!
1027 ! X =       308.4470,     5158.904,     178.43,       0 ! !END!
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1028 ! X =       308.4450,     5158.844,     179.27,       0 ! !END!
1029 ! X =       308.4020,     5157.885,     208,       0 ! !END!
1030 ! X =       308.3990,     5157.825,     208,       0 ! !END!
1031 ! X =       308.3970,     5157.765,     208,       0 ! !END!
1032 ! X =       308.3940,     5157.705,     208.5,       0 ! !END!
1033 ! X =       308.3910,     5157.645,     209,       0 ! !END!
1034 ! X =       308.3890,     5157.585,     209.5,       0 ! !END!
1035 ! X =       308.3860,     5157.525,     211,       0 ! !END!
1036 ! X =       308.3830,     5157.465,     212,       0 ! !END!
1037 ! X =       308.3810,     5157.405,     213,       0 ! !END!
1038 ! X =       308.3780,     5157.345,     213,       0 ! !END!
1039 ! X =       308.3750,     5157.285,     214,       0 ! !END!
1040 ! X =       308.3730,     5157.225,     214.05,       0 ! !END!
1041 ! X =       308.5390,     5159.62,     180,       0 ! !END!
1042 ! X =       308.5370,     5159.56,     179.43,       0 ! !END!
1043 ! X =       308.5340,     5159.501,     179.7,       0 ! !END!
1044 ! X =       308.5310,     5159.441,     179.23,       0 ! !END!
1045 ! X =       308.5290,     5159.381,     179,       0 ! !END!
1046 ! X =       308.5260,     5159.321,     178.8,       0 ! !END!
1047 ! X =       308.5230,     5159.261,     178,       0 ! !END!
1048 ! X =       308.5210,     5159.201,     178,       0 ! !END!
1049 ! X =       308.5180,     5159.141,     178,       0 ! !END!
1050 ! X =       308.5150,     5159.081,     178,       0 ! !END!
1051 ! X =       308.5130,     5159.021,     178,       0 ! !END!
1052 ! X =       308.5100,     5158.961,     177.37,       0 ! !END!
1053 ! X =       308.5070,     5158.901,     177.79,       0 ! !END!
1054 ! X =       308.5050,     5158.841,     178,       0 ! !END!
1055 ! X =       308.5020,     5158.781,     180,       0 ! !END!
1056 ! X =       308.4990,     5158.721,     182.27,       0 ! !END!
1057 ! X =       308.4970,     5158.661,     185.27,       0 ! !END!
1058 ! X =       308.4940,     5158.601,     188.63,       0 ! !END!
1059 ! X =       308.4910,     5158.542,     190.6,       0 ! !END!
1060 ! X =       308.4890,     5158.482,     192.63,       0 ! !END!
1061 ! X =       308.4860,     5158.422,     194.6,       0 ! !END!
1062 ! X =       308.4830,     5158.362,     197.2,       0 ! !END!
1063 ! X =       308.4810,     5158.302,     201.2,       0 ! !END!
1064 ! X =       308.4780,     5158.242,     205.2,       0 ! !END!
1065 ! X =       308.4620,     5157.882,     208.04,       0 ! !END!
1066 ! X =       308.4590,     5157.822,     208,       0 ! !END!
1067 ! X =       308.4570,     5157.762,     208.9,       0 ! !END!
1068 ! X =       308.4540,     5157.702,     208.92,       0 ! !END!
1069 ! X =       308.4510,     5157.642,     209,       0 ! !END!
1070 ! X =       308.4490,     5157.582,     209.6,       0 ! !END!
1071 ! X =       308.4460,     5157.523,     211,       0 ! !END!
1072 ! X =       308.4430,     5157.463,     212,       0 ! !END!
1073 ! X =       308.4400,     5157.403,     213,       0 ! !END!
1074 ! X =       308.4380,     5157.343,     214,       0 ! !END!
1075 ! X =       308.4350,     5157.283,     214.57,       0 ! !END!
1076 ! X =       308.4320,     5157.222,     215,       0 ! !END!
1077 ! X =       308.5990,     5159.618,     179,       0 ! !END!
1078 ! X =       308.5970,     5159.558,     178.43,       0 ! !END!
1079 ! X =       308.5940,     5159.498,     179,       0 ! !END!
1080 ! X =       308.5910,     5159.438,     179,       0 ! !END!
1081 ! X =       308.5890,     5159.378,     179,       0 ! !END!
1082 ! X =       308.5860,     5159.318,     178,       0 ! !END!
1083 ! X =       308.5830,     5159.258,     178,       0 ! !END!
1084 ! X =       308.5810,     5159.198,     178,       0 ! !END!
1085 ! X =       308.5780,     5159.138,     178,       0 ! !END!
1086 ! X =       308.5750,     5159.078,     178,       0 ! !END!
1087 ! X =       308.5730,     5159.018,     177,       0 ! !END!
1088 ! X =       308.5700,     5158.958,     177,       0 ! !END!
1089 ! X =       308.5670,     5158.898,     176.85,       0 ! !END!
1090 ! X =       308.5650,     5158.839,     177.35,       0 ! !END!
1091 ! X =       308.5620,     5158.779,     179.3,       0 ! !END!
1092 ! X =       308.5590,     5158.719,     181.4,       0 ! !END!
1093 ! X =       308.5570,     5158.659,     185.03,       0 ! !END!
1094 ! X =       308.5540,     5158.599,     188.66,       0 ! !END!
1095 ! X =       308.5510,     5158.539,     190.7,       0 ! !END!
1096 ! X =       308.5490,     5158.479,     192.7,       0 ! !END!
1097 ! X =       308.5460,     5158.419,     194.7,       0 ! !END!
1098 ! X =       308.5430,     5158.359,     197.4,       0 ! !END!
1099 ! X =       308.5410,     5158.299,     201.4,       0 ! !END!
1100 ! X =       308.5380,     5158.239,     205.4,       0 ! !END!
1101 ! X =       308.5350,     5158.179,     208.7,       0 ! !END!
1102 ! X =       308.5330,     5158.119,     208,       0 ! !END!
1103 ! X =       308.5300,     5158.059,     207,       0 ! !END!
1104 ! X =       308.5270,     5157.999,     206,       0 ! !END!
1105 ! X =       308.5250,     5157.939,     207,       0 ! !END!
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1106 ! X =       308.5220,     5157.879,     208.7,       0 ! !END!
1107 ! X =       308.5190,     5157.82,     209.67,       0 ! !END!
1108 ! X =       308.5160,     5157.76,     209.42,       0 ! !END!
1109 ! X =       308.5140,     5157.7,     209.07,       0 ! !END!
1110 ! X =       308.5110,     5157.64,     208.53,       0 ! !END!
1111 ! X =       308.5080,     5157.58,     209.07,       0 ! !END!
1112 ! X =       308.5060,     5157.52,     210.67,       0 ! !END!
1113 ! X =       308.5030,     5157.46,     211.86,       0 ! !END!
1114 ! X =       308.5000,     5157.4,     213,       0 ! !END!
1115 ! X =       308.4980,     5157.34,     214,       0 ! !END!
1116 ! X =       308.4950,     5157.28,     214.67,       0 ! !END!
1117 ! X =       308.4920,     5157.22,     215,       0 ! !END!
1118 ! X =       308.6590,     5159.615,     178,       0 ! !END!
1119 ! X =       308.6570,     5159.555,     178,       0 ! !END!
1120 ! X =       308.6540,     5159.495,     178.53,       0 ! !END!
1121 ! X =       308.6510,     5159.435,     178.94,       0 ! !END!
1122 ! X =       308.6490,     5159.375,     179,       0 ! !END!
1123 ! X =       308.6460,     5159.315,     178.03,       0 ! !END!
1124 ! X =       308.6430,     5159.255,     178,       0 ! !END!
1125 ! X =       308.6410,     5159.195,     178,       0 ! !END!
1126 ! X =       308.6380,     5159.136,     178,       0 ! !END!
1127 ! X =       308.6350,     5159.076,     177.03,       0 ! !END!
1128 ! X =       308.6330,     5159.016,     176.2,       0 ! !END!
1129 ! X =       308.6300,     5158.956,     175.47,       0 ! !END!
1130 ! X =       308.6270,     5158.896,     175.09,       0 ! !END!
1131 ! X =       308.6250,     5158.836,     175.9,       0 ! !END!
1132 ! X =       308.6220,     5158.776,     177.72,       0 ! !END!
1133 ! X =       308.6190,     5158.716,     180.36,       0 ! !END!
1134 ! X =       308.6170,     5158.656,     184.17,       0 ! !END!
1135 ! X =       308.6140,     5158.596,     188.47,       0 ! !END!
1136 ! X =       308.6110,     5158.536,     190.8,       0 ! !END!
1137 ! X =       308.6090,     5158.476,     192.03,       0 ! !END!
1138 ! X =       308.6060,     5158.416,     193.93,       0 ! !END!
1139 ! X =       308.6030,     5158.356,     195.83,       0 ! !END!
1140 ! X =       308.6000,     5158.296,     199.93,       0 ! !END!
1141 ! X =       308.5980,     5158.236,     204.48,       0 ! !END!
1142 ! X =       308.5950,     5158.177,     207.77,       0 ! !END!
1143 ! X =       308.5920,     5158.117,     207.23,       0 ! !END!
1144 ! X =       308.5900,     5158.057,     207,       0 ! !END!
1145 ! X =       308.5870,     5157.997,     206,       0 ! !END!
1146 ! X =       308.5840,     5157.937,     207,       0 ! !END!
1147 ! X =       308.5820,     5157.877,     208.77,       0 ! !END!
1148 ! X =       308.5790,     5157.817,     209.77,       0 ! !END!
1149 ! X =       308.5760,     5157.757,     209.23,       0 ! !END!
1150 ! X =       308.5740,     5157.697,     209,       0 ! !END!
1151 ! X =       308.5710,     5157.637,     208.23,       0 ! !END!
1152 ! X =       308.5680,     5157.577,     208.77,       0 ! !END!
1153 ! X =       308.5660,     5157.517,     210.77,       0 ! !END!
1154 ! X =       308.5630,     5157.457,     211.77,       0 ! !END!
1155 ! X =       308.5600,     5157.397,     213,       0 ! !END!
1156 ! X =       308.5580,     5157.337,     213.94,       0 ! !END!
1157 ! X =       308.5550,     5157.277,     214.64,       0 ! !END!
1158 ! X =       308.5520,     5157.217,     214.93,       0 ! !END!
1159 ! X =       308.7190,     5159.612,     177,       0 ! !END!
1160 ! X =       308.7170,     5159.552,     177,       0 ! !END!
1161 ! X =       308.7140,     5159.493,     178,       0 ! !END!
1162 ! X =       308.7110,     5159.433,     178,       0 ! !END!
1163 ! X =       308.7090,     5159.373,     179,       0 ! !END!
1164 ! X =       308.7060,     5159.313,     178.1,       0 ! !END!
1165 ! X =       308.7030,     5159.253,     178,       0 ! !END!
1166 ! X =       308.7010,     5159.193,     178,       0 ! !END!
1167 ! X =       308.6980,     5159.133,     178,       0 ! !END!
1168 ! X =       308.6950,     5159.073,     177.83,       0 ! !END!
1169 ! X =       308.6930,     5159.013,     176.87,       0 ! !END!
1170 ! X =       308.6900,     5158.953,     175.57,       0 ! !END!
1171 ! X =       308.6870,     5158.893,     174,       0 ! !END!
1172 ! X =       308.6840,     5158.833,     175.9,       0 ! !END!
1173 ! X =       308.6820,     5158.773,     177.5,       0 ! !END!
1174 ! X =       308.6790,     5158.713,     180.5,       0 ! !END!
1175 ! X =       308.6760,     5158.653,     183.78,       0 ! !END!
1176 ! X =       308.6740,     5158.593,     187.8,       0 ! !END!
1177 ! X =       308.6710,     5158.533,     190.9,       0 ! !END!
1178 ! X =       308.6680,     5158.474,     191.87,       0 ! !END!
1179 ! X =       308.6660,     5158.414,     193,       0 ! !END!
1180 ! X =       308.6630,     5158.354,     195.73,       0 ! !END!
1181 ! X =       308.6600,     5158.294,     199.73,       0 ! !END!
1182 ! X =       308.6580,     5158.234,     203.73,       0 ! !END!
1183 ! X =       308.6550,     5158.174,     207.87,       0 ! !END!
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1184 ! X =       308.6520,     5158.114,     207.13,       0 ! !END!
1185 ! X =       308.6500,     5158.054,     207,       0 ! !END!
1186 ! X =       308.6470,     5157.994,     206,       0 ! !END!
1187 ! X =       308.6440,     5157.934,     207,       0 ! !END!
1188 ! X =       308.6420,     5157.874,     208,       0 ! !END!
1189 ! X =       308.6390,     5157.814,     209.87,       0 ! !END!
1190 ! X =       308.6360,     5157.754,     209.13,       0 ! !END!
1191 ! X =       308.6340,     5157.694,     208.31,       0 ! !END!
1192 ! X =       308.6310,     5157.634,     207.43,       0 ! !END!
1193 ! X =       308.6280,     5157.574,     208.27,       0 ! !END!
1194 ! X =       308.6260,     5157.514,     209.93,       0 ! !END!
1195 ! X =       308.6230,     5157.455,     211.83,       0 ! !END!
1196 ! X =       308.6200,     5157.395,     213,       0 ! !END!
1197 ! X =       308.6180,     5157.335,     213,       0 ! !END!
1198 ! X =       308.6150,     5157.275,     212.14,       0 ! !END!
1199 ! X =       308.6120,     5157.214,     212,       0 ! !END!
1200 ! X =       308.7790,     5159.61,     177,       0 ! !END!
1201 ! X =       308.7770,     5159.55,     177,       0 ! !END!
1202 ! X =       308.7740,     5159.49,     178,       0 ! !END!
1203 ! X =       308.7710,     5159.43,     178,       0 ! !END!
1204 ! X =       308.7690,     5159.37,     179,       0 ! !END!
1205 ! X =       308.7660,     5159.31,     178,       0 ! !END!
1206 ! X =       308.7630,     5159.25,     178,       0 ! !END!
1207 ! X =       308.7600,     5159.19,     178,       0 ! !END!
1208 ! X =       308.7580,     5159.13,     178,       0 ! !END!
1209 ! X =       308.7550,     5159.07,     178,       0 ! !END!
1210 ! X =       308.7520,     5159.01,     178,       0 ! !END!
1211 ! X =       308.7500,     5158.95,     174,       0 ! !END!
1212 ! X =       308.7470,     5158.89,     174,       0 ! !END!
1213 ! X =       308.7440,     5158.831,     175.95,       0 ! !END!
1214 ! X =       308.7420,     5158.771,     176.97,       0 ! !END!
1215 ! X =       308.7390,     5158.711,     178.96,       0 ! !END!
1216 ! X =       308.7360,     5158.651,     183.89,       0 ! !END!
1217 ! X =       308.7340,     5158.591,     187.93,       0 ! !END!
1218 ! X =       308.7310,     5158.531,     190.97,       0 ! !END!
1219 ! X =       308.7280,     5158.471,     192.9,       0 ! !END!
1220 ! X =       308.7260,     5158.411,     194.83,       0 ! !END!
1221 ! X =       308.7230,     5158.351,     197.47,       0 ! !END!
1222 ! X =       308.7200,     5158.291,     200.62,       0 ! !END!
1223 ! X =       308.7180,     5158.231,     204.92,       0 ! !END!
1224 ! X =       308.7150,     5158.171,     207.97,       0 ! !END!
1225 ! X =       308.7120,     5158.111,     207.03,       0 ! !END!
1226 ! X =       308.7100,     5158.051,     207,       0 ! !END!
1227 ! X =       308.7070,     5157.991,     206,       0 ! !END!
1228 ! X =       308.7040,     5157.931,     207,       0 ! !END!
1229 ! X =       308.7020,     5157.871,     208,       0 ! !END!
1230 ! X =       308.6990,     5157.812,     209.93,       0 ! !END!
1231 ! X =       308.6960,     5157.752,     209.07,       0 ! !END!
1232 ! X =       308.6940,     5157.692,     208.07,       0 ! !END!
1233 ! X =       308.6910,     5157.632,     207.02,       0 ! !END!
1234 ! X =       308.6880,     5157.572,     207.33,       0 ! !END!
1235 ! X =       308.6860,     5157.512,     209.4,       0 ! !END!
1236 ! X =       308.6830,     5157.452,     211.9,       0 ! !END!
1237 ! X =       308.6800,     5157.392,     213,       0 ! !END!
1238 ! X =       308.6780,     5157.332,     212,       0 ! !END!
1239 ! X =       308.6750,     5157.272,     211.06,       0 ! !END!
1240 ! X =       308.6720,     5157.212,     210.93,       0 ! !END!
1241 ! X =       308.8390,     5159.607,     176.37,       0 ! !END!
1242 ! X =       308.8360,     5159.547,     177.05,       0 ! !END!
1243 ! X =       308.8340,     5159.487,     178,       0 ! !END!
1244 ! X =       308.8310,     5159.427,     178.1,       0 ! !END!
1245 ! X =       308.8280,     5159.367,     179,       0 ! !END!
1246 ! X =       308.8260,     5159.307,     178,       0 ! !END!
1247 ! X =       308.8230,     5159.247,     178,       0 ! !END!
1248 ! X =       308.8200,     5159.187,     178,       0 ! !END!
1249 ! X =       308.8180,     5159.128,     178,       0 ! !END!
1250 ! X =       308.8150,     5159.068,     178,       0 ! !END!
1251 ! X =       308.8120,     5159.008,     177.93,       0 ! !END!
1252 ! X =       308.8100,     5158.948,     174,       0 ! !END!
1253 ! X =       308.8070,     5158.888,     174,       0 ! !END!
1254 ! X =       308.8040,     5158.828,     175.13,       0 ! !END!
1255 ! X =       308.8020,     5158.768,     176.07,       0 ! !END!
1256 ! X =       308.7990,     5158.708,     178.79,       0 ! !END!
1257 ! X =       308.7960,     5158.648,     184.13,       0 ! !END!
1258 ! X =       308.7940,     5158.588,     188.13,       0 ! !END!
1259 ! X =       308.7910,     5158.528,     191.07,       0 ! !END!
1260 ! X =       308.7880,     5158.468,     194.07,       0 ! !END!
1261 ! X =       308.7860,     5158.408,     196.08,       0 ! !END!
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1262 ! X =       308.7830,     5158.348,     199.08,       0 ! !END!
1263 ! X =       308.7800,     5158.288,     202.13,       0 ! !END!
1264 ! X =       308.7780,     5158.228,     205.13,       0 ! !END!
1265 ! X =       308.7750,     5158.168,     207.97,       0 ! !END!
1266 ! X =       308.7720,     5158.109,     207,       0 ! !END!
1267 ! X =       308.7700,     5158.049,     206,       0 ! !END!
1268 ! X =       308.7670,     5157.989,     205.03,       0 ! !END!
1269 ! X =       308.7640,     5157.929,     206.87,       0 ! !END!
1270 ! X =       308.7620,     5157.869,     208.03,       0 ! !END!
1271 ! X =       308.7590,     5157.809,     210,       0 ! !END!
1272 ! X =       308.7560,     5157.749,     208.97,       0 ! !END!
1273 ! X =       308.7540,     5157.689,     207,       0 ! !END!
1274 ! X =       308.7510,     5157.629,     205.97,       0 ! !END!
1275 ! X =       308.7480,     5157.569,     206.05,       0 ! !END!
1276 ! X =       308.7460,     5157.509,     208.52,       0 ! !END!
1277 ! X =       308.7430,     5157.449,     211.05,       0 ! !END!
1278 ! X =       308.7400,     5157.389,     212.63,       0 ! !END!
1279 ! X =       308.7380,     5157.329,     210.72,       0 ! !END!
1280 ! X =       308.7350,     5157.269,     209.64,       0 ! !END!
1281 ! X =       308.7320,     5157.209,     208.9,       0 ! !END!
1282 ! X =       308.8990,     5159.604,     173.86,       0 ! !END!
1283 ! X =       308.8960,     5159.544,     175.57,       0 ! !END!
1284 ! X =       308.8940,     5159.484,     177.63,       0 ! !END!
1285 ! X =       308.8910,     5159.425,     178.11,       0 ! !END!
1286 ! X =       308.8880,     5159.365,     179,       0 ! !END!
1287 ! X =       308.8860,     5159.305,     178,       0 ! !END!
1288 ! X =       308.8830,     5159.245,     178.25,       0 ! !END!
1289 ! X =       308.8800,     5159.185,     179,       0 ! !END!
1290 ! X =       308.8780,     5159.125,     178.93,       0 ! !END!
1291 ! X =       308.8750,     5159.065,     179,       0 ! !END!
1292 ! X =       308.8720,     5159.005,     177.83,       0 ! !END!
1293 ! X =       308.8700,     5158.945,     174,       0 ! !END!
1294 ! X =       308.8670,     5158.885,     174,       0 ! !END!
1295 ! X =       308.8640,     5158.825,     174,       0 ! !END!
1296 ! X =       308.8620,     5158.765,     174.33,       0 ! !END!
1297 ! X =       308.8590,     5158.705,     177.28,       0 ! !END!
1298 ! X =       308.8560,     5158.645,     183.17,       0 ! !END!
1299 ! X =       308.8540,     5158.585,     188.22,       0 ! !END!
1300 ! X =       308.8510,     5158.525,     191.17,       0 ! !END!
1301 ! X =       308.8480,     5158.466,     194.13,       0 ! !END!
1302 ! X =       308.8460,     5158.406,     196.13,       0 ! !END!
1303 ! X =       308.8430,     5158.346,     199.27,       0 ! !END!
1304 ! X =       308.8400,     5158.286,     202.27,       0 ! !END!
1305 ! X =       308.8380,     5158.226,     206.13,       0 ! !END!
1306 ! X =       308.8350,     5158.166,     208.87,       0 ! !END!
1307 ! X =       308.8320,     5158.106,     207.87,       0 ! !END!
1308 ! X =       308.8300,     5158.046,     206,       0 ! !END!
1309 ! X =       308.8270,     5157.986,     205.13,       0 ! !END!
1310 ! X =       308.8240,     5157.926,     206.13,       0 ! !END!
1311 ! X =       308.8220,     5157.866,     208.13,       0 ! !END!
1312 ! X =       308.8190,     5157.806,     209.13,       0 ! !END!
1313 ! X =       308.8160,     5157.746,     208.87,       0 ! !END!
1314 ! X =       308.8140,     5157.686,     207,       0 ! !END!
1315 ! X =       308.8110,     5157.626,     205.87,       0 ! !END!
1316 ! X =       308.8080,     5157.566,     206.05,       0 ! !END!
1317 ! X =       308.8050,     5157.506,     207.57,       0 ! !END!
1318 ! X =       308.8030,     5157.447,     209.23,       0 ! !END!
1319 ! X =       308.8000,     5157.387,     210.23,       0 ! !END!
1320 ! X =       308.7970,     5157.327,     208.67,       0 ! !END!
1321 ! X =       308.7950,     5157.267,     206.98,       0 ! !END!
1322 ! X =       308.7920,     5157.206,     206.26,       0 ! !END!
1323 ! X =       308.9590,     5159.602,     171,       0 ! !END!
1324 ! X =       308.9560,     5159.542,     173.73,       0 ! !END!
1325 ! X =       308.9540,     5159.482,     176.53,       0 ! !END!
1326 ! X =       308.9510,     5159.422,     178,       0 ! !END!
1327 ! X =       308.9480,     5159.362,     178.27,       0 ! !END!
1328 ! X =       308.9460,     5159.302,     178.27,       0 ! !END!
1329 ! X =       308.9430,     5159.242,     179,       0 ! !END!
1330 ! X =       308.9400,     5159.182,     179.27,       0 ! !END!
1331 ! X =       308.9380,     5159.122,     179.73,       0 ! !END!
1332 ! X =       308.9350,     5159.062,     178.73,       0 ! !END!
1333 ! X =       308.9320,     5159.002,     177.2,       0 ! !END!
1334 ! X =       308.9300,     5158.942,     175.33,       0 ! !END!
1335 ! X =       308.9270,     5158.882,     174.17,       0 ! !END!
1336 ! X =       308.9240,     5158.822,     173.53,       0 ! !END!
1337 ! X =       308.9220,     5158.763,     173.6,       0 ! !END!
1338 ! X =       308.9190,     5158.703,     175.17,       0 ! !END!
1339 ! X =       308.9160,     5158.643,     181.5,       0 ! !END!
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! X =      308.9140,     5158.583,     187.57,       0 ! !END!
! X =      308.9110,     5158.523,     191.23,       0 ! !END!
! X =      308.9080,     5158.463,     193.52,       0 ! !END!
! X =      308.9060,     5158.403,     196.23,       0 ! !END!
! X =      308.9030,     5158.343,     198.47,       0 ! !END!
! X =      308.9000,     5158.283,     201.13,       0 ! !END!
! X =      308.8980,     5158.223,     204.13,       0 ! !END!
! X =      308.8950,     5158.163,     206.5,       0 ! !END!
! X =      308.8920,     5158.103,     205.97,       0 ! !END!
! X =      308.8890,     5158.043,     205.24,       0 ! !END!
! X =      308.8870,     5157.983,     204.82,       0 ! !END!
! X =      308.8840,     5157.923,     206.1,       0 ! !END!
! X =      308.8810,     5157.863,     207.23,       0 ! !END!
! X =      308.8790,     5157.803,     209.23,       0 ! !END!
! X =      308.8760,     5157.744,     208.8,       0 ! !END!
! X =      308.8730,     5157.684,     207,       0 ! !END!
! X =      308.8710,     5157.624,     205.8,       0 ! !END!
! X =      308.8680,     5157.564,     205.52,       0 ! !END!
! X =      308.8650,     5157.504,     206.6,       0 ! !END!
! X =      308.8630,     5157.444,     207.65,       0 ! !END!
! X =      308.8600,     5157.384,     207.93,       0 ! !END!
! X =      308.8570,     5157.324,     206.95,       0 ! !END!
! X =      308.8550,     5157.264,     205.67,       0 ! !END!
! X =      308.8520,     5157.204,     205.13,       0 ! !END!
! X =      309.0190,     5159.599,     167.87,       0 ! !END!
! X =      309.0160,     5159.539,     171,       0 ! !END!
! X =      309.0140,     5159.479,     173.9,       0 ! !END!
! X =      309.0110,     5159.419,     176.63,       0 ! !END!
! X =      309.0080,     5159.359,     177.27,       0 ! !END!
! X =      309.0060,     5159.299,     178,       0 ! !END!
! X =      309.0030,     5159.239,     178.94,       0 ! !END!
! X =      309.0000,     5159.179,     179,       0 ! !END!
! X =      308.9980,     5159.12,     178.69,       0 ! !END!
! X =      308.9950,     5159.06,     177.11,       0 ! !END!
! X =      308.9920,     5159,     175.67,       0 ! !END!
! X =      308.9900,     5158.94,     173.78,       0 ! !END!
! X =      308.9870,     5158.88,     172.1,       0 ! !END!
! X =      308.9840,     5158.82,     170.53,       0 ! !END!
! X =      308.9820,     5158.76,     170.6,       0 ! !END!
! X =      308.9790,     5158.7,     172.57,       0 ! !END!
! X =      308.9760,     5158.64,     179.73,       0 ! !END!
! X =      308.9740,     5158.58,     187,       0 ! !END!
! X =      308.9710,     5158.52,     190.32,       0 ! !END!
! X =      308.9680,     5158.46,     191.09,       0 ! !END!
! X =      308.9650,     5158.4,     191.56,       0 ! !END!
! X =      308.9630,     5158.34,     192.34,       0 ! !END!
! X =      308.9600,     5158.28,     195,       0 ! !END!
! X =      308.9570,     5158.22,     197.69,       0 ! !END!
! X =      308.9550,     5158.16,     200,       0 ! !END!
! X =      308.9520,     5158.101,     200.8,       0 ! !END!
! X =      308.9490,     5158.041,     202.19,       0 ! !END!
! X =      308.9470,     5157.981,     202.6,       0 ! !END!
! X =      308.9440,     5157.921,     203.99,       0 ! !END!
! X =      308.9410,     5157.861,     205.19,       0 ! !END!
! X =      308.9390,     5157.801,     206.11,       0 ! !END!
! X =      308.9360,     5157.741,     206.1,       0 ! !END!
! X =      308.9330,     5157.681,     205.47,       0 ! !END!
! X =      308.9310,     5157.621,     205.21,       0 ! !END!
! X =      308.9280,     5157.561,     205.3,       0 ! !END!
! X =      308.9250,     5157.501,     206.3,       0 ! !END!
! X =      308.9230,     5157.441,     207.3,       0 ! !END!
! X =      308.9200,     5157.381,     207.7,       0 ! !END!
! X =      308.9170,     5157.321,     206.54,       0 ! !END!
! X =      308.9150,     5157.261,     204.95,       0 ! !END!
! X =      308.9120,     5157.201,     204.23,       0 ! !END!
! X =      309.0790,     5159.596,     165,       0 ! !END!
! X =      309.0760,     5159.536,     167.4,       0 ! !END!
! X =      309.0740,     5159.476,     169.78,       0 ! !END!
! X =      309.0710,     5159.417,     172.7,       0 ! !END!
! X =      309.0680,     5159.357,     175.02,       0 ! !END!
! X =      309.0660,     5159.297,     176.8,       0 ! !END!
! X =      309.0630,     5159.237,     177.84,       0 ! !END!
! X =      309.0600,     5159.177,     177,       0 ! !END!
! X =      309.0580,     5159.117,     176.66,       0 ! !END!
! X =      309.0550,     5159.057,     176.17,       0 ! !END!
! X =      309.0520,     5158.997,     174.83,       0 ! !END!
! X =      309.0490,     5158.937,     173.57,       0 ! !END!
! X =      309.0470,     5158.877,     171.57,       0 ! !END!
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! X =      309.0440,     5158.817,     169.8,       0 ! !END!
! X =      309.0410,     5158.757,     169.43,       0 ! !END!
! X =      309.0390,     5158.697,     171.26,       0 ! !END!
! X =      309.0360,     5158.637,     177.27,       0 ! !END!
! X =      309.0330,     5158.577,     186.59,       0 ! !END!
! X =      309.0310,     5158.517,     189.5,       0 ! !END!
! X =      309.0280,     5158.457,     187.66,       0 ! !END!
! X =      309.0250,     5158.398,     186.1,       0 ! !END!
! X =      309.0230,     5158.338,     186.1,       0 ! !END!
! X =      309.0200,     5158.278,     188.4,       0 ! !END!
! X =      309.0170,     5158.218,     190.7,       0 ! !END!
! X =      309.0150,     5158.158,     192.9,       0 ! !END!
! X =      309.0120,     5158.098,     194.04,       0 ! !END!
! X =      309.0090,     5158.038,     195.38,       0 ! !END!
! X =      309.0070,     5157.978,     196.3,       0 ! !END!
! X =      309.0040,     5157.918,     196.6,       0 ! !END!
! X =      309.0010,     5157.858,     197.32,       0 ! !END!
! X =      308.9990,     5157.798,     198.13,       0 ! !END!
! X =      308.9960,     5157.738,     199.75,       0 ! !END!
! X =      308.9930,     5157.678,     201.87,       0 ! !END!
! X =      308.9910,     5157.618,     203.7,       0 ! !END!
! X =      308.9880,     5157.558,     205.16,       0 ! !END!
! X =      308.9850,     5157.498,     205.9,       0 ! !END!
! X =      308.9830,     5157.438,     206.57,       0 ! !END!
! X =      308.9800,     5157.379,     206.3,       0 ! !END!
! X =      308.9770,     5157.319,     205.25,       0 ! !END!
! X =      308.9750,     5157.259,     203.47,       0 ! !END!
! X =      308.9720,     5157.198,     201.93,       0 ! !END!
! X =      309.1390,     5159.594,     162.27,       0 ! !END!
! X =      309.1360,     5159.534,     164,       0 ! !END!
! X =      309.1340,     5159.474,     166.07,       0 ! !END!
! X =      309.1310,     5159.414,     168.8,       0 ! !END!
! X =      309.1280,     5159.354,     171,       0 ! !END!
! X =      309.1250,     5159.294,     173.5,       0 ! !END!
! X =      309.1230,     5159.234,     174.28,       0 ! !END!
! X =      309.1200,     5159.174,     174,       0 ! !END!
! X =      309.1170,     5159.114,     174.68,       0 ! !END!
! X =      309.1150,     5159.054,     175,       0 ! !END!
! X =      309.1120,     5158.994,     174.12,       0 ! !END!
! X =      309.1090,     5158.934,     173.47,       0 ! !END!
! X =      309.1070,     5158.874,     171.47,       0 ! !END!
! X =      309.1040,     5158.814,     169.47,       0 ! !END!
! X =      309.1010,     5158.755,     168,       0 ! !END!
! X =      309.0990,     5158.695,     169.5,       0 ! !END!
! X =      309.0960,     5158.635,     175.5,       0 ! !END!
! X =      309.0930,     5158.575,     183.5,       0 ! !END!
! X =      309.0910,     5158.515,     185.47,       0 ! !END!
! X =      309.0880,     5158.455,     183.63,       0 ! !END!
! X =      309.0850,     5158.395,     181.83,       0 ! !END!
! X =      309.0830,     5158.335,     181.58,       0 ! !END!
! X =      309.0800,     5158.275,     183.33,       0 ! !END!
! X =      309.0770,     5158.215,     184.8,       0 ! !END!
! X =      309.0750,     5158.155,     186.5,       0 ! !END!
! X =      309.0720,     5158.095,     187.4,       0 ! !END!
! X =      309.0690,     5158.035,     187.8,       0 ! !END!
! X =      309.0670,     5157.975,     188.3,       0 ! !END!
! X =      309.0640,     5157.915,     189.53,       0 ! !END!
! X =      309.0610,     5157.855,     189.92,       0 ! !END!
! X =      309.0590,     5157.795,     191.13,       0 ! !END!
! X =      309.0560,     5157.736,     193.4,       0 ! !END!
! X =      309.0530,     5157.676,     197.04,       0 ! !END!
! X =      309.0510,     5157.616,     200.07,       0 ! !END!
! X =      309.0480,     5157.556,     202.08,       0 ! !END!
! X =      309.0450,     5157.496,     203,       0 ! !END!
! X =      309.0430,     5157.436,     203.4,       0 ! !END!
! X =      309.0400,     5157.376,     203.69,       0 ! !END!
! X =      309.0370,     5157.316,     203.18,       0 ! !END!
! X =      309.0350,     5157.256,     201.83,       0 ! !END!
! X =      309.0320,     5157.196,     200.53,       0 ! !END!
! X =      309.1990,     5159.591,     158.37,       0 ! !END!
! X =      309.1960,     5159.531,     160.57,       0 ! !END!
! X =      309.1930,     5159.471,     162.61,       0 ! !END!
! X =      309.1910,     5159.411,     165.3,       0 ! !END!
! X =      309.1880,     5159.351,     167.54,       0 ! !END!
! X =      309.1850,     5159.291,     169.67,       0 ! !END!
! X =      309.1830,     5159.231,     169.8,       0 ! !END!
! X =      309.1800,     5159.171,     170,       0 ! !END!
! X =      309.1770,     5159.111,     171.16,       0 ! !END!
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1496 ! X =       309.1750,     5159.052,     172.77,       0 ! !END!
1497 ! X =       309.1720,     5158.992,     174,       0 ! !END!
1498 ! X =       309.1690,     5158.932,     174,       0 ! !END!
1499 ! X =       309.1670,     5158.872,     171.4,       0 ! !END!
1500 ! X =       309.1640,     5158.812,     169.4,       0 ! !END!
1501 ! X =       309.1610,     5158.752,     167.4,       0 ! !END!
1502 ! X =       309.1590,     5158.692,     169.02,       0 ! !END!
1503 ! X =       309.1560,     5158.632,     175.48,       0 ! !END!
1504 ! X =       309.1530,     5158.572,     182.96,       0 ! !END!
1505 ! X =       309.1510,     5158.512,     183.73,       0 ! !END!
1506 ! X =       309.1480,     5158.452,     180.91,       0 ! !END!
1507 ! X =       309.1450,     5158.392,     177.23,       0 ! !END!
1508 ! X =       309.1430,     5158.332,     175.84,       0 ! !END!
1509 ! X =       309.1400,     5158.272,     177.6,       0 ! !END!
1510 ! X =       309.1370,     5158.212,     179.64,       0 ! !END!
1511 ! X =       309.1350,     5158.152,     181,       0 ! !END!
1512 ! X =       309.1320,     5158.092,     181.6,       0 ! !END!
1513 ! X =       309.1290,     5158.033,     182.1,       0 ! !END!
1514 ! X =       309.1270,     5157.973,     182.53,       0 ! !END!
1515 ! X =       309.1240,     5157.913,     183.36,       0 ! !END!
1516 ! X =       309.1210,     5157.853,     184.5,       0 ! !END!
1517 ! X =       309.1190,     5157.793,     185.68,       0 ! !END!
1518 ! X =       309.1160,     5157.733,     188.59,       0 ! !END!
1519 ! X =       309.1130,     5157.673,     192.4,       0 ! !END!
1520 ! X =       309.1110,     5157.613,     195.64,       0 ! !END!
1521 ! X =       309.1080,     5157.553,     197.6,       0 ! !END!
1522 ! X =       309.1050,     5157.493,     198.5,       0 ! !END!
1523 ! X =       309.1030,     5157.433,     198.95,       0 ! !END!
1524 ! X =       309.1000,     5157.373,     199.52,       0 ! !END!
1525 ! X =       309.0970,     5157.313,     199.77,       0 ! !END!
1526 ! X =       309.0940,     5157.253,     200.49,       0 ! !END!
1527 ! X =       309.0920,     5157.193,     200.43,       0 ! !END!
1528 ! X =       309.2590,     5159.588,     153.47,       0 ! !END!
1529 ! X =       309.2560,     5159.528,     155.67,       0 ! !END!
1530 ! X =       309.2530,     5159.468,     158.43,       0 ! !END!
1531 ! X =       309.2510,     5159.409,     160.97,       0 ! !END!
1532 ! X =       309.2480,     5159.349,     163.17,       0 ! !END!
1533 ! X =       309.2450,     5159.289,     165.33,       0 ! !END!
1534 ! X =       309.2430,     5159.229,     164.9,       0 ! !END!
1535 ! X =       309.2400,     5159.169,     166,       0 ! !END!
1536 ! X =       309.2370,     5159.109,     167.9,       0 ! !END!
1537 ! X =       309.2350,     5159.049,     170.03,       0 ! !END!
1538 ! X =       309.2320,     5158.989,     172.05,       0 ! !END!
1539 ! X =       309.2290,     5158.929,     173.55,       0 ! !END!
1540 ! X =       309.2270,     5158.869,     171.3,       0 ! !END!
1541 ! X =       309.2240,     5158.809,     169.3,       0 ! !END!
1542 ! X =       309.2210,     5158.749,     166.74,       0 ! !END!
1543 ! X =       309.2190,     5158.689,     167.4,       0 ! !END!
1544 ! X =       309.2160,     5158.629,     172.94,       0 ! !END!
1545 ! X =       309.2130,     5158.569,     179.3,       0 ! !END!
1546 ! X =       309.2110,     5158.509,     179.57,       0 ! !END!
1547 ! X =       309.2080,     5158.449,     175.73,       0 ! !END!
1548 ! X =       309.2050,     5158.39,     172.17,       0 ! !END!
1549 ! X =       309.2030,     5158.33,     170.37,       0 ! !END!
1550 ! X =       309.2000,     5158.27,     172.67,       0 ! !END!
1551 ! X =       309.1970,     5158.21,     174.97,       0 ! !END!
1552 ! X =       309.1950,     5158.15,     176.83,       0 ! !END!
1553 ! X =       309.1920,     5158.09,     176.8,       0 ! !END!
1554 ! X =       309.1890,     5158.03,     176.8,       0 ! !END!
1555 ! X =       309.1870,     5157.97,     176.4,       0 ! !END!
1556 ! X =       309.1840,     5157.91,     178.13,       0 ! !END!
1557 ! X =       309.1810,     5157.85,     179.53,       0 ! !END!
1558 ! X =       309.1780,     5157.79,     180.82,       0 ! !END!
1559 ! X =       309.1760,     5157.73,     181.49,       0 ! !END!
1560 ! X =       309.1730,     5157.67,     182.32,       0 ! !END!
1561 ! X =       309.1700,     5157.61,     182.56,       0 ! !END!
1562 ! X =       309.1680,     5157.55,     184.67,       0 ! !END!
1563 ! X =       309.1650,     5157.49,     188.83,       0 ! !END!
1564 ! X =       309.1620,     5157.43,     193.13,       0 ! !END!
1565 ! X =       309.1600,     5157.371,     196.09,       0 ! !END!
1566 ! X =       309.1570,     5157.311,     197.02,       0 ! !END!
1567 ! X =       309.1540,     5157.251,     197.6,       0 ! !END!
1568 ! X =       309.1520,     5157.19,     198.04,       0 ! !END!
1569 ! X =       309.3190,     5159.586,     151.29,       0 ! !END!
1570 ! X =       309.3160,     5159.526,     153.27,       0 ! !END!
1571 ! X =       309.3130,     5159.466,     155.37,       0 ! !END!
1572 ! X =       309.3110,     5159.406,     158.36,       0 ! !END!
1573 ! X =       309.3080,     5159.346,     160.53,       0 ! !END!
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1574 ! X =       309.3050,     5159.286,     162.5,       0 ! !END!
1575 ! X =       309.3030,     5159.226,     162.8,       0 ! !END!
1576 ! X =       309.3000,     5159.166,     163.8,       0 ! !END!
1577 ! X =       309.2970,     5159.106,     164.9,       0 ! !END!
1578 ! X =       309.2950,     5159.046,     167.97,       0 ! !END!
1579 ! X =       309.2920,     5158.986,     170.8,       0 ! !END!
1580 ! X =       309.2890,     5158.926,     172.8,       0 ! !END!
1581 ! X =       309.2870,     5158.866,     171.2,       0 ! !END!
1582 ! X =       309.2840,     5158.806,     169.2,       0 ! !END!
1583 ! X =       309.2810,     5158.746,     166.2,       0 ! !END!
1584 ! X =       309.2790,     5158.687,     165.93,       0 ! !END!
1585 ! X =       309.2760,     5158.627,     172.17,       0 ! !END!
1586 ! X =       309.2730,     5158.567,     177.36,       0 ! !END!
1587 ! X =       309.2710,     5158.507,     177.4,       0 ! !END!
1588 ! X =       309.2680,     5158.447,     173.53,       0 ! !END!
1589 ! X =       309.2650,     5158.387,     169.63,       0 ! !END!
1590 ! X =       309.2630,     5158.327,     168,       0 ! !END!
1591 ! X =       309.2600,     5158.267,     169.43,       0 ! !END!
1592 ! X =       309.2570,     5158.207,     171.2,       0 ! !END!
1593 ! X =       309.2540,     5158.147,     172.53,       0 ! !END!
1594 ! X =       309.2520,     5158.087,     171.74,       0 ! !END!
1595 ! X =       309.2490,     5158.027,     170.47,       0 ! !END!
1596 ! X =       309.2460,     5157.967,     169.65,       0 ! !END!
1597 ! X =       309.2440,     5157.907,     170.84,       0 ! !END!
1598 ! X =       309.2410,     5157.847,     172.73,       0 ! !END!
1599 ! X =       309.2380,     5157.787,     174.92,       0 ! !END!
1600 ! X =       309.2360,     5157.727,     174.6,       0 ! !END!
1601 ! X =       309.2330,     5157.668,     173.97,       0 ! !END!
1602 ! X =       309.2300,     5157.608,     174,       0 ! !END!
1603 ! X =       309.2280,     5157.548,     176.51,       0 ! !END!
1604 ! X =       309.2250,     5157.488,     182.7,       0 ! !END!
1605 ! X =       309.2220,     5157.428,     188.96,       0 ! !END!
1606 ! X =       309.2200,     5157.368,     192.67,       0 ! !END!
1607 ! X =       309.2170,     5157.308,     191.8,       0 ! !END!
1608 ! X =       309.2140,     5157.248,     190.87,       0 ! !END!
1609 ! X =       309.2120,     5157.188,     190.05,       0 ! !END!
1610 ! X =       309.3790,     5159.583,     150.9,       0 ! !END!
1611 ! X =       309.3760,     5159.523,     151.95,       0 ! !END!
1612 ! X =       309.3730,     5159.463,     154.8,       0 ! !END!
1613 ! X =       309.3710,     5159.403,     156.53,       0 ! !END!
1614 ! X =       309.3680,     5159.343,     158.63,       0 ! !END!
1615 ! X =       309.3650,     5159.283,     159.83,       0 ! !END!
1616 ! X =       309.3630,     5159.223,     160.8,       0 ! !END!
1617 ! X =       309.3600,     5159.163,     161.9,       0 ! !END!
1618 ! X =       309.3570,     5159.103,     163,       0 ! !END!
1619 ! X =       309.3550,     5159.044,     167.01,       0 ! !END!
1620 ! X =       309.3520,     5158.984,     170.13,       0 ! !END!
1621 ! X =       309.3490,     5158.924,     172.87,       0 ! !END!
1622 ! X =       309.3470,     5158.864,     171.13,       0 ! !END!
1623 ! X =       309.3440,     5158.804,     168.67,       0 ! !END!
1624 ! X =       309.3410,     5158.744,     166.45,       0 ! !END!
1625 ! X =       309.3380,     5158.684,     165.9,       0 ! !END!
1626 ! X =       309.3360,     5158.624,     170.19,       0 ! !END!
1627 ! X =       309.3330,     5158.564,     173.75,       0 ! !END!
1628 ! X =       309.3300,     5158.504,     173.27,       0 ! !END!
1629 ! X =       309.3280,     5158.444,     168.59,       0 ! !END!
1630 ! X =       309.3250,     5158.384,     164.77,       0 ! !END!
1631 ! X =       309.3220,     5158.324,     162.93,       0 ! !END!
1632 ! X =       309.3200,     5158.264,     165.78,       0 ! !END!
1633 ! X =       309.3170,     5158.204,     168.73,       0 ! !END!
1634 ! X =       309.3140,     5158.144,     170.94,       0 ! !END!
1635 ! X =       309.3120,     5158.084,     169.13,       0 ! !END!
1636 ! X =       309.3090,     5158.025,     168.17,       0 ! !END!
1637 ! X =       309.3060,     5157.965,     167.17,       0 ! !END!
1638 ! X =       309.3040,     5157.905,     168.83,       0 ! !END!
1639 ! X =       309.3010,     5157.845,     170.8,       0 ! !END!
1640 ! X =       309.2980,     5157.785,     172.84,       0 ! !END!
1641 ! X =       309.2960,     5157.725,     172.28,       0 ! !END!
1642 ! X =       309.2930,     5157.665,     170.59,       0 ! !END!
1643 ! X =       309.2900,     5157.605,     169.5,       0 ! !END!
1644 ! X =       309.2880,     5157.545,     172.3,       0 ! !END!
1645 ! X =       309.2850,     5157.485,     178.5,       0 ! !END!
1646 ! X =       309.2820,     5157.425,     185.7,       0 ! !END!
1647 ! X =       309.2800,     5157.365,     189.06,       0 ! !END!
1648 ! X =       309.2770,     5157.305,     186.47,       0 ! !END!
1649 ! X =       309.2740,     5157.245,     183.8,       0 ! !END!
1650 ! X =       309.2720,     5157.185,     181.89,       0 ! !END!
1651 ! X =       309.3780,     5159.583,     150.9,       0 ! !END!
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```
! X =       309.3750,     5159.523,     151.95,       0 ! !END!
! X =       309.3730,     5159.463,     154.8,       0 ! !END!
! X =       309.3700,     5159.403,     156.57,       0 ! !END!
! X =       309.3670,     5159.343,     158.67,       0 ! !END!
! X =       309.3650,     5159.283,     159.83,       0 ! !END!
! X =       309.3620,     5159.223,     160.83,       0 ! !END!
! X =       309.3590,     5159.163,     161.9,       0 ! !END!
! X =       309.3570,     5159.103,     163,       0 ! !END!
! X =       309.3540,     5159.044,     167.04,       0 ! !END!
! X =       309.3510,     5158.984,     170.17,       0 ! !END!
! X =       309.3490,     5158.924,     172.87,       0 ! !END!
! X =       309.3460,     5158.864,     171.13,       0 ! !END!
! X =       309.3430,     5158.804,     168.64,       0 ! !END!
! X =       309.3410,     5158.744,     166.45,       0 ! !END!
! X =       309.3380,     5158.684,     165.9,       0 ! !END!
! X =       309.3350,     5158.624,     170.21,       0 ! !END!
! X =       309.3330,     5158.564,     173.75,       0 ! !END!
! X =       309.3300,     5158.504,     173.27,       0 ! !END!
! X =       309.3270,     5158.444,     168.69,       0 ! !END!
! X =       309.3250,     5158.384,     164.77,       0 ! !END!
! X =       309.3220,     5158.324,     162.93,       0 ! !END!
! X =       309.3190,     5158.264,     165.88,       0 ! !END!
! X =       309.3160,     5158.204,     168.8,       0 ! !END!
! X =       309.3140,     5158.144,     170.94,       0 ! !END!
! X =       309.3110,     5158.084,     169.13,       0 ! !END!
! X =       309.3080,     5158.025,     168.17,       0 ! !END!
! X =       309.3060,     5157.965,     167.17,       0 ! !END!
! X =       309.3030,     5157.905,     168.83,       0 ! !END!
! X =       309.3000,     5157.845,     170.83,       0 ! !END!
! X =       309.2980,     5157.785,     172.84,       0 ! !END!
! X =       309.2950,     5157.725,     172.31,       0 ! !END!
! X =       309.2920,     5157.665,     170.66,       0 ! !END!
! X =       309.2900,     5157.605,     169.5,       0 ! !END!
! X =       309.2870,     5157.545,     172.37,       0 ! !END!
! X =       309.2840,     5157.485,     178.57,       0 ! !END!
! X =       309.2820,     5157.425,     185.7,       0 ! !END!
! X =       309.2790,     5157.365,     189.15,       0 ! !END!
! X =       309.2760,     5157.305,     186.57,       0 ! !END!
! X =       309.2740,     5157.245,     183.8,       0 ! !END!
! X =       309.2720,     5157.185,     181.89,       0 ! !END!
! X =       0.0000,     0,     0,       0 ! !END!
! X =       0.0000,     0,     0,       0 ! !END!
! X =       0.0000,     0,     0,       0 ! !END!
! X =       0.0000,     0,     0,       0 ! !END!
! X =       0.0000,     0,     0,       0 ! !END!
! X =       0.0000,     0,     0,       0 ! !END!
! X =       0.0000,     0,     0,       0 ! !END!
! X =       0.0000,     0,     0,       0 ! !END!
! X =       0.0000,     0,     0,       0 ! !END!
! X =       0.0000,     0,     0,       0 ! !END!
! X =       303.7950,     5138.657,     551,       0 ! !END!
! X =       307.7920,     5138.48,     302,       0 ! !END!
! X =       308.7910,     5138.436,     268,       0 ! !END!
! X =       309.7900,     5138.391,     235,       0 ! !END!
! X =       310.7890,     5138.347,     202,       0 ! !END!
! X =       300.8420,     5139.789,     869,       0 ! !END!
! X =       301.8410,     5139.745,     807,       0 ! !END!
! X =       302.8400,     5139.701,     643,       0 ! !END!
! X =       303.8390,     5139.656,     508,       0 ! !END!
! X =       304.8390,     5139.612,     411,       0 ! !END!
! X =       305.8380,     5139.568,     358,       0 ! !END!
! X =       306.8370,     5139.523,     325,       0 ! !END!
! X =       307.8360,     5139.479,     296,       0 ! !END!
! X =       308.8350,     5139.435,     264,       0 ! !END!
! X =       309.8340,     5139.391,     232,       0 ! !END!
! X =       310.8340,     5139.346,     200,       0 ! !END!
! X =       299.8870,     5140.832,     957,       0 ! !END!
! X =       300.8860,     5140.788,     912,       0 ! !END!
! X =       301.8850,     5140.744,     709,       0 ! !END!
! X =       302.8850,     5140.7,     545,       0 ! !END!
! X =       303.8840,     5140.655,     451,       0 ! !END!
! X =       304.8830,     5140.611,     382,       0 ! !END!
! X =       305.8820,     5140.567,     342,       0 ! !END!
! X =       306.8810,     5140.523,     313,       0 ! !END!
! X =       307.8800,     5140.478,     284,       0 ! !END!
! X =       308.8800,     5140.434,     252,       0 ! !END!
! X =       309.8790,     5140.39,     221,       0 ! !END!
! X =       310.8780,     5140.346,     189,       0 ! !END!
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1730 ! X =       311.8770,     5140.301,     163,       0 ! !END!
1731 ! X =       299.9310,     5141.832,     922,       0 ! !END!
1732 ! X =       300.9300,     5141.787,     730,       0 ! !END!
1733 ! X =       301.9300,     5141.743,     571,       0 ! !END!
1734 ! X =       302.9290,     5141.699,     472,       0 ! !END!
1735 ! X =       303.9280,     5141.655,     400,       0 ! !END!
1736 ! X =       304.9270,     5141.61,     352,       0 ! !END!
1737 ! X =       305.9260,     5141.566,     322,       0 ! !END!
1738 ! X =       306.9250,     5141.522,     295,       0 ! !END!
1739 ! X =       307.9250,     5141.477,     266,       0 ! !END!
1740 ! X =       308.9240,     5141.433,     236,       0 ! !END!
1741 ! X =       309.9230,     5141.389,     204,       0 ! !END!
1742 ! X =       310.9220,     5141.345,     175,       0 ! !END!
1743 ! X =       297.9770,     5142.919,     976,       0 ! !END!
1744 ! X =       298.9760,     5142.875,     929,       0 ! !END!
1745 ! X =       299.9760,     5142.831,     743,       0 ! !END!
1746 ! X =       300.9750,     5142.787,     571,       0 ! !END!
1747 ! X =       301.9740,     5142.742,     475,       0 ! !END!
1748 ! X =       302.9730,     5142.698,     403,       0 ! !END!
1749 ! X =       303.9720,     5142.654,     355,       0 ! !END!
1750 ! X =       304.9710,     5142.609,     323,       0 ! !END!
1751 ! X =       305.9710,     5142.565,     298,       0 ! !END!
1752 ! X =       306.9700,     5142.521,     271,       0 ! !END!
1753 ! X =       307.9690,     5142.477,     241,       0 ! !END!
1754 ! X =       308.9680,     5142.432,     210,       0 ! !END!
1755 ! X =       309.9670,     5142.388,     180,       0 ! !END!
1756 ! X =       310.9660,     5142.344,     160,       0 ! !END!
1757 ! X =       297.0220,     5143.963,     932,       0 ! !END!
1758 ! X =       298.0210,     5143.919,     850,       0 ! !END!
1759 ! X =       299.0210,     5143.874,     682,       0 ! !END!
1760 ! X =       300.0200,     5143.83,     551,       0 ! !END!
1761 ! X =       301.0190,     5143.786,     456,       0 ! !END!
1762 ! X =       302.0180,     5143.741,     396,       0 ! !END!
1763 ! X =       303.0170,     5143.697,     351,       0 ! !END!
1764 ! X =       304.0170,     5143.653,     320,       0 ! !END!
1765 ! X =       305.0160,     5143.609,     294,       0 ! !END!
1766 ! X =       306.0150,     5143.564,     266,       0 ! !END!
1767 ! X =       307.0140,     5143.52,     239,       0 ! !END!
1768 ! X =       308.0130,     5143.476,     210,       0 ! !END!
1769 ! X =       309.0120,     5143.431,     181,       0 ! !END!
1770 ! X =       310.0120,     5143.387,     161,       0 ! !END!
1771 ! X =       288.0730,     5145.361,     854,       0 ! !END!
1772 ! X =       289.0730,     5145.316,     780,       0 ! !END!
1773 ! X =       290.0720,     5145.272,     690,       0 ! !END!
1774 ! X =       291.0710,     5145.228,     657,       0 ! !END!
1775 ! X =       292.0700,     5145.184,     691,       0 ! !END!
1776 ! X =       293.0700,     5145.139,     760,       0 ! !END!
1777 ! X =       294.0690,     5145.095,     798,       0 ! !END!
1778 ! X =       295.0680,     5145.051,     789,       0 ! !END!
1779 ! X =       296.0670,     5145.006,     784,       0 ! !END!
1780 ! X =       297.0670,     5144.962,     734,       0 ! !END!
1781 ! X =       298.0660,     5144.918,     616,       0 ! !END!
1782 ! X =       299.0650,     5144.874,     511,       0 ! !END!
1783 ! X =       300.0640,     5144.829,     437,       0 ! !END!
1784 ! X =       301.0630,     5144.785,     377,       0 ! !END!
1785 ! X =       302.0620,     5144.741,     337,       0 ! !END!
1786 ! X =       303.0620,     5144.696,     311,       0 ! !END!
1787 ! X =       304.0610,     5144.652,     285,       0 ! !END!
1788 ! X =       305.0600,     5144.608,     259,       0 ! !END!
1789 ! X =       306.0590,     5144.564,     232,       0 ! !END!
1790 ! X =       307.0580,     5144.519,     205,       0 ! !END!
1791 ! X =       308.0570,     5144.475,     181,       0 ! !END!
1792 ! X =       309.0570,     5144.431,     161,       0 ! !END!
1793 ! X =       287.1180,     5146.404,     775,       0 ! !END!
1794 ! X =       288.1180,     5146.36,     757,       0 ! !END!
1795 ! X =       289.1170,     5146.316,     681,       0 ! !END!
1796 ! X =       290.1160,     5146.271,     593,       0 ! !END!
1797 ! X =       291.1150,     5146.227,     561,       0 ! !END!
1798 ! X =       292.1150,     5146.183,     588,       0 ! !END!
1799 ! X =       293.1140,     5146.139,     647,       0 ! !END!
1800 ! X =       294.1130,     5146.094,     657,       0 ! !END!
1801 ! X =       295.1120,     5146.05,     640,       0 ! !END!
1802 ! X =       296.1120,     5146.006,     608,       0 ! !END!
1803 ! X =       297.1110,     5145.961,     531,       0 ! !END!
1804 ! X =       298.1100,     5145.917,     455,       0 ! !END!
1805 ! X =       299.1090,     5145.873,     398,       0 ! !END!
1806 ! X =       300.1080,     5145.828,     354,       0 ! !END!
1807 ! X =       301.1080,     5145.784,     319,       0 ! !END!
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1808 ! X =       302.1070,     5145.74,     293,       0 ! !END!
1809 ! X =       303.1060,     5145.696,     271,       0 ! !END!
1810 ! X =       304.1050,     5145.651,     246,       0 ! !END!
1811 ! X =       305.1040,     5145.607,     222,       0 ! !END!
1812 ! X =       306.1030,     5145.563,     198,       0 ! !END!
1813 ! X =       307.1030,     5145.518,     178,       0 ! !END!
1814 ! X =       308.1020,     5145.474,     162,       0 ! !END!
1815 ! X =       287.1630,     5147.404,     641,       0 ! !END!
1816 ! X =       288.1620,     5147.359,     629,       0 ! !END!
1817 ! X =       289.1610,     5147.315,     598,       0 ! !END!
1818 ! X =       290.1610,     5147.271,     543,       0 ! !END!
1819 ! X =       291.1600,     5147.226,     512,       0 ! !END!
1820 ! X =       292.1590,     5147.182,     544,       0 ! !END!
1821 ! X =       293.1580,     5147.138,     594,       0 ! !END!
1822 ! X =       294.1570,     5147.093,     586,       0 ! !END!
1823 ! X =       295.1570,     5147.049,     549,       0 ! !END!
1824 ! X =       296.1560,     5147.005,     506,       0 ! !END!
1825 ! X =       297.1550,     5146.961,     433,       0 ! !END!
1826 ! X =       298.1540,     5146.916,     362,       0 ! !END!
1827 ! X =       299.1540,     5146.872,     316,       0 ! !END!
1828 ! X =       300.1530,     5146.828,     290,       0 ! !END!
1829 ! X =       301.1520,     5146.783,     269,       0 ! !END!
1830 ! X =       302.1510,     5146.739,     246,       0 ! !END!
1831 ! X =       303.1500,     5146.695,     226,       0 ! !END!
1832 ! X =       304.1490,     5146.65,     207,       0 ! !END!
1833 ! X =       305.1490,     5146.606,     190,       0 ! !END!
1834 ! X =       306.1480,     5146.562,     177,       0 ! !END!
1835 ! X =       307.1470,     5146.518,     166,       0 ! !END!
1836 ! X =       286.2080,     5148.447,     577,       0 ! !END!
1837 ! X =       287.2070,     5148.403,     517,       0 ! !END!
1838 ! X =       288.2060,     5148.359,     519,       0 ! !END!
1839 ! X =       289.2060,     5148.314,     529,       0 ! !END!
1840 ! X =       290.2050,     5148.27,     493,       0 ! !END!
1841 ! X =       291.2040,     5148.226,     470,       0 ! !END!
1842 ! X =       292.2030,     5148.181,     491,       0 ! !END!
1843 ! X =       293.2030,     5148.137,     508,       0 ! !END!
1844 ! X =       294.2020,     5148.093,     517,       0 ! !END!
1845 ! X =       295.2010,     5148.048,     483,       0 ! !END!
1846 ! X =       296.2000,     5148.004,     391,       0 ! !END!
1847 ! X =       297.1990,     5147.96,     324,       0 ! !END!
1848 ! X =       298.1990,     5147.915,     289,       0 ! !END!
1849 ! X =       299.1980,     5147.871,     265,       0 ! !END!
1850 ! X =       300.1970,     5147.827,     243,       0 ! !END!
1851 ! X =       301.1960,     5147.783,     224,       0 ! !END!
1852 ! X =       302.1950,     5147.738,     205,       0 ! !END!
1853 ! X =       303.1950,     5147.694,     193,       0 ! !END!
1854 ! X =       304.1940,     5147.65,     187,       0 ! !END!
1855 ! X =       305.1930,     5147.605,     180,       0 ! !END!
1856 ! X =       306.1920,     5147.561,     172,       0 ! !END!
1857 ! X =       307.1910,     5147.517,     164,       0 ! !END!
1858 ! X =       308.1900,     5147.472,     157,       0 ! !END!
1859 ! X =       286.2520,     5149.446,     452,       0 ! !END!
1860 ! X =       287.2510,     5149.402,     418,       0 ! !END!
1861 ! X =       288.2510,     5149.358,     412,       0 ! !END!
1862 ! X =       289.2500,     5149.313,     420,       0 ! !END!
1863 ! X =       290.2490,     5149.269,     404,       0 ! !END!
1864 ! X =       291.2480,     5149.225,     404,       0 ! !END!
1865 ! X =       292.2480,     5149.181,     387,       0 ! !END!
1866 ! X =       293.2470,     5149.136,     358,       0 ! !END!
1867 ! X =       294.2460,     5149.092,     355,       0 ! !END!
1868 ! X =       295.2450,     5149.048,     326,       0 ! !END!
1869 ! X =       296.2450,     5149.003,     300,       0 ! !END!
1870 ! X =       297.2440,     5148.959,     274,       0 ! !END!
1871 ! X =       298.2430,     5148.915,     247,       0 ! !END!
1872 ! X =       299.2420,     5148.87,     228,       0 ! !END!
1873 ! X =       300.2410,     5148.826,     213,       0 ! !END!
1874 ! X =       301.2410,     5148.782,     196,       0 ! !END!
1875 ! X =       302.2400,     5148.737,     187,       0 ! !END!
1876 ! X =       303.2390,     5148.693,     185,       0 ! !END!
1877 ! X =       304.2380,     5148.649,     184,       0 ! !END!
1878 ! X =       305.2370,     5148.604,     181,       0 ! !END!
1879 ! X =       306.2360,     5148.56,     175,       0 ! !END!
1880 ! X =       307.2360,     5148.516,     167,       0 ! !END!
1881 ! X =       308.2350,     5148.472,     159,       0 ! !END!
1882 ! X =       309.2340,     5148.427,     154,       0 ! !END!
1883 ! X =       286.2960,     5150.446,     372,       0 ! !END!
1884 ! X =       287.2960,     5150.401,     362,       0 ! !END!
1885 ! X =       288.2950,     5150.357,     352,       0 ! !END!
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1886 ! X =       289.2940,     5150.313,     341,       0 ! !END!
1887 ! X =       290.2930,     5150.268,     327,       0 ! !END!
1888 ! X =       291.2930,     5150.224,     325,       0 ! !END!
1889 ! X =       292.2920,     5150.18,     302,       0 ! !END!
1890 ! X =       293.2910,     5150.135,     271,       0 ! !END!
1891 ! X =       294.2900,     5150.091,     250,       0 ! !END!
1892 ! X =       295.2900,     5150.047,     242,       0 ! !END!
1893 ! X =       296.2890,     5150.002,     245,       0 ! !END!
1894 ! X =       297.2880,     5149.958,     234,       0 ! !END!
1895 ! X =       298.2870,     5149.914,     218,       0 ! !END!
1896 ! X =       299.2860,     5149.87,     202,       0 ! !END!
1897 ! X =       300.2860,     5149.825,     190,       0 ! !END!
1898 ! X =       301.2850,     5149.781,     185,       0 ! !END!
1899 ! X =       302.2840,     5149.737,     184,       0 ! !END!
1900 ! X =       303.2830,     5149.692,     184,       0 ! !END!
1901 ! X =       304.2820,     5149.648,     184,       0 ! !END!
1902 ! X =       305.2820,     5149.604,     182,       0 ! !END!
1903 ! X =       306.2810,     5149.559,     178,       0 ! !END!
1904 ! X =       307.2800,     5149.515,     170,       0 ! !END!
1905 ! X =       308.2790,     5149.471,     162,       0 ! !END!
1906 ! X =       309.2780,     5149.426,     155,       0 ! !END!
1907 ! X =       310.2770,     5149.382,     153,       0 ! !END!
1908 ! X =       311.2760,     5149.338,     153,       0 ! !END!
1909 ! X =       286.3410,     5151.445,     326,       0 ! !END!
1910 ! X =       287.3400,     5151.401,     321,       0 ! !END!
1911 ! X =       288.3390,     5151.356,     316,       0 ! !END!
1912 ! X =       289.3390,     5151.312,     303,       0 ! !END!
1913 ! X =       290.3380,     5151.268,     286,       0 ! !END!
1914 ! X =       291.3370,     5151.223,     277,       0 ! !END!
1915 ! X =       292.3360,     5151.179,     262,       0 ! !END!
1916 ! X =       293.3350,     5151.135,     240,       0 ! !END!
1917 ! X =       294.3350,     5151.09,     220,       0 ! !END!
1918 ! X =       295.3340,     5151.046,     212,       0 ! !END!
1919 ! X =       296.3330,     5151.002,     209,       0 ! !END!
1920 ! X =       297.3320,     5150.957,     202,       0 ! !END!
1921 ! X =       298.3320,     5150.913,     190,       0 ! !END!
1922 ! X =       299.3310,     5150.869,     185,       0 ! !END!
1923 ! X =       300.3300,     5150.824,     184,       0 ! !END!
1924 ! X =       301.3290,     5150.78,     184,       0 ! !END!
1925 ! X =       302.3280,     5150.736,     184,       0 ! !END!
1926 ! X =       303.3280,     5150.691,     184,       0 ! !END!
1927 ! X =       304.3270,     5150.647,     184,       0 ! !END!
1928 ! X =       305.3260,     5150.603,     183,       0 ! !END!
1929 ! X =       306.3250,     5150.558,     181,       0 ! !END!
1930 ! X =       307.3240,     5150.514,     173,       0 ! !END!
1931 ! X =       308.3230,     5150.47,     166,       0 ! !END!
1932 ! X =       309.3220,     5150.426,     155,       0 ! !END!
1933 ! X =       310.3220,     5150.381,     153,       0 ! !END!
1934 ! X =       311.3210,     5150.337,     153,       0 ! !END!
1935 ! X =       312.3200,     5150.293,     153,       0 ! !END!
1936 ! X =       313.3190,     5150.248,     157,       0 ! !END!
1937 ! X =       286.3850,     5152.444,     304,       0 ! !END!
1938 ! X =       287.3840,     5152.4,     290,       0 ! !END!
1939 ! X =       288.3840,     5152.356,     280,       0 ! !END!
1940 ! X =       289.3830,     5152.311,     271,       0 ! !END!
1941 ! X =       290.3820,     5152.267,     259,       0 ! !END!
1942 ! X =       291.3810,     5152.223,     254,       0 ! !END!
1943 ! X =       292.3810,     5152.178,     241,       0 ! !END!
1944 ! X =       293.3800,     5152.134,     225,       0 ! !END!
1945 ! X =       294.3790,     5152.09,     211,       0 ! !END!
1946 ! X =       295.3780,     5152.045,     201,       0 ! !END!
1947 ! X =       296.3770,     5152.001,     192,       0 ! !END!
1948 ! X =       297.3770,     5151.957,     186,       0 ! !END!
1949 ! X =       298.3760,     5151.912,     184,       0 ! !END!
1950 ! X =       299.3750,     5151.868,     184,       0 ! !END!
1951 ! X =       300.3740,     5151.824,     184,       0 ! !END!
1952 ! X =       301.3730,     5151.779,     184,       0 ! !END!
1953 ! X =       302.3730,     5151.735,     184,       0 ! !END!
1954 ! X =       303.3720,     5151.691,     184,       0 ! !END!
1955 ! X =       304.3710,     5151.646,     184,       0 ! !END!
1956 ! X =       305.3700,     5151.602,     190,       0 ! !END!
1957 ! X =       306.3690,     5151.558,     185,       0 ! !END!
1958 ! X =       307.3680,     5151.513,     177,       0 ! !END!
1959 ! X =       308.3680,     5151.469,     169,       0 ! !END!
1960 ! X =       309.3670,     5151.425,     155,       0 ! !END!
1961 ! X =       310.3660,     5151.38,     153,       0 ! !END!
1962 ! X =       311.3650,     5151.336,     153,       0 ! !END!
1963 ! X =       312.3640,     5151.292,     153,       0 ! !END!
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1964 ! X =       313.3630,     5151.247,     156,       0 ! !END!
1965 ! X =       314.3620,     5151.203,     160,       0 ! !END!
1966 ! X =       315.3620,     5151.159,     162,       0 ! !END!
1967 ! X =       316.3610,     5151.114,     160,       0 ! !END!
1968 ! X =       317.3600,     5151.07,     154,       0 ! !END!
1969 ! X =       318.3590,     5151.026,     153,       0 ! !END!
1970 ! X =       319.3580,     5150.981,     153,       0 ! !END!
1971 ! X =       320.3570,     5150.937,     151,       0 ! !END!
1972 ! X =       321.3560,     5150.893,     147,       0 ! !END!
1973 ! X =       322.3550,     5150.848,     141,       0 ! !END!
1974 ! X =       323.3540,     5150.804,     134,       0 ! !END!
1975 ! X =       324.3540,     5150.76,     128,       0 ! !END!
1976 ! X =       286.4290,     5153.443,     302,       0 ! !END!
1977 ! X =       287.4290,     5153.399,     290,       0 ! !END!
1978 ! X =       288.4280,     5153.355,     278,       0 ! !END!
1979 ! X =       289.4270,     5153.31,     277,       0 ! !END!
1980 ! X =       290.4260,     5153.266,     275,       0 ! !END!
1981 ! X =       291.4260,     5153.222,     260,       0 ! !END!
1982 ! X =       292.4250,     5153.177,     227,       0 ! !END!
1983 ! X =       293.4240,     5153.133,     214,       0 ! !END!
1984 ! X =       294.4230,     5153.089,     206,       0 ! !END!
1985 ! X =       295.4230,     5153.044,     196,       0 ! !END!
1986 ! X =       296.4220,     5153,     187,       0 ! !END!
1987 ! X =       297.4210,     5152.956,     184,       0 ! !END!
1988 ! X =       298.4200,     5152.911,     184,       0 ! !END!
1989 ! X =       299.4190,     5152.867,     184,       0 ! !END!
1990 ! X =       300.4190,     5152.823,     185,       0 ! !END!
1991 ! X =       301.4180,     5152.778,     185,       0 ! !END!
1992 ! X =       302.4170,     5152.734,     185,       0 ! !END!
1993 ! X =       303.4160,     5152.69,     185,       0 ! !END!
1994 ! X =       304.4150,     5152.645,     186,       0 ! !END!
1995 ! X =       305.4140,     5152.601,     188,       0 ! !END!
1996 ! X =       306.4140,     5152.557,     185,       0 ! !END!
1997 ! X =       307.4130,     5152.512,     180,       0 ! !END!
1998 ! X =       308.4120,     5152.468,     172,       0 ! !END!
1999 ! X =       309.4110,     5152.424,     156,       0 ! !END!
2000 ! X =       310.4100,     5152.379,     153,       0 ! !END!
2001 ! X =       311.4090,     5152.335,     153,       0 ! !END!
2002 ! X =       312.4090,     5152.291,     153,       0 ! !END!
2003 ! X =       313.4080,     5152.247,     154,       0 ! !END!
2004 ! X =       314.4070,     5152.202,     156,       0 ! !END!
2005 ! X =       315.4060,     5152.158,     158,       0 ! !END!
2006 ! X =       316.4050,     5152.114,     158,       0 ! !END!
2007 ! X =       317.4040,     5152.069,     153,       0 ! !END!
2008 ! X =       318.4030,     5152.025,     153,       0 ! !END!
2009 ! X =       319.4020,     5151.981,     153,       0 ! !END!
2010 ! X =       320.4010,     5151.936,     151,       0 ! !END!
2011 ! X =       321.4010,     5151.892,     149,       0 ! !END!
2012 ! X =       322.4000,     5151.848,     144,       0 ! !END!
2013 ! X =       323.3990,     5151.803,     136,       0 ! !END!
2014 ! X =       324.3980,     5151.759,     129,       0 ! !END!
2015 ! X =       286.4740,     5154.443,     305,       0 ! !END!
2016 ! X =       287.4730,     5154.398,     302,       0 ! !END!
2017 ! X =       288.4720,     5154.354,     301,       0 ! !END!
2018 ! X =       289.4720,     5154.31,     311,       0 ! !END!
2019 ! X =       290.4710,     5154.265,     329,       0 ! !END!
2020 ! X =       291.4700,     5154.221,     299,       0 ! !END!
2021 ! X =       292.4690,     5154.177,     225,       0 ! !END!
2022 ! X =       293.4680,     5154.132,     213,       0 ! !END!
2023 ! X =       294.4680,     5154.088,     205,       0 ! !END!
2024 ! X =       295.4670,     5154.044,     197,       0 ! !END!
2025 ! X =       296.4660,     5153.999,     191,       0 ! !END!
2026 ! X =       297.4650,     5153.955,     187,       0 ! !END!
2027 ! X =       298.4650,     5153.911,     187,       0 ! !END!
2028 ! X =       299.4640,     5153.866,     187,       0 ! !END!
2029 ! X =       300.4630,     5153.822,     192,       0 ! !END!
2030 ! X =       301.4620,     5153.778,     193,       0 ! !END!
2031 ! X =       302.4610,     5153.733,     194,       0 ! !END!
2032 ! X =       303.4600,     5153.689,     194,       0 ! !END!
2033 ! X =       304.4600,     5153.645,     194,       0 ! !END!
2034 ! X =       305.4590,     5153.6,     192,       0 ! !END!
2035 ! X =       306.4580,     5153.556,     188,       0 ! !END!
2036 ! X =       307.4570,     5153.512,     182,       0 ! !END!
2037 ! X =       308.4560,     5153.467,     174,       0 ! !END!
2038 ! X =       309.4550,     5153.423,     156,       0 ! !END!
2039 ! X =       310.4550,     5153.379,     153,       0 ! !END!
2040 ! X =       311.4540,     5153.334,     153,       0 ! !END!
2041 ! X =       312.4530,     5153.29,     153,       0 ! !END!
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2042 ! X =       313.4520,     5153.246,     153,       0 ! !END!
2043 ! X =       314.4510,     5153.201,     153,       0 ! !END!
2044 ! X =       315.4500,     5153.157,     153,       0 ! !END!
2045 ! X =       316.4490,     5153.113,     153,       0 ! !END!
2046 ! X =       317.4480,     5153.068,     153,       0 ! !END!
2047 ! X =       318.4480,     5153.024,     153,       0 ! !END!
2048 ! X =       319.4470,     5152.98,     153,       0 ! !END!
2049 ! X =       320.4460,     5152.935,     152,       0 ! !END!
2050 ! X =       321.4450,     5152.891,     150,       0 ! !END!
2051 ! X =       322.4440,     5152.847,     147,       0 ! !END!
2052 ! X =       323.4430,     5152.802,     138,       0 ! !END!
2053 ! X =       324.4420,     5152.758,     130,       0 ! !END!
2054 ! X =       286.5180,     5155.442,     323,       0 ! !END!
2055 ! X =       287.5170,     5155.398,     328,       0 ! !END!
2056 ! X =       288.5170,     5155.353,     347,       0 ! !END!
2057 ! X =       289.5160,     5155.309,     337,       0 ! !END!
2058 ! X =       290.5150,     5155.265,     345,       0 ! !END!
2059 ! X =       291.5140,     5155.22,     304,       0 ! !END!
2060 ! X =       292.5140,     5155.176,     224,       0 ! !END!
2061 ! X =       293.5130,     5155.132,     213,       0 ! !END!
2062 ! X =       294.5120,     5155.087,     207,       0 ! !END!
2063 ! X =       295.5110,     5155.043,     200,       0 ! !END!
2064 ! X =       296.5100,     5154.999,     195,       0 ! !END!
2065 ! X =       297.5100,     5154.954,     192,       0 ! !END!
2066 ! X =       298.5090,     5154.91,     196,       0 ! !END!
2067 ! X =       299.5080,     5154.866,     198,       0 ! !END!
2068 ! X =       300.5070,     5154.821,     201,       0 ! !END!
2069 ! X =       301.5060,     5154.777,     203,       0 ! !END!
2070 ! X =       302.5060,     5154.732,     204,       0 ! !END!
2071 ! X =       303.5050,     5154.688,     204,       0 ! !END!
2072 ! X =       304.5040,     5154.644,     205,       0 ! !END!
2073 ! X =       305.5030,     5154.599,     204,       0 ! !END!
2074 ! X =       306.5020,     5154.555,     197,       0 ! !END!
2075 ! X =       307.5010,     5154.511,     184,       0 ! !END!
2076 ! X =       308.5010,     5154.466,     177,       0 ! !END!
2077 ! X =       309.5000,     5154.422,     156,       0 ! !END!
2078 ! X =       310.4990,     5154.378,     153,       0 ! !END!
2079 ! X =       311.4980,     5154.333,     153,       0 ! !END!
2080 ! X =       312.4970,     5154.289,     153,       0 ! !END!
2081 ! X =       313.4960,     5154.245,     153,       0 ! !END!
2082 ! X =       314.4950,     5154.2,     153,       0 ! !END!
2083 ! X =       315.4950,     5154.156,     153,       0 ! !END!
2084 ! X =       316.4940,     5154.112,     153,       0 ! !END!
2085 ! X =       317.4930,     5154.067,     153,       0 ! !END!
2086 ! X =       318.4920,     5154.023,     153,       0 ! !END!
2087 ! X =       319.4910,     5153.979,     153,       0 ! !END!
2088 ! X =       320.4900,     5153.934,     153,       0 ! !END!
2089 ! X =       321.4890,     5153.89,     152,       0 ! !END!
2090 ! X =       322.4880,     5153.846,     148,       0 ! !END!
2091 ! X =       323.4870,     5153.801,     137,       0 ! !END!
2092 ! X =       324.4860,     5153.757,     128,       0 ! !END!
2093 ! X =       286.5620,     5156.441,     376,       0 ! !END!
2094 ! X =       287.5620,     5156.397,     368,       0 ! !END!
2095 ! X =       288.5610,     5156.353,     391,       0 ! !END!
2096 ! X =       289.5600,     5156.308,     352,       0 ! !END!
2097 ! X =       290.5590,     5156.264,     316,       0 ! !END!
2098 ! X =       291.5590,     5156.219,     264,       0 ! !END!
2099 ! X =       292.5580,     5156.175,     216,       0 ! !END!
2100 ! X =       293.5570,     5156.131,     213,       0 ! !END!
2101 ! X =       294.5560,     5156.086,     208,       0 ! !END!
2102 ! X =       295.5560,     5156.042,     203,       0 ! !END!
2103 ! X =       296.5550,     5155.998,     200,       0 ! !END!
2104 ! X =       297.5540,     5155.953,     198,       0 ! !END!
2105 ! X =       298.5530,     5155.909,     201,       0 ! !END!
2106 ! X =       299.5520,     5155.865,     206,       0 ! !END!
2107 ! X =       300.5520,     5155.82,     210,       0 ! !END!
2108 ! X =       301.5510,     5155.776,     212,       0 ! !END!
2109 ! X =       302.5500,     5155.732,     212,       0 ! !END!
2110 ! X =       303.5490,     5155.687,     212,       0 ! !END!
2111 ! X =       304.5480,     5155.643,     213,       0 ! !END!
2112 ! X =       305.5480,     5155.599,     212,       0 ! !END!
2113 ! X =       306.5470,     5155.554,     209,       0 ! !END!
2114 ! X =       307.5460,     5155.51,     193,       0 ! !END!
2115 ! X =       308.5450,     5155.466,     179,       0 ! !END!
2116 ! X =       309.5440,     5155.421,     157,       0 ! !END!
2117 ! X =       310.5430,     5155.377,     153,       0 ! !END!
2118 ! X =       311.5420,     5155.333,     153,       0 ! !END!
2119 ! X =       312.5420,     5155.288,     153,       0 ! !END!
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2120 ! X =       313.5410,     5155.244,     153,       0 ! !END!
2121 ! X =       314.5400,     5155.2,     153,       0 ! !END!
2122 ! X =       315.5390,     5155.155,     153,       0 ! !END!
2123 ! X =       316.5380,     5155.111,     153,       0 ! !END!
2124 ! X =       317.5370,     5155.067,     153,       0 ! !END!
2125 ! X =       318.5360,     5155.022,     153,       0 ! !END!
2126 ! X =       319.5350,     5154.978,     153,       0 ! !END!
2127 ! X =       320.5340,     5154.934,     153,       0 ! !END!
2128 ! X =       321.5340,     5154.889,     153,       0 ! !END!
2129 ! X =       322.5330,     5154.845,     146,       0 ! !END!
2130 ! X =       323.5320,     5154.8,     130,       0 ! !END!
2131 ! X =       324.5310,     5154.756,     123,       0 ! !END!
2132 ! X =       325.5300,     5154.712,     117,       0 ! !END!
2133 ! X =       286.6070,     5157.44,     382,       0 ! !END!
2134 ! X =       287.6060,     5157.396,     358,       0 ! !END!
2135 ! X =       288.6050,     5157.352,     354,       0 ! !END!
2136 ! X =       289.6050,     5157.307,     315,       0 ! !END!
2137 ! X =       290.6040,     5157.263,     270,       0 ! !END!
2138 ! X =       291.6030,     5157.219,     231,       0 ! !END!
2139 ! X =       292.6020,     5157.174,     214,       0 ! !END!
2140 ! X =       293.6020,     5157.13,     213,       0 ! !END!
2141 ! X =       294.6010,     5157.086,     210,       0 ! !END!
2142 ! X =       309.5880,     5156.42,     159,       0 ! !END!
2143 ! X =       310.5880,     5156.376,     153,       0 ! !END!
2144 ! X =       316.5820,     5156.11,     153,       0 ! !END!
2145 ! X =       317.5820,     5156.066,     153,       0 ! !END!
2146 ! X =       318.5810,     5156.021,     153,       0 ! !END!
2147 ! X =       319.5800,     5155.977,     153,       0 ! !END!
2148 ! X =       320.5790,     5155.933,     153,       0 ! !END!
2149 ! X =       321.5780,     5155.888,     150,       0 ! !END!
2150 ! X =       322.5770,     5155.844,     136,       0 ! !END!
2151 ! X =       323.5760,     5155.8,     122,       0 ! !END!
2152 ! X =       324.5750,     5155.755,     118,       0 ! !END!
2153 ! X =       286.6510,     5158.44,     352,       0 ! !END!
2154 ! X =       287.6500,     5158.395,     318,       0 ! !END!
2155 ! X =       288.6500,     5158.351,     300,       0 ! !END!
2156 ! X =       289.6490,     5158.307,     279,       0 ! !END!
2157 ! X =       290.6480,     5158.262,     247,       0 ! !END!
2158 ! X =       291.6470,     5158.218,     220,       0 ! !END!
2159 ! X =       292.6470,     5158.174,     214,       0 ! !END!
2160 ! X =       293.6460,     5158.129,     213,       0 ! !END!
2161 ! X =       294.6450,     5158.085,     211,       0 ! !END!
2162 ! X =       309.6330,     5157.42,     160,       0 ! !END!
2163 ! X =       310.6320,     5157.375,     153,       0 ! !END!
2164 ! X =       316.6270,     5157.109,     153,       0 ! !END!
2165 ! X =       317.6260,     5157.065,     153,       0 ! !END!
2166 ! X =       318.6250,     5157.02,     153,       0 ! !END!
2167 ! X =       319.6240,     5156.976,     151,       0 ! !END!
2168 ! X =       320.6230,     5156.932,     148,       0 ! !END!
2169 ! X =       321.6220,     5156.887,     138,       0 ! !END!
2170 ! X =       322.6210,     5156.843,     123,       0 ! !END!
2171 ! X =       323.6200,     5156.799,     116,       0 ! !END!
2172 ! X =       286.6960,     5159.439,     322,       0 ! !END!
2173 ! X =       287.6950,     5159.395,     292,       0 ! !END!
2174 ! X =       288.6940,     5159.35,     272,       0 ! !END!
2175 ! X =       289.6930,     5159.306,     253,       0 ! !END!
2176 ! X =       290.6930,     5159.262,     234,       0 ! !END!
2177 ! X =       291.6920,     5159.217,     216,       0 ! !END!
2178 ! X =       292.6910,     5159.173,     215,       0 ! !END!
2179 ! X =       293.6900,     5159.128,     215,       0 ! !END!
2180 ! X =       294.6890,     5159.084,     213,       0 ! !END!
2181 ! X =       309.6770,     5158.419,     159,       0 ! !END!
2182 ! X =       310.6760,     5158.374,     153,       0 ! !END!
2183 ! X =       315.6720,     5158.153,     153,       0 ! !END!
2184 ! X =       316.6710,     5158.108,     153,       0 ! !END!
2185 ! X =       317.6700,     5158.064,     152,       0 ! !END!
2186 ! X =       318.6690,     5158.02,     150,       0 ! !END!
2187 ! X =       319.6680,     5157.975,     141,       0 ! !END!
2188 ! X =       320.6680,     5157.931,     135,       0 ! !END!
2189 ! X =       321.6670,     5157.886,     124,       0 ! !END!
2190 ! X =       322.6660,     5157.842,     117,       0 ! !END!
2191 ! X =       323.6650,     5157.798,     126,       0 ! !END!
2192 ! X =       286.7400,     5160.438,     302,       0 ! !END!
2193 ! X =       287.7390,     5160.394,     280,       0 ! !END!
2194 ! X =       288.7380,     5160.35,     258,       0 ! !END!
2195 ! X =       289.7380,     5160.305,     243,       0 ! !END!
2196 ! X =       290.7370,     5160.261,     232,       0 ! !END!
2197 ! X =       291.7360,     5160.216,     223,       0 ! !END!
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2198 ! X =       292.7350,     5160.172,     224,       0 ! !END!
2199 ! X =       293.7350,     5160.128,     225,       0 ! !END!
2200 ! X =       294.7340,     5160.083,     221,       0 ! !END!
2201 ! X =       309.7220,     5159.418,     155,       0 ! !END!
2202 ! X =       310.7210,     5159.373,     153,       0 ! !END!
2203 ! X =       313.7180,     5159.24,     154,       0 ! !END!
2204 ! X =       314.7170,     5159.196,     153,       0 ! !END!
2205 ! X =       315.7160,     5159.152,     152,       0 ! !END!
2206 ! X =       316.7150,     5159.107,     150,       0 ! !END!
2207 ! X =       317.7150,     5159.063,     147,       0 ! !END!
2208 ! X =       318.7140,     5159.019,     140,       0 ! !END!
2209 ! X =       319.7130,     5158.974,     129,       0 ! !END!
2210 ! X =       320.7120,     5158.93,     122,       0 ! !END!
2211 ! X =       321.7110,     5158.886,     117,       0 ! !END!
2212 ! X =       322.7100,     5158.841,     124,       0 ! !END!
2213 ! X =       323.7090,     5158.797,     162,       0 ! !END!
2214 ! X =       286.7840,     5161.438,     299,       0 ! !END!
2215 ! X =       287.7840,     5161.393,     281,       0 ! !END!
2216 ! X =       288.7830,     5161.349,     261,       0 ! !END!
2217 ! X =       289.7820,     5161.304,     246,       0 ! !END!
2218 ! X =       290.7810,     5161.26,     240,       0 ! !END!
2219 ! X =       291.7810,     5161.216,     240,       0 ! !END!
2220 ! X =       292.7800,     5161.171,     243,       0 ! !END!
2221 ! X =       293.7790,     5161.127,     243,       0 ! !END!
2222 ! X =       294.7780,     5161.083,     237,       0 ! !END!
2223 ! X =       295.7770,     5161.038,     223,       0 ! !END!
2224 ! X =       296.7770,     5160.994,     213,       0 ! !END!
2225 ! X =       297.7760,     5160.949,     211,       0 ! !END!
2226 ! X =       298.7750,     5160.905,     211,       0 ! !END!
2227 ! X =       299.7740,     5160.861,     210,       0 ! !END!
2228 ! X =       300.7730,     5160.816,     206,       0 ! !END!
2229 ! X =       301.7730,     5160.772,     201,       0 ! !END!
2230 ! X =       302.7720,     5160.728,     195,       0 ! !END!
2231 ! X =       303.7710,     5160.683,     192,       0 ! !END!
2232 ! X =       304.7700,     5160.639,     188,       0 ! !END!
2233 ! X =       305.7690,     5160.594,     182,       0 ! !END!
2234 ! X =       306.7680,     5160.55,     173,       0 ! !END!
2235 ! X =       307.7680,     5160.506,     163,       0 ! !END!
2236 ! X =       308.7670,     5160.461,     156,       0 ! !END!
2237 ! X =       309.7660,     5160.417,     153,       0 ! !END!
2238 ! X =       310.7650,     5160.373,     154,       0 ! !END!
2239 ! X =       311.7640,     5160.328,     156,       0 ! !END!
2240 ! X =       312.7630,     5160.284,     159,       0 ! !END!
2241 ! X =       313.7620,     5160.24,     158,       0 ! !END!
2242 ! X =       314.7620,     5160.195,     152,       0 ! !END!
2243 ! X =       315.7610,     5160.151,     148,       0 ! !END!
2244 ! X =       316.7600,     5160.106,     140,       0 ! !END!
2245 ! X =       317.7590,     5160.062,     134,       0 ! !END!
2246 ! X =       318.7580,     5160.018,     126,       0 ! !END!
2247 ! X =       319.7570,     5159.973,     118,       0 ! !END!
2248 ! X =       320.7560,     5159.929,     117,       0 ! !END!
2249 ! X =       321.7550,     5159.885,     133,       0 ! !END!
2250 ! X =       322.7540,     5159.84,     181,       0 ! !END!
2251 ! X =       286.8290,     5162.437,     305,       0 ! !END!
2252 ! X =       287.8280,     5162.392,     289,       0 ! !END!
2253 ! X =       288.8270,     5162.348,     270,       0 ! !END!
2254 ! X =       289.8260,     5162.304,     254,       0 ! !END!
2255 ! X =       290.8260,     5162.259,     246,       0 ! !END!
2256 ! X =       291.8250,     5162.215,     243,       0 ! !END!
2257 ! X =       292.8240,     5162.171,     240,       0 ! !END!
2258 ! X =       293.8230,     5162.126,     234,       0 ! !END!
2259 ! X =       294.8230,     5162.082,     223,       0 ! !END!
2260 ! X =       295.8220,     5162.037,     211,       0 ! !END!
2261 ! X =       296.8210,     5161.993,     203,       0 ! !END!
2262 ! X =       297.8200,     5161.949,     197,       0 ! !END!
2263 ! X =       298.8190,     5161.904,     194,       0 ! !END!
2264 ! X =       299.8190,     5161.86,     191,       0 ! !END!
2265 ! X =       300.8180,     5161.816,     187,       0 ! !END!
2266 ! X =       301.8170,     5161.771,     185,       0 ! !END!
2267 ! X =       302.8160,     5161.727,     181,       0 ! !END!
2268 ! X =       303.8150,     5161.682,     177,       0 ! !END!
2269 ! X =       304.8140,     5161.638,     173,       0 ! !END!
2270 ! X =       305.8140,     5161.594,     166,       0 ! !END!
2271 ! X =       306.8130,     5161.549,     160,       0 ! !END!
2272 ! X =       307.8120,     5161.505,     155,       0 ! !END!
2273 ! X =       308.8110,     5161.461,     154,       0 ! !END!
2274 ! X =       309.8100,     5161.416,     158,       0 ! !END!
2275 ! X =       310.8090,     5161.372,     162,       0 ! !END!
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2276 ! X =       311.8090,     5161.327,     168,       0 ! !END!
2277 ! X =       312.8080,     5161.283,     171,       0 ! !END!
2278 ! X =       313.8070,     5161.239,     163,       0 ! !END!
2279 ! X =       314.8060,     5161.194,     146,       0 ! !END!
2280 ! X =       315.8050,     5161.15,     137,       0 ! !END!
2281 ! X =       316.8040,     5161.106,     128,       0 ! !END!
2282 ! X =       317.8030,     5161.061,     122,       0 ! !END!
2283 ! X =       318.8020,     5161.017,     117,       0 ! !END!
2284 ! X =       319.8010,     5160.972,     122,       0 ! !END!
2285 ! X =       320.8010,     5160.928,     150,       0 ! !END!
2286 ! X =       285.8740,     5163.48,     362,       0 ! !END!
2287 ! X =       286.8730,     5163.436,     325,       0 ! !END!
2288 ! X =       287.8720,     5163.392,     301,       0 ! !END!
2289 ! X =       288.8720,     5163.347,     286,       0 ! !END!
2290 ! X =       289.8710,     5163.303,     269,       0 ! !END!
2291 ! X =       290.8700,     5163.259,     249,       0 ! !END!
2292 ! X =       291.8690,     5163.214,     236,       0 ! !END!
2293 ! X =       292.8680,     5163.17,     224,       0 ! !END!
2294 ! X =       293.8680,     5163.125,     211,       0 ! !END!
2295 ! X =       294.8670,     5163.081,     198,       0 ! !END!
2296 ! X =       295.8660,     5163.037,     189,       0 ! !END!
2297 ! X =       296.8650,     5162.992,     185,       0 ! !END!
2298 ! X =       297.8650,     5162.948,     184,       0 ! !END!
2299 ! X =       298.8640,     5162.903,     184,       0 ! !END!
2300 ! X =       299.8630,     5162.859,     184,       0 ! !END!
2301 ! X =       300.8620,     5162.815,     184,       0 ! !END!
2302 ! X =       301.8610,     5162.77,     182,       0 ! !END!
2303 ! X =       302.8610,     5162.726,     174,       0 ! !END!
2304 ! X =       303.8600,     5162.682,     166,       0 ! !END!
2305 ! X =       304.8590,     5162.637,     162,       0 ! !END!
2306 ! X =       305.8580,     5162.593,     158,       0 ! !END!
2307 ! X =       306.8570,     5162.548,     155,       0 ! !END!
2308 ! X =       307.8560,     5162.504,     159,       0 ! !END!
2309 ! X =       308.8550,     5162.46,     170,       0 ! !END!
2310 ! X =       309.8550,     5162.415,     182,       0 ! !END!
2311 ! X =       310.8540,     5162.371,     194,       0 ! !END!
2312 ! X =       311.8530,     5162.327,     196,       0 ! !END!
2313 ! X =       312.8520,     5162.282,     178,       0 ! !END!
2314 ! X =       313.8510,     5162.238,     155,       0 ! !END!
2315 ! X =       314.8500,     5162.193,     133,       0 ! !END!
2316 ! X =       315.8490,     5162.149,     125,       0 ! !END!
2317 ! X =       316.8490,     5162.105,     122,       0 ! !END!
2318 ! X =       317.8480,     5162.06,     123,       0 ! !END!
2319 ! X =       318.8470,     5162.016,     132,       0 ! !END!
2320 ! X =       319.8460,     5161.972,     168,       0 ! !END!
2321 ! X =       320.8450,     5161.927,     237,       0 ! !END!
2322 ! X =       285.9180,     5164.48,     402,       0 ! !END!
2323 ! X =       286.9170,     5164.435,     357,       0 ! !END!
2324 ! X =       287.9170,     5164.391,     319,       0 ! !END!
2325 ! X =       288.9160,     5164.347,     298,       0 ! !END!
2326 ! X =       289.9150,     5164.302,     273,       0 ! !END!
2327 ! X =       290.9140,     5164.258,     235,       0 ! !END!
2328 ! X =       291.9140,     5164.213,     211,       0 ! !END!
2329 ! X =       292.9130,     5164.169,     193,       0 ! !END!
2330 ! X =       293.9120,     5164.125,     181,       0 ! !END!
2331 ! X =       294.9110,     5164.08,     174,       0 ! !END!
2332 ! X =       295.9110,     5164.036,     175,       0 ! !END!
2333 ! X =       296.9100,     5163.991,     180,       0 ! !END!
2334 ! X =       297.9090,     5163.947,     184,       0 ! !END!
2335 ! X =       298.9080,     5163.903,     184,       0 ! !END!
2336 ! X =       299.9070,     5163.858,     184,       0 ! !END!
2337 ! X =       300.9070,     5163.814,     184,       0 ! !END!
2338 ! X =       301.9060,     5163.769,     180,       0 ! !END!
2339 ! X =       302.9050,     5163.725,     168,       0 ! !END!
2340 ! X =       303.9040,     5163.681,     157,       0 ! !END!
2341 ! X =       304.9030,     5163.636,     163,       0 ! !END!
2342 ! X =       305.9020,     5163.592,     184,       0 ! !END!
2343 ! X =       306.9020,     5163.548,     204,       0 ! !END!
2344 ! X =       307.9010,     5163.503,     209,       0 ! !END!
2345 ! X =       308.9000,     5163.459,     208,       0 ! !END!
2346 ! X =       309.8990,     5163.414,     212,       0 ! !END!
2347 ! X =       310.8980,     5163.37,     220,       0 ! !END!
2348 ! X =       311.8970,     5163.326,     206,       0 ! !END!
2349 ! X =       312.8960,     5163.281,     166,       0 ! !END!
2350 ! X =       313.8960,     5163.237,     139,       0 ! !END!
2351 ! X =       314.8950,     5163.193,     125,       0 ! !END!
2352 ! X =       315.8940,     5163.148,     122,       0 ! !END!
2353 ! X =       316.8930,     5163.104,     126,       0 ! !END!
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2354 ! X =       317.8920,     5163.059,     156,       0 ! !END!
2355 ! X =       318.8910,     5163.015,     206,       0 ! !END!
2356 ! X =       319.8900,     5162.971,     251,       0 ! !END!
2357 ! X =       320.8890,     5162.926,     275,       0 ! !END!
2358 ! X =       284.9630,     5165.523,     452,       0 ! !END!
2359 ! X =       285.9630,     5165.479,     399,       0 ! !END!
2360 ! X =       286.9620,     5165.435,     340,       0 ! !END!
2361 ! X =       287.9610,     5165.39,     292,       0 ! !END!
2362 ! X =       288.9600,     5165.346,     269,       0 ! !END!
2363 ! X =       289.9600,     5165.301,     229,       0 ! !END!
2364 ! X =       290.9590,     5165.257,     190,       0 ! !END!
2365 ! X =       291.9580,     5165.213,     172,       0 ! !END!
2366 ! X =       292.9570,     5165.168,     163,       0 ! !END!
2367 ! X =       293.9560,     5165.124,     163,       0 ! !END!
2368 ! X =       294.9560,     5165.079,     162,       0 ! !END!
2369 ! X =       295.9550,     5165.035,     166,       0 ! !END!
2370 ! X =       296.9540,     5164.991,     176,       0 ! !END!
2371 ! X =       297.9530,     5164.946,     183,       0 ! !END!
2372 ! X =       298.9530,     5164.902,     183,       0 ! !END!
2373 ! X =       299.9520,     5164.857,     182,       0 ! !END!
2374 ! X =       300.9510,     5164.813,     177,       0 ! !END!
2375 ! X =       301.9500,     5164.769,     167,       0 ! !END!
2376 ! X =       302.9490,     5164.724,     157,       0 ! !END!
2377 ! X =       303.9480,     5164.68,     158,       0 ! !END!
2378 ! X =       304.9480,     5164.636,     175,       0 ! !END!
2379 ! X =       305.9470,     5164.591,     195,       0 ! !END!
2380 ! X =       306.9460,     5164.547,     204,       0 ! !END!
2381 ! X =       307.9450,     5164.502,     203,       0 ! !END!
2382 ! X =       308.9440,     5164.458,     197,       0 ! !END!
2383 ! X =       309.9430,     5164.414,     194,       0 ! !END!
2384 ! X =       310.9430,     5164.369,     192,       0 ! !END!
2385 ! X =       311.9420,     5164.325,     174,       0 ! !END!
2386 ! X =       312.9410,     5164.28,     146,       0 ! !END!
2387 ! X =       313.9400,     5164.236,     129,       0 ! !END!
2388 ! X =       314.9390,     5164.192,     122,       0 ! !END!
2389 ! X =       315.9380,     5164.147,     124,       0 ! !END!
2390 ! X =       316.9370,     5164.103,     159,       0 ! !END!
2391 ! X =       317.9360,     5164.059,     227,       0 ! !END!
2392 ! X =       318.9360,     5164.014,     269,       0 ! !END!
2393 ! X =       319.9350,     5163.97,     275,       0 ! !END!
2394 ! X =       320.9340,     5163.925,     275,       0 ! !END!
2395 ! X =       285.0080,     5166.523,     273,       0 ! !END!
2396 ! X =       286.0070,     5166.478,     255,       0 ! !END!
2397 ! X =       287.0060,     5166.434,     227,       0 ! !END!
2398 ! X =       288.0050,     5166.389,     205,       0 ! !END!
2399 ! X =       289.0050,     5166.345,     193,       0 ! !END!
2400 ! X =       290.0040,     5166.301,     166,       0 ! !END!
2401 ! X =       291.0030,     5166.256,     150,       0 ! !END!
2402 ! X =       292.0020,     5166.212,     148,       0 ! !END!
2403 ! X =       293.0020,     5166.167,     148,       0 ! !END!
2404 ! X =       294.0010,     5166.123,     149,       0 ! !END!
2405 ! X =       295.0000,     5166.079,     150,       0 ! !END!
2406 ! X =       295.9990,     5166.034,     153,       0 ! !END!
2407 ! X =       296.9990,     5165.99,     163,       0 ! !END!
2408 ! X =       297.9980,     5165.945,     172,       0 ! !END!
2409 ! X =       298.9970,     5165.901,     174,       0 ! !END!
2410 ! X =       299.9960,     5165.857,     171,       0 ! !END!
2411 ! X =       300.9950,     5165.812,     166,       0 ! !END!
2412 ! X =       301.9940,     5165.768,     159,       0 ! !END!
2413 ! X =       302.9940,     5165.723,     154,       0 ! !END!
2414 ! X =       303.9930,     5165.679,     155,       0 ! !END!
2415 ! X =       304.9920,     5165.635,     161,       0 ! !END!
2416 ! X =       305.9910,     5165.59,     168,       0 ! !END!
2417 ! X =       306.9900,     5165.546,     173,       0 ! !END!
2418 ! X =       307.9890,     5165.502,     172,       0 ! !END!
2419 ! X =       308.9890,     5165.457,     166,       0 ! !END!
2420 ! X =       309.9880,     5165.413,     159,       0 ! !END!
2421 ! X =       310.9870,     5165.368,     152,       0 ! !END!
2422 ! X =       311.9860,     5165.324,     143,       0 ! !END!
2423 ! X =       312.9850,     5165.28,     131,       0 ! !END!
2424 ! X =       313.9840,     5165.235,     124,       0 ! !END!
2425 ! X =       314.9830,     5165.191,     120,       0 ! !END!
2426 ! X =       315.9830,     5165.146,     140,       0 ! !END!
2427 ! X =       316.9820,     5165.102,     211,       0 ! !END!
2428 ! X =       317.9810,     5165.058,     270,       0 ! !END!
2429 ! X =       318.9800,     5165.013,     275,       0 ! !END!
2430 ! X =       319.9790,     5164.969,     275,       0 ! !END!
2431 ! X =       320.9780,     5164.924,     275,       0 ! !END!
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! X =      285.0520,     5167.522,     147,       0 ! !END!
! X =      286.0510,     5167.477,     144,       0 ! !END!
! X =      287.0510,     5167.433,     142,       0 ! !END!
! X =      288.0500,     5167.389,     142,       0 ! !END!
! X =      289.0490,     5167.344,     139,       0 ! !END!
! X =      290.0480,     5167.3,     136,       0 ! !END!
! X =      291.0480,     5167.255,     137,       0 ! !END!
! X =      292.0470,     5167.211,     139,       0 ! !END!
! X =      293.0460,     5167.167,     140,       0 ! !END!
! X =      294.0450,     5167.122,     139,       0 ! !END!
! X =      295.0450,     5167.078,     138,       0 ! !END!
! X =      296.0440,     5167.033,     138,       0 ! !END!
! X =      297.0430,     5166.989,     140,       0 ! !END!
! X =      298.0420,     5166.945,     147,       0 ! !END!
! X =      299.0410,     5166.9,     154,       0 ! !END!
! X =      300.0410,     5166.856,     158,       0 ! !END!
! X =      301.0400,     5166.811,     156,       0 ! !END!
! X =      302.0390,     5166.767,     154,       0 ! !END!
! X =      303.0380,     5166.723,     153,       0 ! !END!
! X =      304.0370,     5166.678,     153,       0 ! !END!
! X =      305.0360,     5166.634,     153,       0 ! !END!
! X =      306.0360,     5166.589,     154,       0 ! !END!
! X =      307.0350,     5166.545,     157,       0 ! !END!
! X =      308.0340,     5166.501,     158,       0 ! !END!
! X =      309.0330,     5166.456,     151,       0 ! !END!
! X =      310.0320,     5166.412,     142,       0 ! !END!
! X =      311.0310,     5166.367,     134,       0 ! !END!
! X =      312.0300,     5166.323,     128,       0 ! !END!
! X =      313.0300,     5166.279,     124,       0 ! !END!
! X =      314.0290,     5166.234,     122,       0 ! !END!
! X =      315.0280,     5166.19,     119,       0 ! !END!
! X =      316.0270,     5166.146,     163,       0 ! !END!
! X =      317.0260,     5166.101,     239,       0 ! !END!
! X =      318.0250,     5166.057,     272,       0 ! !END!
! X =      319.0240,     5166.012,     274,       0 ! !END!
! X =      320.0230,     5165.968,     275,       0 ! !END!
! X =      321.0220,     5165.924,     275,       0 ! !END!
! X =      287.0950,     5168.432,     135,       0 ! !END!
! X =      288.0940,     5168.388,     132,       0 ! !END!
! X =      289.0940,     5168.344,     130,       0 ! !END!
! X =      290.0930,     5168.299,     128,       0 ! !END!
! X =      291.0920,     5168.255,     129,       0 ! !END!
! X =      292.0910,     5168.21,     131,       0 ! !END!
! X =      293.0900,     5168.166,     132,       0 ! !END!
! X =      294.0900,     5168.121,     131,       0 ! !END!
! X =      295.0890,     5168.077,     128,       0 ! !END!
! X =      296.0880,     5168.033,     127,       0 ! !END!
! X =      297.0870,     5167.988,     127,       0 ! !END!
! X =      298.0870,     5167.944,     131,       0 ! !END!
! X =      299.0860,     5167.899,     140,       0 ! !END!
! X =      300.0850,     5167.855,     150,       0 ! !END!
! X =      301.0840,     5167.811,     153,       0 ! !END!
! X =      302.0830,     5167.766,     153,       0 ! !END!
! X =      303.0820,     5167.722,     153,       0 ! !END!
! X =      304.0820,     5167.677,     153,       0 ! !END!
! X =      305.0810,     5167.633,     153,       0 ! !END!
! X =      306.0800,     5167.589,     153,       0 ! !END!
! X =      307.0790,     5167.544,     153,       0 ! !END!
! X =      308.0780,     5167.5,     150,       0 ! !END!
! X =      309.0770,     5167.455,     140,       0 ! !END!
! X =      310.0770,     5167.411,     130,       0 ! !END!
! X =      311.0760,     5167.367,     125,       0 ! !END!
! X =      312.0750,     5167.322,     124,       0 ! !END!
! X =      313.0740,     5167.278,     124,       0 ! !END!
! X =      314.0730,     5167.233,     122,       0 ! !END!
! X =      315.0720,     5167.189,     119,       0 ! !END!
! X =      316.0710,     5167.145,     176,       0 ! !END!
! X =      317.0700,     5167.1,     240,       0 ! !END!
! X =      318.0700,     5167.056,     259,       0 ! !END!
! X =      319.0690,     5167.011,     266,       0 ! !END!
! X =      320.0680,     5166.967,     272,       0 ! !END!
! X =      321.0670,     5166.923,     272,       0 ! !END!
! X =      287.1390,     5169.432,     162,       0 ! !END!
! X =      288.1390,     5169.387,     161,       0 ! !END!
! X =      289.1380,     5169.343,     163,       0 ! !END!
! X =      290.1370,     5169.298,     157,       0 ! !END!
! X =      291.1360,     5169.254,     146,       0 ! !END!
! X =      292.1360,     5169.21,     135,       0 ! !END!
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2510 ! X =       293.1350,     5169.165,     130,       0 ! !END!
2511 ! X =       294.1340,     5169.121,     129,       0 ! !END!
2512 ! X =       295.1330,     5169.076,     127,       0 ! !END!
2513 ! X =       296.1330,     5169.032,     126,       0 ! !END!
2514 ! X =       297.1320,     5168.987,     124,       0 ! !END!
2515 ! X =       298.1310,     5168.943,     122,       0 ! !END!
2516 ! X =       299.1300,     5168.899,     124,       0 ! !END!
2517 ! X =       300.1290,     5168.854,     136,       0 ! !END!
2518 ! X =       301.1290,     5168.81,     147,       0 ! !END!
2519 ! X =       302.1280,     5168.765,     152,       0 ! !END!
2520 ! X =       303.1270,     5168.721,     153,       0 ! !END!
2521 ! X =       304.1260,     5168.677,     153,       0 ! !END!
2522 ! X =       305.1250,     5168.632,     153,       0 ! !END!
2523 ! X =       306.1240,     5168.588,     153,       0 ! !END!
2524 ! X =       307.1240,     5168.543,     150,       0 ! !END!
2525 ! X =       308.1230,     5168.499,     143,       0 ! !END!
2526 ! X =       309.1220,     5168.455,     132,       0 ! !END!
2527 ! X =       310.1210,     5168.41,     125,       0 ! !END!
2528 ! X =       311.1200,     5168.366,     123,       0 ! !END!
2529 ! X =       312.1190,     5168.321,     124,       0 ! !END!
2530 ! X =       313.1180,     5168.277,     124,       0 ! !END!
2531 ! X =       314.1180,     5168.233,     122,       0 ! !END!
2532 ! X =       315.1170,     5168.188,     120,       0 ! !END!
2533 ! X =       316.1160,     5168.144,     180,       0 ! !END!
2534 ! X =       317.1150,     5168.099,     232,       0 ! !END!
2535 ! X =       318.1140,     5168.055,     242,       0 ! !END!
2536 ! X =       319.1130,     5168.011,     245,       0 ! !END!
2537 ! X =       320.1120,     5167.966,     253,       0 ! !END!
2538 ! X =       321.1110,     5167.922,     253,       0 ! !END!
2539 ! X =       288.1830,     5170.386,     203,       0 ! !END!
2540 ! X =       289.1820,     5170.342,     211,       0 ! !END!
2541 ! X =       290.1820,     5170.298,     211,       0 ! !END!
2542 ! X =       291.1810,     5170.253,     200,       0 ! !END!
2543 ! X =       292.1800,     5170.209,     181,       0 ! !END!
2544 ! X =       293.1790,     5170.164,     161,       0 ! !END!
2545 ! X =       294.1790,     5170.12,     149,       0 ! !END!
2546 ! X =       295.1780,     5170.075,     146,       0 ! !END!
2547 ! X =       296.1770,     5170.031,     144,       0 ! !END!
2548 ! X =       297.1760,     5169.987,     138,       0 ! !END!
2549 ! X =       298.1750,     5169.942,     130,       0 ! !END!
2550 ! X =       299.1750,     5169.898,     124,       0 ! !END!
2551 ! X =       300.1740,     5169.853,     122,       0 ! !END!
2552 ! X =       301.1730,     5169.809,     129,       0 ! !END!
2553 ! X =       302.1720,     5169.765,     140,       0 ! !END!
2554 ! X =       303.1710,     5169.72,     146,       0 ! !END!
2555 ! X =       304.1700,     5169.676,     148,       0 ! !END!
2556 ! X =       305.1700,     5169.631,     149,       0 ! !END!
2557 ! X =       306.1690,     5169.587,     149,       0 ! !END!
2558 ! X =       307.1680,     5169.543,     145,       0 ! !END!
2559 ! X =       308.1670,     5169.498,     137,       0 ! !END!
2560 ! X =       309.1660,     5169.454,     128,       0 ! !END!
2561 ! X =       310.1650,     5169.409,     124,       0 ! !END!
2562 ! X =       311.1650,     5169.365,     123,       0 ! !END!
2563 ! X =       312.1640,     5169.32,     123,       0 ! !END!
2564 ! X =       313.1630,     5169.276,     122,       0 ! !END!
2565 ! X =       314.1620,     5169.232,     120,       0 ! !END!
2566 ! X =       315.1610,     5169.187,     132,       0 ! !END!
2567 ! X =       316.1600,     5169.143,     192,       0 ! !END!
2568 ! X =       317.1590,     5169.098,     230,       0 ! !END!
2569 ! X =       318.1580,     5169.054,     237,       0 ! !END!
2570 ! X =       319.1570,     5169.01,     238,       0 ! !END!
2571 ! X =       320.1570,     5168.965,     240,       0 ! !END!
2572 ! X =       321.1560,     5168.921,     242,       0 ! !END!
2573 ! X =       289.2270,     5171.341,     235,       0 ! !END!
2574 ! X =       290.2260,     5171.297,     238,       0 ! !END!
2575 ! X =       291.2250,     5171.252,     240,       0 ! !END!
2576 ! X =       292.2240,     5171.208,     239,       0 ! !END!
2577 ! X =       293.2240,     5171.164,     219,       0 ! !END!
2578 ! X =       294.2230,     5171.119,     186,       0 ! !END!
2579 ! X =       295.2220,     5171.075,     163,       0 ! !END!
2580 ! X =       296.2210,     5171.03,     155,       0 ! !END!
2581 ! X =       297.2210,     5170.986,     151,       0 ! !END!
2582 ! X =       298.2200,     5170.941,     144,       0 ! !END!
2583 ! X =       299.2190,     5170.897,     135,       0 ! !END!
2584 ! X =       300.2180,     5170.853,     127,       0 ! !END!
2585 ! X =       301.2170,     5170.808,     122,       0 ! !END!
2586 ! X =       302.2170,     5170.764,     127,       0 ! !END!
2587 ! X =       303.2160,     5170.719,     136,       0 ! !END!
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2588 ! X =       304.2150,     5170.675,     140,       0 ! !END!
2589 ! X =       305.2140,     5170.631,     143,       0 ! !END!
2590 ! X =       306.2130,     5170.586,     143,       0 ! !END!
2591 ! X =       307.2120,     5170.542,     139,       0 ! !END!
2592 ! X =       308.2120,     5170.497,     132,       0 ! !END!
2593 ! X =       309.2110,     5170.453,     126,       0 ! !END!
2594 ! X =       310.2100,     5170.408,     123,       0 ! !END!
2595 ! X =       311.2090,     5170.364,     122,       0 ! !END!
2596 ! X =       312.2080,     5170.32,     122,       0 ! !END!
2597 ! X =       313.2070,     5170.275,     121,       0 ! !END!
2598 ! X =       314.2060,     5170.231,     133,       0 ! !END!
2599 ! X =       315.2050,     5170.186,     167,       0 ! !END!
2600 ! X =       316.2050,     5170.142,     206,       0 ! !END!
2601 ! X =       317.2040,     5170.098,     227,       0 ! !END!
2602 ! X =       318.2030,     5170.053,     237,       0 ! !END!
2603 ! X =       319.2020,     5170.009,     239,       0 ! !END!
2604 ! X =       320.2010,     5169.964,     239,       0 ! !END!
2605 ! X =       321.2000,     5169.92,     241,       0 ! !END!
2606 ! X =       290.2700,     5172.296,     245,       0 ! !END!
2607 ! X =       291.2700,     5172.252,     245,       0 ! !END!
2608 ! X =       292.2690,     5172.207,     244,       0 ! !END!
2609 ! X =       293.2680,     5172.163,     241,       0 ! !END!
2610 ! X =       294.2670,     5172.118,     212,       0 ! !END!
2611 ! X =       295.2670,     5172.074,     169,       0 ! !END!
2612 ! X =       296.2660,     5172.029,     155,       0 ! !END!
2613 ! X =       297.2650,     5171.985,     153,       0 ! !END!
2614 ! X =       298.2640,     5171.941,     152,       0 ! !END!
2615 ! X =       299.2630,     5171.896,     148,       0 ! !END!
2616 ! X =       300.2630,     5171.852,     139,       0 ! !END!
2617 ! X =       301.2620,     5171.807,     129,       0 ! !END!
2618 ! X =       302.2610,     5171.763,     123,       0 ! !END!
2619 ! X =       303.2600,     5171.719,     127,       0 ! !END!
2620 ! X =       304.2590,     5171.674,     133,       0 ! !END!
2621 ! X =       305.2580,     5171.63,     138,       0 ! !END!
2622 ! X =       306.2580,     5171.585,     138,       0 ! !END!
2623 ! X =       307.2570,     5171.541,     134,       0 ! !END!
2624 ! X =       308.2560,     5171.496,     130,       0 ! !END!
2625 ! X =       309.2550,     5171.452,     126,       0 ! !END!
2626 ! X =       310.2540,     5171.408,     123,       0 ! !END!
2627 ! X =       311.2530,     5171.363,     122,       0 ! !END!
2628 ! X =       312.2520,     5171.319,     120,       0 ! !END!
2629 ! X =       313.2520,     5171.274,     132,       0 ! !END!
2630 ! X =       314.2510,     5171.23,     170,       0 ! !END!
2631 ! X =       315.2500,     5171.186,     203,       0 ! !END!
2632 ! X =       316.2490,     5171.141,     213,       0 ! !END!
2633 ! X =       317.2480,     5171.097,     225,       0 ! !END!
2634 ! X =       318.2470,     5171.052,     238,       0 ! !END!
2635 ! X =       319.2460,     5171.008,     240,       0 ! !END!
2636 ! X =       320.2450,     5170.963,     241,       0 ! !END!
2637 ! X =       291.3140,     5173.251,     244,       0 ! !END!
2638 ! X =       292.3130,     5173.206,     237,       0 ! !END!
2639 ! X =       293.3130,     5173.162,     226,       0 ! !END!
2640 ! X =       294.3120,     5173.118,     206,       0 ! !END!
2641 ! X =       295.3110,     5173.073,     172,       0 ! !END!
2642 ! X =       296.3100,     5173.029,     156,       0 ! !END!
2643 ! X =       297.3090,     5172.984,     153,       0 ! !END!
2644 ! X =       298.3090,     5172.94,     153,       0 ! !END!
2645 ! X =       299.3080,     5172.895,     155,       0 ! !END!
2646 ! X =       300.3070,     5172.851,     150,       0 ! !END!
2647 ! X =       301.3060,     5172.807,     139,       0 ! !END!
2648 ! X =       302.3050,     5172.762,     128,       0 ! !END!
2649 ! X =       303.3050,     5172.718,     123,       0 ! !END!
2650 ! X =       304.3040,     5172.673,     127,       0 ! !END!
2651 ! X =       305.3030,     5172.629,     132,       0 ! !END!
2652 ! X =       306.3020,     5172.584,     134,       0 ! !END!
2653 ! X =       307.3010,     5172.54,     131,       0 ! !END!
2654 ! X =       308.3000,     5172.496,     129,       0 ! !END!
2655 ! X =       309.2990,     5172.451,     127,       0 ! !END!
2656 ! X =       310.2990,     5172.407,     125,       0 ! !END!
2657 ! X =       311.2980,     5172.362,     122,       0 ! !END!
2658 ! X =       312.2970,     5172.318,     119,       0 ! !END!
2659 ! X =       313.2960,     5172.273,     154,       0 ! !END!
2660 ! X =       314.2950,     5172.229,     189,       0 ! !END!
2661 ! X =       315.2940,     5172.185,     206,       0 ! !END!
2662 ! X =       316.2930,     5172.14,     215,       0 ! !END!
2663 ! X =       317.2920,     5172.096,     227,       0 ! !END!
2664 ! X =       318.2920,     5172.051,     240,       0 ! !END!
2665 ! X =       319.2910,     5172.007,     243,       0 ! !END!
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2666 ! X =       320.2900,     5171.963,     245,       0 ! !END!
2667 ! X =       291.3590,     5174.25,     240,       0 ! !END!
2668 ! X =       292.3580,     5174.206,     221,       0 ! !END!
2669 ! X =       293.3570,     5174.161,     210,       0 ! !END!
2670 ! X =       294.3560,     5174.117,     199,       0 ! !END!
2671 ! X =       295.3550,     5174.072,     186,       0 ! !END!
2672 ! X =       296.3550,     5174.028,     164,       0 ! !END!
2673 ! X =       297.3540,     5173.983,     155,       0 ! !END!
2674 ! X =       298.3530,     5173.939,     153,       0 ! !END!
2675 ! X =       299.3520,     5173.895,     153,       0 ! !END!
2676 ! X =       300.3510,     5173.85,     153,       0 ! !END!
2677 ! X =       301.3510,     5173.806,     144,       0 ! !END!
2678 ! X =       302.3500,     5173.761,     133,       0 ! !END!
2679 ! X =       303.3490,     5173.717,     125,       0 ! !END!
2680 ! X =       304.3480,     5173.672,     123,       0 ! !END!
2681 ! X =       305.3470,     5173.628,     127,       0 ! !END!
2682 ! X =       306.3460,     5173.584,     130,       0 ! !END!
2683 ! X =       307.3460,     5173.539,     129,       0 ! !END!
2684 ! X =       308.3450,     5173.495,     133,       0 ! !END!
2685 ! X =       309.3440,     5173.45,     135,       0 ! !END!
2686 ! X =       310.3430,     5173.406,     134,       0 ! !END!
2687 ! X =       311.3420,     5173.361,     122,       0 ! !END!
2688 ! X =       312.3410,     5173.317,     118,       0 ! !END!
2689 ! X =       313.3400,     5173.273,     164,       0 ! !END!
2690 ! X =       314.3400,     5173.228,     194,       0 ! !END!
2691 ! X =       315.3390,     5173.184,     209,       0 ! !END!
2692 ! X =       316.3380,     5173.139,     226,       0 ! !END!
2693 ! X =       317.3370,     5173.095,     237,       0 ! !END!
2694 ! X =       318.3360,     5173.05,     244,       0 ! !END!
2695 ! X =       319.3350,     5173.006,     248,       0 ! !END!
2696 ! X =       320.3340,     5172.962,     256,       0 ! !END!
2697 ! X =       294.4010,     5175.116,     203,       0 ! !END!
2698 ! X =       295.4000,     5175.072,     194,       0 ! !END!
2699 ! X =       296.3990,     5175.027,     186,       0 ! !END!
2700 ! X =       297.3980,     5174.983,     168,       0 ! !END!
2701 ! X =       298.3970,     5174.938,     156,       0 ! !END!
2702 ! X =       299.3970,     5174.894,     153,       0 ! !END!
2703 ! X =       300.3960,     5174.849,     153,       0 ! !END!
2704 ! X =       301.3950,     5174.805,     146,       0 ! !END!
2705 ! X =       302.3940,     5174.76,     137,       0 ! !END!
2706 ! X =       303.3930,     5174.716,     129,       0 ! !END!
2707 ! X =       304.3930,     5174.672,     123,       0 ! !END!
2708 ! X =       305.3920,     5174.627,     122,       0 ! !END!
2709 ! X =       306.3910,     5174.583,     126,       0 ! !END!
2710 ! X =       307.3900,     5174.538,     126,       0 ! !END!
2711 ! X =       308.3890,     5174.494,     136,       0 ! !END!
2712 ! X =       309.3880,     5174.449,     143,       0 ! !END!
2713 ! X =       310.3870,     5174.405,     135,       0 ! !END!
2714 ! X =       311.3870,     5174.361,     120,       0 ! !END!
2715 ! X =       312.3860,     5174.316,     128,       0 ! !END!
2716 ! X =       313.3850,     5174.272,     177,       0 ! !END!
2717 ! X =       314.3840,     5174.227,     201,       0 ! !END!
2718 ! X =       315.3830,     5174.183,     216,       0 ! !END!
2719 ! X =       316.3820,     5174.138,     237,       0 ! !END!
2720 ! X =       317.3810,     5174.094,     244,       0 ! !END!
2721 ! X =       318.3800,     5174.05,     246,       0 ! !END!
2722 ! X =       319.3800,     5174.005,     259,       0 ! !END!
2723 ! X =       295.4440,     5176.071,     197,       0 ! !END!
2724 ! X =       296.4440,     5176.026,     191,       0 ! !END!
2725 ! X =       297.4430,     5175.982,     185,       0 ! !END!
2726 ! X =       298.4420,     5175.937,     176,       0 ! !END!
2727 ! X =       299.4410,     5175.893,     164,       0 ! !END!
2728 ! X =       300.4400,     5175.849,     154,       0 ! !END!
2729 ! X =       301.4390,     5175.804,     148,       0 ! !END!
2730 ! X =       302.4390,     5175.76,     141,       0 ! !END!
2731 ! X =       303.4380,     5175.715,     134,       0 ! !END!
2732 ! X =       304.4370,     5175.671,     128,       0 ! !END!
2733 ! X =       305.4360,     5175.626,     123,       0 ! !END!
2734 ! X =       306.4350,     5175.582,     122,       0 ! !END!
2735 ! X =       307.4340,     5175.537,     124,       0 ! !END!
2736 ! X =       308.4340,     5175.493,     130,       0 ! !END!
2737 ! X =       309.4330,     5175.449,     135,       0 ! !END!
2738 ! X =       310.4320,     5175.404,     124,       0 ! !END!
2739 ! X =       311.4310,     5175.36,     125,       0 ! !END!
2740 ! X =       312.4300,     5175.315,     161,       0 ! !END!
2741 ! X =       313.4290,     5175.271,     193,       0 ! !END!
2742 ! X =       314.4280,     5175.226,     206,       0 ! !END!
2743 ! X =       315.4280,     5175.182,     218,       0 ! !END!
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2744 ! X =       316.4270,     5175.138,     234,       0 ! !END!
2745 ! X =       317.4260,     5175.093,     242,       0 ! !END!
2746 ! X =       318.4250,     5175.049,     251,       0 ! !END!
2747 ! X =       319.4240,     5175.004,     269,       0 ! !END!
2748 ! X =       296.4880,     5177.026,     195,       0 ! !END!
2749 ! X =       297.4870,     5176.981,     187,       0 ! !END!
2750 ! X =       298.4860,     5176.937,     184,       0 ! !END!
2751 ! X =       299.4860,     5176.892,     184,       0 ! !END!
2752 ! X =       300.4850,     5176.848,     172,       0 ! !END!
2753 ! X =       301.4840,     5176.803,     151,       0 ! !END!
2754 ! X =       302.4830,     5176.759,     146,       0 ! !END!
2755 ! X =       303.4820,     5176.714,     143,       0 ! !END!
2756 ! X =       304.4810,     5176.67,     137,       0 ! !END!
2757 ! X =       305.4810,     5176.625,     127,       0 ! !END!
2758 ! X =       306.4800,     5176.581,     122,       0 ! !END!
2759 ! X =       307.4790,     5176.537,     121,       0 ! !END!
2760 ! X =       308.4780,     5176.492,     123,       0 ! !END!
2761 ! X =       309.4770,     5176.448,     125,       0 ! !END!
2762 ! X =       310.4760,     5176.403,     130,       0 ! !END!
2763 ! X =       311.4750,     5176.359,     156,       0 ! !END!
2764 ! X =       312.4750,     5176.314,     190,       0 ! !END!
2765 ! X =       313.4740,     5176.27,     198,       0 ! !END!
2766 ! X =       314.4730,     5176.226,     207,       0 ! !END!
2767 ! X =       315.4720,     5176.181,     214,       0 ! !END!
2768 ! X =       316.4710,     5176.137,     223,       0 ! !END!
2769 ! X =       317.4700,     5176.092,     235,       0 ! !END!
2770 ! X =       318.4690,     5176.048,     257,       0 ! !END!
2771 ! X =       319.4680,     5176.003,     273,       0 ! !END!
2772 ! X =       298.5310,     5177.936,     188,       0 ! !END!
2773 ! X =       299.5300,     5177.891,     186,       0 ! !END!
2774 ! X =       300.5290,     5177.847,     184,       0 ! !END!
2775 ! X =       301.5280,     5177.802,     169,       0 ! !END!
2776 ! X =       302.5280,     5177.758,     157,       0 ! !END!
2777 ! X =       303.5270,     5177.714,     164,       0 ! !END!
2778 ! X =       304.5260,     5177.669,     162,       0 ! !END!
2779 ! X =       305.5250,     5177.625,     158,       0 ! !END!
2780 ! X =       306.5240,     5177.58,     150,       0 ! !END!
2781 ! X =       307.5230,     5177.536,     130,       0 ! !END!
2782 ! X =       308.5230,     5177.491,     134,       0 ! !END!
2783 ! X =       309.5220,     5177.447,     159,       0 ! !END!
2784 ! X =       310.5210,     5177.402,     170,       0 ! !END!
2785 ! X =       311.5200,     5177.358,     190,       0 ! !END!
2786 ! X =       312.5190,     5177.314,     198,       0 ! !END!
2787 ! X =       313.5180,     5177.269,     202,       0 ! !END!
2788 ! X =       314.5170,     5177.225,     206,       0 ! !END!
2789 ! X =       315.5160,     5177.18,     211,       0 ! !END!
2790 ! X =       316.5160,     5177.136,     216,       0 ! !END!
2791 ! X =       317.5150,     5177.091,     223,       0 ! !END!
2792 ! X =       318.5140,     5177.047,     238,       0 ! !END!
2793 ! X =       319.5130,     5177.002,     259,       0 ! !END!
2794 ! X =       299.5740,     5178.891,     200,       0 ! !END!
2795 ! X =       300.5740,     5178.846,     196,       0 ! !END!
2796 ! X =       301.5730,     5178.802,     192,       0 ! !END!
2797 ! X =       302.5720,     5178.757,     188,       0 ! !END!
2798 ! X =       303.5710,     5178.713,     189,       0 ! !END!
2799 ! X =       304.5700,     5178.668,     190,       0 ! !END!
2800 ! X =       305.5700,     5178.624,     191,       0 ! !END!
2801 ! X =       306.5690,     5178.579,     184,       0 ! !END!
2802 ! X =       307.5680,     5178.535,     172,       0 ! !END!
2803 ! X =       308.5670,     5178.49,     179,       0 ! !END!
2804 ! X =       309.5660,     5178.446,     195,       0 ! !END!
2805 ! X =       310.5650,     5178.402,     202,       0 ! !END!
2806 ! X =       311.5640,     5178.357,     205,       0 ! !END!
2807 ! X =       312.5640,     5178.313,     205,       0 ! !END!
2808 ! X =       313.5630,     5178.268,     208,       0 ! !END!
2809 ! X =       314.5620,     5178.224,     210,       0 ! !END!
2810 ! X =       315.5610,     5178.179,     211,       0 ! !END!
2811 ! X =       316.5600,     5178.135,     214,       0 ! !END!
2812 ! X =       317.5590,     5178.09,     218,       0 ! !END!
2813 ! X =       318.5580,     5178.046,     227,       0 ! !END!
2814 ! X =       299.6190,     5179.89,     217,       0 ! !END!
2815 ! X =       300.6180,     5179.845,     213,       0 ! !END!
2816 ! X =       301.6170,     5179.801,     211,       0 ! !END!
2817 ! X =       302.6160,     5179.756,     209,       0 ! !END!
2818 ! X =       303.6160,     5179.712,     209,       0 ! !END!
2819 ! X =       304.6150,     5179.667,     211,       0 ! !END!
2820 ! X =       305.6140,     5179.623,     214,       0 ! !END!
2821 ! X =       306.6130,     5179.578,     211,       0 ! !END!
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2822 ! X =       307.6120,     5179.534,     210,       0 ! !END!
2823 ! X =       308.6110,     5179.49,     213,       0 ! !END!
2824 ! X =       309.6110,     5179.445,     215,       0 ! !END!
2825 ! X =       310.6100,     5179.401,     218,       0 ! !END!
2826 ! X =       311.6090,     5179.356,     218,       0 ! !END!
2827 ! X =       312.6080,     5179.312,     217,       0 ! !END!
2828 ! X =       313.6070,     5179.267,     219,       0 ! !END!
2829 ! X =       314.6060,     5179.223,     217,       0 ! !END!
2830 ! X =       315.6050,     5179.178,     216,       0 ! !END!
2831 ! X =       316.6040,     5179.134,     220,       0 ! !END!
2832 ! X =       317.6040,     5179.09,     228,       0 ! !END!
2833 ! X =       318.6030,     5179.045,     236,       0 ! !END!
2834 ! X =       300.6630,     5180.844,     237,       0 ! !END!
2835 ! X =       301.6620,     5180.8,     235,       0 ! !END!
2836 ! X =       302.6610,     5180.756,     234,       0 ! !END!
2837 ! X =       303.6600,     5180.711,     235,       0 ! !END!
2838 ! X =       304.6590,     5180.667,     235,       0 ! !END!
2839 ! X =       305.6580,     5180.622,     239,       0 ! !END!
2840 ! X =       306.6580,     5180.578,     238,       0 ! !END!
2841 ! X =       307.6570,     5180.533,     239,       0 ! !END!
2842 ! X =       308.6560,     5180.489,     239,       0 ! !END!
2843 ! X =       309.6550,     5180.444,     237,       0 ! !END!
2844 ! X =       310.6540,     5180.4,     239,       0 ! !END!
2845 ! X =       311.6530,     5180.355,     240,       0 ! !END!
2846 ! X =       312.6520,     5180.311,     238,       0 ! !END!
2847 ! X =       313.6520,     5180.266,     238,       0 ! !END!
2848 ! X =       314.6510,     5180.222,     235,       0 ! !END!
2849 ! X =       315.6500,     5180.178,     232,       0 ! !END!
2850 ! X =       316.6490,     5180.133,     235,       0 ! !END!
2851 ! X =       317.6480,     5180.089,     242,       0 ! !END!
2852 ! X =       302.7050,     5181.755,     267,       0 ! !END!
2853 ! X =       303.7050,     5181.71,     269,       0 ! !END!
2854 ! X =       304.7040,     5181.666,     269,       0 ! !END!
2855 ! X =       305.7030,     5181.621,     271,       0 ! !END!
2856 ! X =       306.7020,     5181.577,     272,       0 ! !END!
2857 ! X =       307.7010,     5181.532,     272,       0 ! !END!
2858 ! X =       308.7000,     5181.488,     272,       0 ! !END!
2859 ! X =       309.6990,     5181.443,     271,       0 ! !END!
2860 ! X =       310.6990,     5181.399,     272,       0 ! !END!
2861 ! X =       311.6980,     5181.354,     272,       0 ! !END!
2862 ! X =       312.6970,     5181.31,     272,       0 ! !END!
2863 ! X =       313.6960,     5181.266,     268,       0 ! !END!
2864 ! X =       314.6950,     5181.221,     265,       0 ! !END!
2865 ! X =       315.6940,     5181.177,     261,       0 ! !END!
2866 ! X =       316.6930,     5181.132,     260,       0 ! !END!
2867 ! X =       317.6920,     5181.088,     264,       0 ! !END!
2868 ! X =       303.7490,     5182.709,     308,       0 ! !END!
2869 ! X =       304.7480,     5182.665,     311,       0 ! !END!
2870 ! X =       305.7470,     5182.62,     312,       0 ! !END!
2871 ! X =       306.7470,     5182.576,     313,       0 ! !END!
2872 ! X =       307.7460,     5182.531,     315,       0 ! !END!
2873 ! X =       308.7450,     5182.487,     316,       0 ! !END!
2874 ! X =       309.7440,     5182.443,     316,       0 ! !END!
2875 ! X =       310.7430,     5182.398,     315,       0 ! !END!
2876 ! X =       311.7420,     5182.354,     314,       0 ! !END!
2877 ! X =       312.7410,     5182.309,     315,       0 ! !END!
2878 ! X =       313.7400,     5182.265,     313,       0 ! !END!
2879 ! X =       314.7400,     5182.22,     310,       0 ! !END!
2880 ! X =       315.7390,     5182.176,     307,       0 ! !END!
2881 ! X =       304.7930,     5183.664,     367,       0 ! !END!
2882 ! X =       305.7920,     5183.62,     368,       0 ! !END!
2883 ! X =       306.7910,     5183.575,     367,       0 ! !END!
2884 ! X =       307.7900,     5183.531,     370,       0 ! !END!
2885 ! X =       308.7890,     5183.486,     372,       0 ! !END!
2886 ! X =       309.7880,     5183.442,     377,       0 ! !END!
2887 ! X =       310.7880,     5183.397,     385,       0 ! !END!
2888 ! X =       311.7870,     5183.353,     382,       0 ! !END!
2889 ! X =       312.7860,     5183.308,     377,       0 ! !END!
2890 ! X =       313.7850,     5183.264,     388,       0 ! !END!
2891 ! X =       314.7840,     5183.219,     390,       0 ! !END!
2892 ! X =       306.8350,     5184.574,     447,       0 ! !END!
2893 ! X =       307.8350,     5184.53,     449,       0 ! !END!
2894 ! X =       308.8340,     5184.485,     457,       0 ! !END!
2895 ! X =       309.8330,     5184.441,     471,       0 ! !END!
2896 ! X =       310.8320,     5184.396,     489,       0 ! !END!
2897 ! X =       311.8310,     5184.352,     477,       0 ! !END!
2898 ! X =       312.8300,     5184.307,     470,       0 ! !END!
2899 ! X =       313.8290,     5184.263,     487,       0 ! !END!
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2900 ! X =       318.7380,     5136.994,     144,       0 ! !END!
2901 ! X =       319.7370,     5136.95,     139,       0 ! !END!
2902 ! X =       320.7360,     5136.905,     131,       0 ! !END!
2903 ! X =       321.7350,     5136.861,     125,       0 ! !END!
2904 ! X =       322.7340,     5136.817,     123,       0 ! !END!
2905 ! X =       323.7330,     5136.773,     123,       0 ! !END!
2906 ! X =       306.7930,     5138.524,     336,       0 ! !END!
2907 ! X =       315.7850,     5138.126,     133,       0 ! !END!
2908 ! X =       316.7840,     5138.082,     139,       0 ! !END!
2909 ! X =       317.7830,     5138.037,     147,       0 ! !END!
2910 ! X =       318.7820,     5137.993,     150,       0 ! !END!
2911 ! X =       319.7810,     5137.949,     144,       0 ! !END!
2912 ! X =       320.7800,     5137.905,     134,       0 ! !END!
2913 ! X =       321.7800,     5137.86,     126,       0 ! !END!
2914 ! X =       322.7790,     5137.816,     123,       0 ! !END!
2915 ! X =       323.7780,     5137.772,     122,       0 ! !END!
2916 ! X =       313.8310,     5139.214,     153,       0 ! !END!
2917 ! X =       314.8300,     5139.169,     148,       0 ! !END!
2918 ! X =       315.8290,     5139.125,     141,       0 ! !END!
2919 ! X =       316.8280,     5139.081,     145,       0 ! !END!
2920 ! X =       317.8270,     5139.036,     151,       0 ! !END!
2921 ! X =       318.8270,     5138.992,     152,       0 ! !END!
2922 ! X =       319.8260,     5138.948,     145,       0 ! !END!
2923 ! X =       320.8250,     5138.904,     135,       0 ! !END!
2924 ! X =       321.8240,     5138.859,     127,       0 ! !END!
2925 ! X =       322.8230,     5138.815,     123,       0 ! !END!
2926 ! X =       323.8220,     5138.771,     122,       0 ! !END!
2927 ! X =       312.8760,     5140.257,     153,       0 ! !END!
2928 ! X =       313.8750,     5140.213,     153,       0 ! !END!
2929 ! X =       314.8740,     5140.168,     151,       0 ! !END!
2930 ! X =       315.8730,     5140.124,     148,       0 ! !END!
2931 ! X =       316.8730,     5140.08,     149,       0 ! !END!
2932 ! X =       317.8720,     5140.036,     152,       0 ! !END!
2933 ! X =       318.8710,     5139.991,     152,       0 ! !END!
2934 ! X =       319.8700,     5139.947,     146,       0 ! !END!
2935 ! X =       320.8690,     5139.903,     136,       0 ! !END!
2936 ! X =       321.8680,     5139.858,     128,       0 ! !END!
2937 ! X =       322.8670,     5139.814,     124,       0 ! !END!
2938 ! X =       323.8660,     5139.77,     123,       0 ! !END!
2939 ! X =       311.9210,     5141.3,     156,       0 ! !END!
2940 ! X =       312.9200,     5141.256,     153,       0 ! !END!
2941 ! X =       313.9190,     5141.212,     153,       0 ! !END!
2942 ! X =       314.9190,     5141.168,     153,       0 ! !END!
2943 ! X =       315.9180,     5141.123,     152,       0 ! !END!
2944 ! X =       316.9170,     5141.079,     152,       0 ! !END!
2945 ! X =       317.9160,     5141.035,     153,       0 ! !END!
2946 ! X =       318.9150,     5140.99,     152,       0 ! !END!
2947 ! X =       319.9140,     5140.946,     146,       0 ! !END!
2948 ! X =       320.9130,     5140.902,     137,       0 ! !END!
2949 ! X =       321.9120,     5140.858,     128,       0 ! !END!
2950 ! X =       322.9110,     5140.813,     124,       0 ! !END!
2951 ! X =       323.9110,     5140.769,     123,       0 ! !END!
2952 ! X =       311.9660,     5142.299,     153,       0 ! !END!
2953 ! X =       312.9650,     5142.255,     153,       0 ! !END!
2954 ! X =       313.9640,     5142.211,     153,       0 ! !END!
2955 ! X =       314.9630,     5142.167,     153,       0 ! !END!
2956 ! X =       315.9620,     5142.122,     153,       0 ! !END!
2957 ! X =       316.9610,     5142.078,     153,       0 ! !END!
2958 ! X =       317.9600,     5142.034,     153,       0 ! !END!
2959 ! X =       318.9590,     5141.99,     152,       0 ! !END!
2960 ! X =       319.9580,     5141.945,     146,       0 ! !END!
2961 ! X =       320.9580,     5141.901,     137,       0 ! !END!
2962 ! X =       321.9570,     5141.857,     129,       0 ! !END!
2963 ! X =       322.9560,     5141.812,     123,       0 ! !END!
2964 ! X =       323.9550,     5141.768,     121,       0 ! !END!
2965 ! X =       311.0110,     5143.343,     154,       0 ! !END!
2966 ! X =       312.0100,     5143.299,     153,       0 ! !END!
2967 ! X =       313.0090,     5143.254,     153,       0 ! !END!
2968 ! X =       314.0080,     5143.21,     153,       0 ! !END!
2969 ! X =       315.0070,     5143.166,     153,       0 ! !END!
2970 ! X =       316.0060,     5143.121,     153,       0 ! !END!
2971 ! X =       317.0050,     5143.077,     153,       0 ! !END!
2972 ! X =       318.0050,     5143.033,     153,       0 ! !END!
2973 ! X =       319.0040,     5142.989,     152,       0 ! !END!
2974 ! X =       320.0030,     5142.944,     146,       0 ! !END!
2975 ! X =       321.0020,     5142.9,     137,       0 ! !END!
2976 ! X =       322.0010,     5142.856,     129,       0 ! !END!
2977 ! X =       323.0000,     5142.811,     124,       0 ! !END!
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2978 ! X =       323.9990,     5142.767,     122,       0 ! !END!
2979 ! X =       310.0560,     5144.386,     154,       0 ! !END!
2980 ! X =       311.0550,     5144.342,     153,       0 ! !END!
2981 ! X =       312.0540,     5144.298,     153,       0 ! !END!
2982 ! X =       313.0530,     5144.253,     153,       0 ! !END!
2983 ! X =       314.0520,     5144.209,     153,       0 ! !END!
2984 ! X =       315.0510,     5144.165,     153,       0 ! !END!
2985 ! X =       316.0510,     5144.121,     153,       0 ! !END!
2986 ! X =       317.0500,     5144.076,     153,       0 ! !END!
2987 ! X =       318.0490,     5144.032,     153,       0 ! !END!
2988 ! X =       319.0480,     5143.988,     152,       0 ! !END!
2989 ! X =       320.0470,     5143.943,     147,       0 ! !END!
2990 ! X =       321.0460,     5143.899,     138,       0 ! !END!
2991 ! X =       322.0450,     5143.855,     130,       0 ! !END!
2992 ! X =       323.0440,     5143.811,     125,       0 ! !END!
2993 ! X =       324.0430,     5143.766,     123,       0 ! !END!
2994 ! X =       309.1010,     5145.43,     154,       0 ! !END!
2995 ! X =       310.1000,     5145.385,     153,       0 ! !END!
2996 ! X =       311.0990,     5145.341,     153,       0 ! !END!
2997 ! X =       312.0980,     5145.297,     153,       0 ! !END!
2998 ! X =       313.0970,     5145.253,     153,       0 ! !END!
2999 ! X =       314.0970,     5145.208,     153,       0 ! !END!
3000 ! X =       315.0960,     5145.164,     153,       0 ! !END!
3001 ! X =       316.0950,     5145.12,     153,       0 ! !END!
3002 ! X =       317.0940,     5145.075,     153,       0 ! !END!
3003 ! X =       318.0930,     5145.031,     153,       0 ! !END!
3004 ! X =       319.0920,     5144.987,     152,       0 ! !END!
3005 ! X =       320.0910,     5144.943,     147,       0 ! !END!
3006 ! X =       321.0900,     5144.898,     139,       0 ! !END!
3007 ! X =       322.0890,     5144.854,     132,       0 ! !END!
3008 ! X =       323.0890,     5144.81,     127,       0 ! !END!
3009 ! X =       324.0880,     5144.765,     124,       0 ! !END!
3010 ! X =       308.1460,     5146.473,     157,       0 ! !END!
3011 ! X =       309.1450,     5146.429,     153,       0 ! !END!
3012 ! X =       310.1440,     5146.385,     153,       0 ! !END!
3013 ! X =       311.1440,     5146.34,     153,       0 ! !END!
3014 ! X =       312.1430,     5146.296,     153,       0 ! !END!
3015 ! X =       313.1420,     5146.252,     153,       0 ! !END!
3016 ! X =       314.1410,     5146.207,     153,       0 ! !END!
3017 ! X =       315.1400,     5146.163,     153,       0 ! !END!
3018 ! X =       316.1390,     5146.119,     153,       0 ! !END!
3019 ! X =       317.1380,     5146.075,     153,       0 ! !END!
3020 ! X =       318.1370,     5146.03,     153,       0 ! !END!
3021 ! X =       319.1360,     5145.986,     152,       0 ! !END!
3022 ! X =       320.1360,     5145.942,     147,       0 ! !END!
3023 ! X =       321.1350,     5145.897,     140,       0 ! !END!
3024 ! X =       322.1340,     5145.853,     134,       0 ! !END!
3025 ! X =       323.1330,     5145.809,     128,       0 ! !END!
3026 ! X =       324.1320,     5145.764,     124,       0 ! !END!
3027 ! X =       309.1900,     5147.428,     154,       0 ! !END!
3028 ! X =       310.1890,     5147.384,     153,       0 ! !END!
3029 ! X =       311.1880,     5147.339,     153,       0 ! !END!
3030 ! X =       312.1870,     5147.295,     153,       0 ! !END!
3031 ! X =       313.1860,     5147.251,     153,       0 ! !END!
3032 ! X =       314.1850,     5147.207,     153,       0 ! !END!
3033 ! X =       315.1840,     5147.162,     153,       0 ! !END!
3034 ! X =       316.1830,     5147.118,     153,       0 ! !END!
3035 ! X =       317.1830,     5147.074,     153,       0 ! !END!
3036 ! X =       318.1820,     5147.029,     153,       0 ! !END!
3037 ! X =       319.1810,     5146.985,     152,       0 ! !END!
3038 ! X =       320.1800,     5146.941,     148,       0 ! !END!
3039 ! X =       321.1790,     5146.896,     141,       0 ! !END!
3040 ! X =       322.1780,     5146.852,     135,       0 ! !END!
3041 ! X =       323.1770,     5146.808,     130,       0 ! !END!
3042 ! X =       324.1760,     5146.764,     125,       0 ! !END!
3043 ! X =       310.2330,     5148.383,     153,       0 ! !END!
3044 ! X =       311.2320,     5148.339,     153,       0 ! !END!
3045 ! X =       312.2310,     5148.294,     153,       0 ! !END!
3046 ! X =       313.2300,     5148.25,     154,       0 ! !END!
3047 ! X =       314.2300,     5148.206,     154,       0 ! !END!
3048 ! X =       315.2290,     5148.161,     153,       0 ! !END!
3049 ! X =       316.2280,     5148.117,     153,       0 ! !END!
3050 ! X =       317.2270,     5148.073,     153,       0 ! !END!
3051 ! X =       318.2260,     5148.028,     153,       0 ! !END!
3052 ! X =       319.2250,     5147.984,     153,       0 ! !END!
3053 ! X =       320.2240,     5147.94,     149,       0 ! !END!
3054 ! X =       321.2230,     5147.896,     142,       0 ! !END!
3055 ! X =       322.2220,     5147.851,     136,       0 ! !END!
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3056 ! X =       323.2210,     5147.807,     130,       0 ! !END!
3057 ! X =       324.2210,     5147.763,     126,       0 ! !END!
3058 ! X =       312.2760,     5149.293,     153,       0 ! !END!
3059 ! X =       313.2750,     5149.249,     155,       0 ! !END!
3060 ! X =       314.2740,     5149.205,     156,       0 ! !END!
3061 ! X =       315.2730,     5149.16,     154,       0 ! !END!
3062 ! X =       316.2720,     5149.116,     153,       0 ! !END!
3063 ! X =       317.2710,     5149.072,     153,       0 ! !END!
3064 ! X =       318.2700,     5149.028,     153,       0 ! !END!
3065 ! X =       319.2690,     5148.983,     153,       0 ! !END!
3066 ! X =       320.2690,     5148.939,     149,       0 ! !END!
3067 ! X =       321.2680,     5148.895,     144,       0 ! !END!
3068 ! X =       322.2670,     5148.85,     137,       0 ! !END!
3069 ! X =       323.2660,     5148.806,     131,       0 ! !END!
3070 ! X =       324.2650,     5148.762,     126,       0 ! !END!
3071 ! X =       314.3180,     5150.204,     159,       0 ! !END!
3072 ! X =       315.3170,     5150.16,     158,       0 ! !END!
3073 ! X =       316.3160,     5150.115,     156,       0 ! !END!
3074 ! X =       317.3160,     5150.071,     154,       0 ! !END!
3075 ! X =       318.3150,     5150.027,     153,       0 ! !END!
3076 ! X =       319.3140,     5149.982,     153,       0 ! !END!
3077 ! X =       320.3130,     5149.938,     150,       0 ! !END!
3078 ! X =       321.3120,     5149.894,     145,       0 ! !END!
3079 ! X =       322.3110,     5149.849,     139,       0 ! !END!
3080 ! X =       323.3100,     5149.805,     132,       0 ! !END!
3081 ! X =       324.3090,     5149.761,     127,       0 ! !END!
3082 ! X =       326.0000,     5135.397,     109,       0 ! !END!
3083 ! X =       325.8730,     5135.857,     109,       0 ! !END!
3084 ! X =       325.7780,     5136.349,     109,       0 ! !END!
3085 ! X =       325.7380,     5136.611,     109,       0 ! !END!
3086 ! X =       325.6980,     5136.873,     109,       0 ! !END!
3087 ! X =       325.6270,     5137.119,     109,       0 ! !END!
3088 ! X =       325.5560,     5137.365,     109,       0 ! !END!
3089 ! X =       325.5480,     5137.635,     109,       0 ! !END!
3090 ! X =       325.5390,     5137.905,     109,       0 ! !END!
3091 ! X =       325.7780,     5138.333,     109,       0 ! !END!
3092 ! X =       325.8330,     5138.587,     109,       0 ! !END!
3093 ! X =       325.8880,     5138.841,     111,       0 ! !END!
3094 ! X =       325.9200,     5139.325,     111,       0 ! !END!
3095 ! X =       325.9360,     5139.794,     111,       0 ! !END!
3096 ! X =       325.9200,     5140.064,     111,       0 ! !END!
3097 ! X =       325.9040,     5140.333,     109,       0 ! !END!
3098 ! X =       325.8410,     5140.825,     109,       0 ! !END!
3099 ! X =       325.8570,     5141.079,     109,       0 ! !END!
3100 ! X =       325.8730,     5141.333,     109,       0 ! !END!
3101 ! X =       325.9210,     5141.579,     109,       0 ! !END!
3102 ! X =       325.9680,     5141.825,     109,       0 ! !END!
3103 ! X =       326.0790,     5142.286,     109,       0 ! !END!
3104 ! X =       326.1430,     5142.548,     109,       0 ! !END!
3105 ! X =       326.2060,     5142.81,     109,       0 ! !END!
3106 ! X =       326.3090,     5143.278,     109,       0 ! !END!
3107 ! X =       326.4120,     5143.746,     109,       0 ! !END!
3108 ! X =       326.4440,     5144.008,     109,       0 ! !END!
3109 ! X =       326.4760,     5144.27,     109,       0 ! !END!
3110 ! X =       326.5230,     5144.762,     110,       0 ! !END!
3111 ! X =       326.4760,     5145.024,     111,       0 ! !END!
3112 ! X =       326.4280,     5145.286,     112,       0 ! !END!
3113 ! X =       326.3490,     5145.714,     111,       0 ! !END!
3114 ! X =       326.3330,     5145.976,     112,       0 ! !END!
3115 ! X =       326.3170,     5146.238,     112,       0 ! !END!
3116 ! X =       326.2380,     5146.73,     112,       0 ! !END!
3117 ! X =       326.3060,     5146.992,     112,       0 ! !END!
3118 ! X =       326.3730,     5147.254,     112,       0 ! !END!
3119 ! X =       326.4040,     5147.714,     112,       0 ! !END!
3120 ! X =       326.4760,     5148.206,     112,       0 ! !END!
3121 ! X =       326.4680,     5148.46,     112,       0 ! !END!
3122 ! X =       326.4600,     5148.714,     112,       0 ! !END!
3123 ! X =       326.3650,     5149.175,     112,       0 ! !END!
3124 ! X =       326.2690,     5149.571,     112,       0 ! !END!
3125 ! X =       326.3730,     5149.801,     112,       0 ! !END!
3126 ! X =       326.4760,     5150.031,     112,       0 ! !END!
3127 ! X =       326.7420,     5150.452,     112,       0 ! !END!
3128 ! X =       326.7460,     5150.952,     113,       0 ! !END!
3129 ! X =       326.6670,     5151.428,     113,       0 ! !END!
3130 ! X =       326.6270,     5151.872,     113,       0 ! !END!
3131 ! X =       326.5870,     5152.317,     113,       0 ! !END!
3132 ! X =       326.4840,     5152.587,     112,       0 ! !END!
3133 ! X =       326.3800,     5152.857,     112,       0 ! !END!
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3134 ! X =       326.2850,     5153.151,     112,       0 ! !END!
3135 ! X =       326.1900,     5153.444,     112,       0 ! !END!
3136 ! X =       326.1110,     5153.706,     112,       0 ! !END!
3137 ! X =       326.0310,     5153.968,     112,       0 ! !END!
3138 ! X =       326.3970,     5153.86,     113,       0 ! !END!
3139 ! X =       326.7630,     5153.752,     125,       0 ! !END!
3140 ! X =       326.7670,     5154.008,     145,       0 ! !END!
3141 ! X =       326.7710,     5154.263,     161,       0 ! !END!
3142 ! X =       326.7900,     5154.517,     177,       0 ! !END!
3143 ! X =       326.8090,     5154.771,     189,       0 ! !END!
3144 ! X =       326.8280,     5154.931,     203,       0 ! !END!
3145 ! X =       326.4160,     5154.933,     157,       0 ! !END!
3146 ! X =       326.4240,     5155.359,     216,       0 ! !END!
3147 ! X =       326.0340,     5155.363,     141,       0 ! !END!
3148 ! X =       326.0360,     5155.74,     185,       0 ! !END!
3149 ! X =       325.6300,     5155.751,     122,       0 ! !END!
3150 ! X =       325.6360,     5156.006,     167,       0 ! !END!
3151 ! X =       325.6410,     5156.26,     180,       0 ! !END!
3152 ! X =       325.6450,     5156.546,     180,       0 ! !END!
3153 ! X =       325.2400,     5156.55,     163,       0 ! !END!
3154 ! X =       325.2480,     5156.808,     183,       0 ! !END!
3155 ! X =       325.2550,     5157.065,     183,       0 ! !END!
3156 ! X =       325.2540,     5157.319,     185,       0 ! !END!
3157 ! X =       325.2520,     5157.572,     185,       0 ! !END!
3158 ! X =       325.2480,     5158.071,     212,       0 ! !END!
3159 ! X =       325.2370,     5158.569,     239,       0 ! !END!
3160 ! X =       325.2350,     5158.855,     254,       0 ! !END!
3161 ! X =       324.7440,     5158.866,     262,       0 ! !END!
3162 ! X =       324.3320,     5158.878,     224,       0 ! !END!
3163 ! X =       324.3440,     5159.275,     274,       0 ! !END!
3164 ! X =       323.9230,     5159.286,     221,       0 ! !END!
3165 ! X =       323.9310,     5159.538,     268,       0 ! !END!
3166 ! X =       323.9380,     5159.79,     273,       0 ! !END!
3167 ! X =       323.9480,     5160.145,     274,       0 ! !END!
3168 ! X =       323.9580,     5160.5,     274,       0 ! !END!
3169 ! X =       323.7030,     5160.51,     270,       0 ! !END!
3170 ! X =       323.4470,     5160.519,     253,       0 ! !END!
3171 ! X =       322.9540,     5160.53,     273,       0 ! !END!
3172 ! X =       322.6980,     5160.534,     274,       0 ! !END!
3173 ! X =       322.4420,     5160.538,     274,       0 ! !END!
3174 ! X =       322.1850,     5160.546,     241,       0 ! !END!
3175 ! X =       321.9270,     5160.553,     174,       0 ! !END!
3176 ! X =       321.9440,     5160.811,     254,       0 ! !END!
3177 ! X =       321.9610,     5161.069,     274,       0 ! !END!
3178 ! X =       321.9730,     5161.565,     274,       0 ! !END!
3179 ! X =       321.9830,     5161.815,     274,       0 ! !END!
3180 ! X =       321.9920,     5162.065,     274,       0 ! !END!
3181 ! X =       321.9960,     5162.317,     274,       0 ! !END!
3182 ! X =       322.0000,     5162.569,     274,       0 ! !END!
3183 ! X =       322.0050,     5163.065,     274,       0 ! !END!
3184 ! X =       322.0180,     5163.319,     274,       0 ! !END!
3185 ! X =       322.0310,     5163.572,     274,       0 ! !END!
3186 ! X =       322.0390,     5164.07,     274,       0 ! !END!
3187 ! X =       322.0450,     5164.321,     274,       0 ! !END!
3188 ! X =       322.0510,     5164.572,     274,       0 ! !END!
3189 ! X =       322.0590,     5165.069,     274,       0 ! !END!
3190 ! X =       322.0600,     5165.321,     274,       0 ! !END!
3191 ! X =       322.0610,     5165.573,     274,       0 ! !END!
3192 ! X =       322.0760,     5166,     274,       0 ! !END!
3193 ! X =       322.0800,     5166.25,     274,       0 ! !END!
3194 ! X =       322.0840,     5166.5,     274,       0 ! !END!
3195 ! X =       322.0940,     5166.75,     274,       0 ! !END!
3196 ! X =       322.1030,     5167,     274,       0 ! !END!
3197 ! X =       322.1130,     5167.25,     273,       0 ! !END!
3198 ! X =       322.1220,     5167.5,     268,       0 ! !END!
3199 ! X =       322.1370,     5167.75,     265,       0 ! !END!
3200 ! X =       322.1520,     5168,     263,       0 ! !END!
3201 ! X =       322.1700,     5168.25,     261,       0 ! !END!
3202 ! X =       322.1870,     5168.5,     260,       0 ! !END!
3203 ! X =       322.1930,     5168.75,     260,       0 ! !END!
3204 ! X =       322.1980,     5169,     258,       0 ! !END!
3205 ! X =       322.2100,     5169.25,     254,       0 ! !END!
3206 ! X =       322.2210,     5169.5,     250,       0 ! !END!
3207 ! X =       322.2270,     5169.75,     247,       0 ! !END!
3208 ! X =       322.2320,     5170,     243,       0 ! !END!
3209 ! X =       322.2360,     5170.233,     242,       0 ! !END!
3210 ! X =       321.7440,     5170.255,     241,       0 ! !END!
3211 ! X =       321.4500,     5170.257,     240,       0 ! !END!
```

```
3212 ! X =       321.4540,     5170.512,     241,       0 ! !END!
3213 ! X =       321.4580,     5170.767,     241,       0 ! !END!
3214 ! X =       321.4640,     5171.019,     242,       0 ! !END!
3215 ! X =       321.4690,     5171.271,     243,       0 ! !END!
3216 ! X =       321.4790,     5171.527,     244,       0 ! !END!
3217 ! X =       321.4880,     5171.782,     250,       0 ! !END!
3218 ! X =       321.5040,     5172.274,     264,       0 ! !END!
3219 ! X =       321.5120,     5172.532,     270,       0 ! !END!
3220 ! X =       321.5190,     5172.79,     271,       0 ! !END!
3221 ! X =       321.5330,     5173.135,     274,       0 ! !END!
3222 ! X =       321.5460,     5173.48,     274,       0 ! !END!
3223 ! X =       321.2940,     5173.484,     274,       0 ! !END!
3224 ! X =       321.0420,     5173.488,     274,       0 ! !END!
3225 ! X =       320.7520,     5173.492,     271,       0 ! !END!
3226 ! X =       320.7580,     5173.746,     272,       0 ! !END!
3227 ! X =       320.7630,     5174,     274,       0 ! !END!
3228 ! X =       320.7670,     5174.25,     274,       0 ! !END!
3229 ! X =       320.7710,     5174.5,     274,       0 ! !END!
3230 ! X =       320.7770,     5174.75,     273,       0 ! !END!
3231 ! X =       320.7820,     5175,     273,       0 ! !END!
3232 ! X =       320.7880,     5175.25,     273,       0 ! !END!
3233 ! X =       320.7940,     5175.5,     274,       0 ! !END!
3234 ! X =       320.8020,     5175.75,     274,       0 ! !END!
3235 ! X =       320.8090,     5176,     274,       0 ! !END!
3236 ! X =       320.8130,     5176.25,     274,       0 ! !END!
3237 ! X =       320.8170,     5176.5,     274,       0 ! !END!
3238 ! X =       320.8270,     5176.75,     274,       0 ! !END!
3239 ! X =       320.8360,     5177,     274,       0 ! !END!
3240 ! X =       320.8470,     5177.285,     274,       0 ! !END!
3241 ! X =       320.8580,     5177.569,     260,       0 ! !END!
3242 ! X =       320.6070,     5177.575,     261,       0 ! !END!
3243 ! X =       320.3550,     5177.58,     254,       0 ! !END!
3244 ! X =       320.0000,     5177.589,     242,       0 ! !END!
3245 ! X =       320.0040,     5177.848,     240,       0 ! !END!
3246 ! X =       320.0080,     5178.106,     241,       0 ! !END!
3247 ! X =       320.0190,     5178.36,     242,       0 ! !END!
3248 ! X =       320.0300,     5178.614,     243,       0 ! !END!
3249 ! X =       320.0350,     5178.874,     244,       0 ! !END!
3250 ! X =       320.0390,     5179.133,     247,       0 ! !END!
3251 ! X =       320.0430,     5179.385,     253,       0 ! !END!
3252 ! X =       326.5000,     5135.397,     122,       0 ! !END!
3253 ! X =       327.0000,     5135.397,     139,       0 ! !END!
3254 ! X =       327.5000,     5135.397,     152,       0 ! !END!
3255 ! X =       328.0000,     5135.397,     152,       0 ! !END!
3256 ! X =       328.5000,     5135.397,     152,       0 ! !END!
3257 ! X =       329.0000,     5135.397,     152,       0 ! !END!
3258 ! X =       329.5000,     5135.397,     156,       0 ! !END!
3259 ! X =       330.0000,     5135.397,     164,       0 ! !END!
3260 ! X =       330.5000,     5135.397,     173,       0 ! !END!
3261 ! X =       331.0000,     5135.397,     172,       0 ! !END!
3262 ! X =       331.5000,     5135.397,     168,       0 ! !END!
3263 ! X =       332.0000,     5135.397,     172,       0 ! !END!
3264 ! X =       332.5000,     5135.397,     177,       0 ! !END!
3265 ! X =       333.0000,     5135.397,     179,       0 ! !END!
3266 ! X =       326.0000,     5135.897,     109,       0 ! !END!
3267 ! X =       326.5000,     5135.897,     126,       0 ! !END!
3268 ! X =       327.0000,     5135.897,     144,       0 ! !END!
3269 ! X =       327.5000,     5135.897,     152,       0 ! !END!
3270 ! X =       328.0000,     5135.897,     152,       0 ! !END!
3271 ! X =       328.5000,     5135.897,     154,       0 ! !END!
3272 ! X =       329.0000,     5135.897,     161,       0 ! !END!
3273 ! X =       329.5000,     5135.897,     168,       0 ! !END!
3274 ! X =       330.0000,     5135.897,     178,       0 ! !END!
3275 ! X =       330.5000,     5135.897,     183,       0 ! !END!
3276 ! X =       331.0000,     5135.897,     183,       0 ! !END!
3277 ! X =       331.5000,     5135.897,     177,       0 ! !END!
3278 ! X =       332.0000,     5135.897,     179,       0 ! !END!
3279 ! X =       332.5000,     5135.897,     185,       0 ! !END!
3280 ! X =       333.0000,     5135.897,     186,       0 ! !END!
3281 ! X =       326.0000,     5136.397,     109,       0 ! !END!
3282 ! X =       326.5000,     5136.397,     130,       0 ! !END!
3283 ! X =       327.0000,     5136.397,     152,       0 ! !END!
3284 ! X =       327.5000,     5136.397,     152,       0 ! !END!
3285 ! X =       328.0000,     5136.397,     160,       0 ! !END!
3286 ! X =       328.5000,     5136.397,     165,       0 ! !END!
3287 ! X =       329.0000,     5136.397,     170,       0 ! !END!
3288 ! X =       329.5000,     5136.397,     178,       0 ! !END!
3289 ! X =       330.0000,     5136.397,     183,       0 ! !END!
```

```
! X =       330.5000,     5136.397,     183,       0 ! !END!
! X =       331.0000,     5136.397,     183,       0 ! !END!
! X =       331.5000,     5136.397,     183,       0 ! !END!
! X =       332.0000,     5136.397,     183,       0 ! !END!
! X =       332.5000,     5136.397,     192,       0 ! !END!
! X =       333.0000,     5136.397,     192,       0 ! !END!
! X =       326.0000,     5136.897,     110,       0 ! !END!
! X =       326.5000,     5136.897,     133,       0 ! !END!
! X =       327.0000,     5136.897,     152,       0 ! !END!
! X =       327.5000,     5136.897,     159,       0 ! !END!
! X =       328.0000,     5136.897,     176,       0 ! !END!
! X =       328.5000,     5136.897,     177,       0 ! !END!
! X =       329.0000,     5136.897,     178,       0 ! !END!
! X =       329.5000,     5136.897,     180,       0 ! !END!
! X =       330.0000,     5136.897,     186,       0 ! !END!
! X =       330.5000,     5136.897,     191,       0 ! !END!
! X =       331.0000,     5136.897,     187,       0 ! !END!
! X =       331.5000,     5136.897,     183,       0 ! !END!
! X =       332.0000,     5136.897,     190,       0 ! !END!
! X =       332.5000,     5136.897,     197,       0 ! !END!
! X =       333.0000,     5136.897,     198,       0 ! !END!
! X =       326.0000,     5137.397,     112,       0 ! !END!
! X =       326.5000,     5137.397,     142,       0 ! !END!
! X =       327.0000,     5137.397,     163,       0 ! !END!
! X =       327.5000,     5137.397,     177,       0 ! !END!
! X =       328.0000,     5137.397,     187,       0 ! !END!
! X =       328.5000,     5137.397,     192,       0 ! !END!
! X =       329.0000,     5137.397,     191,       0 ! !END!
! X =       329.5000,     5137.397,     188,       0 ! !END!
! X =       330.0000,     5137.397,     198,       0 ! !END!
! X =       330.5000,     5137.397,     203,       0 ! !END!
! X =       331.0000,     5137.397,     194,       0 ! !END!
! X =       331.5000,     5137.397,     192,       0 ! !END!
! X =       332.0000,     5137.397,     196,       0 ! !END!
! X =       332.5000,     5137.397,     203,       0 ! !END!
! X =       333.0000,     5137.397,     204,       0 ! !END!
! X =       326.0000,     5137.897,     113,       0 ! !END!
! X =       326.5000,     5137.897,     144,       0 ! !END!
! X =       327.0000,     5137.897,     175,       0 ! !END!
! X =       327.5000,     5137.897,     194,       0 ! !END!
! X =       328.0000,     5137.897,     205,       0 ! !END!
! X =       328.5000,     5137.897,     211,       0 ! !END!
! X =       329.0000,     5137.897,     217,       0 ! !END!
! X =       329.5000,     5137.897,     206,       0 ! !END!
! X =       330.0000,     5137.897,     211,       0 ! !END!
! X =       330.5000,     5137.897,     213,       0 ! !END!
! X =       331.0000,     5137.897,     201,       0 ! !END!
! X =       331.5000,     5137.897,     200,       0 ! !END!
! X =       332.0000,     5137.897,     208,       0 ! !END!
! X =       332.5000,     5137.897,     211,       0 ! !END!
! X =       333.0000,     5137.897,     210,       0 ! !END!
! X =       326.0000,     5138.397,     113,       0 ! !END!
! X =       326.5000,     5138.397,     151,       0 ! !END!
! X =       327.0000,     5138.397,     189,       0 ! !END!
! X =       327.5000,     5138.397,     226,       0 ! !END!
! X =       328.0000,     5138.397,     238,       0 ! !END!
! X =       328.5000,     5138.397,     244,       0 ! !END!
! X =       329.0000,     5138.397,     243,       0 ! !END!
! X =       329.5000,     5138.397,     223,       0 ! !END!
! X =       330.0000,     5138.397,     217,       0 ! !END!
! X =       330.5000,     5138.397,     214,       0 ! !END!
! X =       331.0000,     5138.397,     209,       0 ! !END!
! X =       331.5000,     5138.397,     208,       0 ! !END!
! X =       332.0000,     5138.397,     212,       0 ! !END!
! X =       332.5000,     5138.397,     213,       0 ! !END!
! X =       333.0000,     5138.397,     213,       0 ! !END!
! X =       326.0000,     5138.897,     116,       0 ! !END!
! X =       326.5000,     5138.897,     184,       0 ! !END!
! X =       327.0000,     5138.897,     218,       0 ! !END!
! X =       327.5000,     5138.897,     244,       0 ! !END!
! X =       328.0000,     5138.897,     244,       0 ! !END!
! X =       328.5000,     5138.897,     244,       0 ! !END!
! X =       329.0000,     5138.897,     244,       0 ! !END!
! X =       329.5000,     5138.897,     235,       0 ! !END!
! X =       330.0000,     5138.897,     227,       0 ! !END!
! X =       330.5000,     5138.897,     221,       0 ! !END!
! X =       331.0000,     5138.897,     216,       0 ! !END!
! X =       331.5000,     5138.897,     214,       0 ! !END!
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! X =      332.0000,     5138.897,     213,       0 ! !END!
! X =      332.5000,     5138.897,     213,       0 ! !END!
! X =      333.0000,     5138.897,     213,       0 ! !END!
! X =      326.0000,     5139.397,     114,       0 ! !END!
! X =      326.5000,     5139.397,     243,       0 ! !END!
! X =      327.0000,     5139.397,     244,       0 ! !END!
! X =      327.5000,     5139.397,     244,       0 ! !END!
! X =      328.0000,     5139.397,     244,       0 ! !END!
! X =      328.5000,     5139.397,     244,       0 ! !END!
! X =      329.0000,     5139.397,     244,       0 ! !END!
! X =      329.5000,     5139.397,     238,       0 ! !END!
! X =      330.0000,     5139.397,     231,       0 ! !END!
! X =      330.5000,     5139.397,     226,       0 ! !END!
! X =      331.0000,     5139.397,     221,       0 ! !END!
! X =      331.5000,     5139.397,     216,       0 ! !END!
! X =      332.0000,     5139.397,     213,       0 ! !END!
! X =      332.5000,     5139.397,     213,       0 ! !END!
! X =      333.0000,     5139.397,     213,       0 ! !END!
! X =      326.0000,     5139.897,     114,       0 ! !END!
! X =      326.5000,     5139.897,     241,       0 ! !END!
! X =      327.0000,     5139.897,     244,       0 ! !END!
! X =      327.5000,     5139.897,     244,       0 ! !END!
! X =      328.0000,     5139.897,     244,       0 ! !END!
! X =      328.5000,     5139.897,     244,       0 ! !END!
! X =      329.0000,     5139.897,     244,       0 ! !END!
! X =      329.5000,     5139.897,     241,       0 ! !END!
! X =      330.0000,     5139.897,     236,       0 ! !END!
! X =      330.5000,     5139.897,     234,       0 ! !END!
! X =      331.0000,     5139.897,     231,       0 ! !END!
! X =      331.5000,     5139.897,     225,       0 ! !END!
! X =      332.0000,     5139.897,     219,       0 ! !END!
! X =      332.5000,     5139.897,     216,       0 ! !END!
! X =      333.0000,     5139.897,     214,       0 ! !END!
! X =      326.0000,     5140.397,     111,       0 ! !END!
! X =      326.5000,     5140.397,     217,       0 ! !END!
! X =      327.0000,     5140.397,     244,       0 ! !END!
! X =      327.5000,     5140.397,     244,       0 ! !END!
! X =      328.0000,     5140.397,     244,       0 ! !END!
! X =      328.5000,     5140.397,     244,       0 ! !END!
! X =      329.0000,     5140.397,     244,       0 ! !END!
! X =      329.5000,     5140.397,     243,       0 ! !END!
! X =      330.0000,     5140.397,     240,       0 ! !END!
! X =      330.5000,     5140.397,     239,       0 ! !END!
! X =      331.0000,     5140.397,     240,       0 ! !END!
! X =      331.5000,     5140.397,     237,       0 ! !END!
! X =      332.0000,     5140.397,     231,       0 ! !END!
! X =      332.5000,     5140.397,     227,       0 ! !END!
! X =      333.0000,     5140.397,     221,       0 ! !END!
! X =      326.0000,     5140.897,     109,       0 ! !END!
! X =      326.5000,     5140.897,     206,       0 ! !END!
! X =      327.0000,     5140.897,     244,       0 ! !END!
! X =      327.5000,     5140.897,     244,       0 ! !END!
! X =      328.0000,     5140.897,     244,       0 ! !END!
! X =      328.5000,     5140.897,     244,       0 ! !END!
! X =      329.0000,     5140.897,     244,       0 ! !END!
! X =      329.5000,     5140.897,     244,       0 ! !END!
! X =      330.0000,     5140.897,     244,       0 ! !END!
! X =      330.5000,     5140.897,     244,       0 ! !END!
! X =      331.0000,     5140.897,     244,       0 ! !END!
! X =      331.5000,     5140.897,     244,       0 ! !END!
! X =      332.0000,     5140.897,     243,       0 ! !END!
! X =      332.5000,     5140.897,     237,       0 ! !END!
! X =      333.0000,     5140.897,     230,       0 ! !END!
! X =      326.0000,     5141.397,     109,       0 ! !END!
! X =      326.5000,     5141.397,     156,       0 ! !END!
! X =      327.0000,     5141.397,     244,       0 ! !END!
! X =      327.5000,     5141.397,     244,       0 ! !END!
! X =      328.0000,     5141.397,     244,       0 ! !END!
! X =      328.5000,     5141.397,     244,       0 ! !END!
! X =      329.0000,     5141.397,     244,       0 ! !END!
! X =      329.5000,     5141.397,     244,       0 ! !END!
! X =      330.0000,     5141.397,     244,       0 ! !END!
! X =      330.5000,     5141.397,     244,       0 ! !END!
! X =      331.0000,     5141.397,     244,       0 ! !END!
! X =      331.5000,     5141.397,     244,       0 ! !END!
! X =      332.0000,     5141.397,     244,       0 ! !END!
! X =      332.5000,     5141.397,     244,       0 ! !END!
! X =      333.0000,     5141.397,     241,       0 ! !END!
```

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! X =      326.0000,     5141.897,     109,       0 ! !END!
! X =      326.5000,     5141.897,     148,       0 ! !END!
! X =      327.0000,     5141.897,     243,       0 ! !END!
! X =      327.5000,     5141.897,     244,       0 ! !END!
! X =      328.0000,     5141.897,     244,       0 ! !END!
! X =      328.5000,     5141.897,     244,       0 ! !END!
! X =      329.0000,     5141.897,     244,       0 ! !END!
! X =      329.5000,     5141.897,     244,       0 ! !END!
! X =      330.0000,     5141.897,     248,       0 ! !END!
! X =      330.5000,     5141.897,     249,       0 ! !END!
! X =      331.0000,     5141.897,     250,       0 ! !END!
! X =      331.5000,     5141.897,     250,       0 ! !END!
! X =      332.0000,     5141.897,     248,       0 ! !END!
! X =      332.5000,     5141.897,     246,       0 ! !END!
! X =      333.0000,     5141.897,     244,       0 ! !END!
! X =      326.5000,     5142.397,     128,       0 ! !END!
! X =      327.0000,     5142.397,     238,       0 ! !END!
! X =      327.5000,     5142.397,     214,       0 ! !END!
! X =      328.0000,     5142.397,     244,       0 ! !END!
! X =      328.5000,     5142.397,     244,       0 ! !END!
! X =      329.0000,     5142.397,     244,       0 ! !END!
! X =      329.5000,     5142.397,     244,       0 ! !END!
! X =      330.0000,     5142.397,     253,       0 ! !END!
! X =      330.5000,     5142.397,     255,       0 ! !END!
! X =      331.0000,     5142.397,     258,       0 ! !END!
! X =      331.5000,     5142.397,     258,       0 ! !END!
! X =      332.0000,     5142.397,     255,       0 ! !END!
! X =      332.5000,     5142.397,     251,       0 ! !END!
! X =      333.0000,     5142.397,     249,       0 ! !END!
! X =      326.5000,     5142.897,     119,       0 ! !END!
! X =      327.0000,     5142.897,     170,       0 ! !END!
! X =      327.5000,     5142.897,     226,       0 ! !END!
! X =      328.0000,     5142.897,     244,       0 ! !END!
! X =      328.5000,     5142.897,     244,       0 ! !END!
! X =      329.0000,     5142.897,     244,       0 ! !END!
! X =      329.5000,     5142.897,     244,       0 ! !END!
! X =      330.0000,     5142.897,     257,       0 ! !END!
! X =      330.5000,     5142.897,     261,       0 ! !END!
! X =      331.0000,     5142.897,     265,       0 ! !END!
! X =      331.5000,     5142.897,     265,       0 ! !END!
! X =      332.0000,     5142.897,     263,       0 ! !END!
! X =      332.5000,     5142.897,     255,       0 ! !END!
! X =      333.0000,     5142.897,     254,       0 ! !END!
! X =      326.5000,     5143.397,     114,       0 ! !END!
! X =      327.0000,     5143.397,     160,       0 ! !END!
! X =      327.5000,     5143.397,     241,       0 ! !END!
! X =      328.0000,     5143.397,     244,       0 ! !END!
! X =      328.5000,     5143.397,     244,       0 ! !END!
! X =      329.0000,     5143.397,     244,       0 ! !END!
! X =      329.5000,     5143.397,     244,       0 ! !END!
! X =      330.0000,     5143.397,     258,       0 ! !END!
! X =      330.5000,     5143.397,     267,       0 ! !END!
! X =      331.0000,     5143.397,     272,       0 ! !END!
! X =      331.5000,     5143.397,     274,       0 ! !END!
! X =      332.0000,     5143.397,     270,       0 ! !END!
! X =      332.5000,     5143.397,     260,       0 ! !END!
! X =      333.0000,     5143.397,     260,       0 ! !END!
! X =      326.5000,     5143.897,     111,       0 ! !END!
! X =      327.0000,     5143.897,     151,       0 ! !END!
! X =      327.5000,     5143.897,     214,       0 ! !END!
! X =      328.0000,     5143.897,     238,       0 ! !END!
! X =      328.5000,     5143.897,     242,       0 ! !END!
! X =      329.0000,     5143.897,     244,       0 ! !END!
! X =      329.5000,     5143.897,     244,       0 ! !END!
! X =      330.0000,     5143.897,     257,       0 ! !END!
! X =      330.5000,     5143.897,     273,       0 ! !END!
! X =      331.0000,     5143.897,     274,       0 ! !END!
! X =      331.5000,     5143.897,     274,       0 ! !END!
! X =      332.0000,     5143.897,     274,       0 ! !END!
! X =      332.5000,     5143.897,     265,       0 ! !END!
! X =      333.0000,     5143.897,     266,       0 ! !END!
! X =      326.5000,     5144.397,     109,       0 ! !END!
! X =      327.0000,     5144.397,     148,       0 ! !END!
! X =      327.5000,     5144.397,     193,       0 ! !END!
! X =      328.0000,     5144.397,     196,       0 ! !END!
! X =      328.5000,     5144.397,     234,       0 ! !END!
! X =      329.0000,     5144.397,     244,       0 ! !END!
! X =      329.5000,     5144.397,     244,       0 ! !END!
```

```
3524 ! X =       330.0000,     5144.397,     262,       0 ! !END!
3525 ! X =       330.5000,     5144.397,     274,       0 ! !END!
3526 ! X =       331.0000,     5144.397,     274,       0 ! !END!
3527 ! X =       331.5000,     5144.397,     274,       0 ! !END!
3528 ! X =       332.0000,     5144.397,     274,       0 ! !END!
3529 ! X =       332.5000,     5144.397,     269,       0 ! !END!
3530 ! X =       333.0000,     5144.397,     271,       0 ! !END!
3531 ! X =       326.5000,     5144.897,     110,       0 ! !END!
3532 ! X =       327.0000,     5144.897,     139,       0 ! !END!
3533 ! X =       327.5000,     5144.897,     183,       0 ! !END!
3534 ! X =       328.0000,     5144.897,     188,       0 ! !END!
3535 ! X =       328.5000,     5144.897,     238,       0 ! !END!
3536 ! X =       329.0000,     5144.897,     244,       0 ! !END!
3537 ! X =       329.5000,     5144.897,     259,       0 ! !END!
3538 ! X =       330.0000,     5144.897,     272,       0 ! !END!
3539 ! X =       330.5000,     5144.897,     274,       0 ! !END!
3540 ! X =       331.0000,     5144.897,     274,       0 ! !END!
3541 ! X =       331.5000,     5144.897,     274,       0 ! !END!
3542 ! X =       332.0000,     5144.897,     274,       0 ! !END!
3543 ! X =       332.5000,     5144.897,     274,       0 ! !END!
3544 ! X =       333.0000,     5144.897,     274,       0 ! !END!
3545 ! X =       326.5000,     5145.397,     112,       0 ! !END!
3546 ! X =       327.0000,     5145.397,     134,       0 ! !END!
3547 ! X =       327.5000,     5145.397,     188,       0 ! !END!
3548 ! X =       328.0000,     5145.397,     224,       0 ! !END!
3549 ! X =       328.5000,     5145.397,     250,       0 ! !END!
3550 ! X =       329.0000,     5145.397,     261,       0 ! !END!
3551 ! X =       329.5000,     5145.397,     274,       0 ! !END!
3552 ! X =       330.0000,     5145.397,     274,       0 ! !END!
3553 ! X =       330.5000,     5145.397,     274,       0 ! !END!
3554 ! X =       331.0000,     5145.397,     274,       0 ! !END!
3555 ! X =       331.5000,     5145.397,     274,       0 ! !END!
3556 ! X =       332.0000,     5145.397,     274,       0 ! !END!
3557 ! X =       332.5000,     5145.397,     274,       0 ! !END!
3558 ! X =       333.0000,     5145.397,     274,       0 ! !END!
3559 ! X =       326.5000,     5145.897,     112,       0 ! !END!
3560 ! X =       327.0000,     5145.897,     149,       0 ! !END!
3561 ! X =       327.5000,     5145.897,     200,       0 ! !END!
3562 ! X =       328.0000,     5145.897,     240,       0 ! !END!
3563 ! X =       328.5000,     5145.897,     247,       0 ! !END!
3564 ! X =       329.0000,     5145.897,     256,       0 ! !END!
3565 ! X =       329.5000,     5145.897,     267,       0 ! !END!
3566 ! X =       330.0000,     5145.897,     274,       0 ! !END!
3567 ! X =       330.5000,     5145.897,     274,       0 ! !END!
3568 ! X =       331.0000,     5145.897,     274,       0 ! !END!
3569 ! X =       331.5000,     5145.897,     274,       0 ! !END!
3570 ! X =       332.0000,     5145.897,     274,       0 ! !END!
3571 ! X =       332.5000,     5145.897,     274,       0 ! !END!
3572 ! X =       333.0000,     5145.897,     274,       0 ! !END!
3573 ! X =       326.5000,     5146.397,     112,       0 ! !END!
3574 ! X =       327.0000,     5146.397,     174,       0 ! !END!
3575 ! X =       327.5000,     5146.397,     224,       0 ! !END!
3576 ! X =       328.0000,     5146.397,     244,       0 ! !END!
3577 ! X =       328.5000,     5146.397,     244,       0 ! !END!
3578 ! X =       329.0000,     5146.397,     250,       0 ! !END!
3579 ! X =       329.5000,     5146.397,     268,       0 ! !END!
3580 ! X =       330.0000,     5146.397,     274,       0 ! !END!
3581 ! X =       330.5000,     5146.397,     274,       0 ! !END!
3582 ! X =       331.0000,     5146.397,     274,       0 ! !END!
3583 ! X =       331.5000,     5146.397,     274,       0 ! !END!
3584 ! X =       332.0000,     5146.397,     274,       0 ! !END!
3585 ! X =       332.5000,     5146.397,     274,       0 ! !END!
3586 ! X =       333.0000,     5146.397,     274,       0 ! !END!
3587 ! X =       326.5000,     5146.897,     115,       0 ! !END!
3588 ! X =       327.0000,     5146.897,     178,       0 ! !END!
3589 ! X =       327.5000,     5146.897,     242,       0 ! !END!
3590 ! X =       328.0000,     5146.897,     244,       0 ! !END!
3591 ! X =       328.5000,     5146.897,     244,       0 ! !END!
3592 ! X =       329.0000,     5146.897,     254,       0 ! !END!
3593 ! X =       329.5000,     5146.897,     275,       0 ! !END!
3594 ! X =       330.0000,     5146.897,     274,       0 ! !END!
3595 ! X =       330.5000,     5146.897,     274,       0 ! !END!
3596 ! X =       331.0000,     5146.897,     274,       0 ! !END!
3597 ! X =       331.5000,     5146.897,     274,       0 ! !END!
3598 ! X =       332.0000,     5146.897,     274,       0 ! !END!
3599 ! X =       332.5000,     5146.897,     274,       0 ! !END!
3600 ! X =       333.0000,     5146.897,     274,       0 ! !END!
3601 ! X =       326.5000,     5147.397,     114,       0 ! !END!
```

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3602 ! X =       327.0000,     5147.397,     150,       0 ! !END!
3603 ! X =       327.5000,     5147.397,     243,       0 ! !END!
3604 ! X =       328.0000,     5147.397,     232,       0 ! !END!
3605 ! X =       328.5000,     5147.397,     245,       0 ! !END!
3606 ! X =       329.0000,     5147.397,     266,       0 ! !END!
3607 ! X =       329.5000,     5147.397,     276,       0 ! !END!
3608 ! X =       330.0000,     5147.397,     274,       0 ! !END!
3609 ! X =       330.5000,     5147.397,     274,       0 ! !END!
3610 ! X =       331.0000,     5147.397,     274,       0 ! !END!
3611 ! X =       331.5000,     5147.397,     274,       0 ! !END!
3612 ! X =       332.0000,     5147.397,     274,       0 ! !END!
3613 ! X =       332.5000,     5147.397,     274,       0 ! !END!
3614 ! X =       333.0000,     5147.397,     274,       0 ! !END!
3615 ! X =       326.5000,     5147.897,     112,       0 ! !END!
3616 ! X =       327.0000,     5147.897,     124,       0 ! !END!
3617 ! X =       327.5000,     5147.897,     197,       0 ! !END!
3618 ! X =       328.0000,     5147.897,     188,       0 ! !END!
3619 ! X =       328.5000,     5147.897,     244,       0 ! !END!
3620 ! X =       329.0000,     5147.897,     263,       0 ! !END!
3621 ! X =       329.5000,     5147.897,     277,       0 ! !END!
3622 ! X =       330.0000,     5147.897,     274,       0 ! !END!
3623 ! X =       330.5000,     5147.897,     274,       0 ! !END!
3624 ! X =       331.0000,     5147.897,     274,       0 ! !END!
3625 ! X =       331.5000,     5147.897,     274,       0 ! !END!
3626 ! X =       332.0000,     5147.897,     274,       0 ! !END!
3627 ! X =       332.5000,     5147.897,     274,       0 ! !END!
3628 ! X =       333.0000,     5147.897,     274,       0 ! !END!
3629 ! X =       326.5000,     5148.397,     112,       0 ! !END!
3630 ! X =       327.0000,     5148.397,     114,       0 ! !END!
3631 ! X =       327.5000,     5148.397,     182,       0 ! !END!
3632 ! X =       328.0000,     5148.397,     237,       0 ! !END!
3633 ! X =       328.5000,     5148.397,     255,       0 ! !END!
3634 ! X =       329.0000,     5148.397,     274,       0 ! !END!
3635 ! X =       329.5000,     5148.397,     277,       0 ! !END!
3636 ! X =       330.0000,     5148.397,     274,       0 ! !END!
3637 ! X =       330.5000,     5148.397,     274,       0 ! !END!
3638 ! X =       331.0000,     5148.397,     274,       0 ! !END!
3639 ! X =       331.5000,     5148.397,     274,       0 ! !END!
3640 ! X =       332.0000,     5148.397,     274,       0 ! !END!
3641 ! X =       332.5000,     5148.397,     274,       0 ! !END!
3642 ! X =       333.0000,     5148.397,     274,       0 ! !END!
3643 ! X =       326.5000,     5148.897,     112,       0 ! !END!
3644 ! X =       327.0000,     5148.897,     114,       0 ! !END!
3645 ! X =       327.5000,     5148.897,     227,       0 ! !END!
3646 ! X =       328.0000,     5148.897,     244,       0 ! !END!
3647 ! X =       328.5000,     5148.897,     270,       0 ! !END!
3648 ! X =       329.0000,     5148.897,     274,       0 ! !END!
3649 ! X =       329.5000,     5148.897,     278,       0 ! !END!
3650 ! X =       330.0000,     5148.897,     274,       0 ! !END!
3651 ! X =       330.5000,     5148.897,     274,       0 ! !END!
3652 ! X =       331.0000,     5148.897,     274,       0 ! !END!
3653 ! X =       331.5000,     5148.897,     274,       0 ! !END!
3654 ! X =       332.0000,     5148.897,     274,       0 ! !END!
3655 ! X =       332.5000,     5148.897,     274,       0 ! !END!
3656 ! X =       333.0000,     5148.897,     274,       0 ! !END!
3657 ! X =       326.5000,     5149.397,     112,       0 ! !END!
3658 ! X =       327.0000,     5149.397,     114,       0 ! !END!
3659 ! X =       327.5000,     5149.397,     235,       0 ! !END!
3660 ! X =       328.0000,     5149.397,     252,       0 ! !END!
3661 ! X =       328.5000,     5149.397,     265,       0 ! !END!
3662 ! X =       329.0000,     5149.397,     274,       0 ! !END!
3663 ! X =       329.5000,     5149.397,     277,       0 ! !END!
3664 ! X =       330.0000,     5149.397,     274,       0 ! !END!
3665 ! X =       330.5000,     5149.397,     274,       0 ! !END!
3666 ! X =       331.0000,     5149.397,     274,       0 ! !END!
3667 ! X =       331.5000,     5149.397,     274,       0 ! !END!
3668 ! X =       332.0000,     5149.397,     274,       0 ! !END!
3669 ! X =       332.5000,     5149.397,     274,       0 ! !END!
3670 ! X =       333.0000,     5149.397,     274,       0 ! !END!
3671 ! X =       326.5000,     5149.897,     112,       0 ! !END!
3672 ! X =       327.0000,     5149.897,     116,       0 ! !END!
3673 ! X =       327.5000,     5149.897,     236,       0 ! !END!
3674 ! X =       328.0000,     5149.897,     250,       0 ! !END!
3675 ! X =       328.5000,     5149.897,     262,       0 ! !END!
3676 ! X =       329.0000,     5149.897,     274,       0 ! !END!
3677 ! X =       329.5000,     5149.897,     276,       0 ! !END!
3678 ! X =       330.0000,     5149.897,     274,       0 ! !END!
3679 ! X =       330.5000,     5149.897,     274,       0 ! !END!
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! X =       331.0000,     5149.897,     274,       0 ! !END!
! X =       331.5000,     5149.897,     274,       0 ! !END!
! X =       332.0000,     5149.897,     274,       0 ! !END!
! X =       332.5000,     5149.897,     274,       0 ! !END!
! X =       333.0000,     5149.897,     274,       0 ! !END!
! X =       327.0000,     5150.397,     123,       0 ! !END!
! X =       327.5000,     5150.397,     220,       0 ! !END!
! X =       328.0000,     5150.397,     248,       0 ! !END!
! X =       328.5000,     5150.397,     256,       0 ! !END!
! X =       329.0000,     5150.397,     264,       0 ! !END!
! X =       329.5000,     5150.397,     272,       0 ! !END!
! X =       330.0000,     5150.397,     275,       0 ! !END!
! X =       330.5000,     5150.397,     274,       0 ! !END!
! X =       331.0000,     5150.397,     274,       0 ! !END!
! X =       331.5000,     5150.397,     274,       0 ! !END!
! X =       332.0000,     5150.397,     274,       0 ! !END!
! X =       332.5000,     5150.397,     274,       0 ! !END!
! X =       333.0000,     5150.397,     274,       0 ! !END!
! X =       327.0000,     5150.897,     125,       0 ! !END!
! X =       327.5000,     5150.897,     221,       0 ! !END!
! X =       328.0000,     5150.897,     245,       0 ! !END!
! X =       328.5000,     5150.897,     251,       0 ! !END!
! X =       329.0000,     5150.897,     256,       0 ! !END!
! X =       329.5000,     5150.897,     264,       0 ! !END!
! X =       330.0000,     5150.897,     274,       0 ! !END!
! X =       330.5000,     5150.897,     274,       0 ! !END!
! X =       331.0000,     5150.897,     274,       0 ! !END!
! X =       331.5000,     5150.897,     274,       0 ! !END!
! X =       332.0000,     5150.897,     274,       0 ! !END!
! X =       332.5000,     5150.897,     274,       0 ! !END!
! X =       333.0000,     5150.897,     274,       0 ! !END!
! X =       327.0000,     5151.397,     126,       0 ! !END!
! X =       327.5000,     5151.397,     188,       0 ! !END!
! X =       328.0000,     5151.397,     230,       0 ! !END!
! X =       328.5000,     5151.397,     247,       0 ! !END!
! X =       329.0000,     5151.397,     250,       0 ! !END!
! X =       329.5000,     5151.397,     257,       0 ! !END!
! X =       330.0000,     5151.397,     263,       0 ! !END!
! X =       330.5000,     5151.397,     273,       0 ! !END!
! X =       331.0000,     5151.397,     274,       0 ! !END!
! X =       331.5000,     5151.397,     274,       0 ! !END!
! X =       332.0000,     5151.397,     274,       0 ! !END!
! X =       332.5000,     5151.397,     274,       0 ! !END!
! X =       333.0000,     5151.397,     274,       0 ! !END!
! X =       327.0000,     5151.897,     121,       0 ! !END!
! X =       327.5000,     5151.897,     180,       0 ! !END!
! X =       328.0000,     5151.897,     205,       0 ! !END!
! X =       328.5000,     5151.897,     226,       0 ! !END!
! X =       329.0000,     5151.897,     240,       0 ! !END!
! X =       329.5000,     5151.897,     249,       0 ! !END!
! X =       330.0000,     5151.897,     254,       0 ! !END!
! X =       330.5000,     5151.897,     261,       0 ! !END!
! X =       331.0000,     5151.897,     268,       0 ! !END!
! X =       331.5000,     5151.897,     273,       0 ! !END!
! X =       332.0000,     5151.897,     274,       0 ! !END!
! X =       332.5000,     5151.897,     274,       0 ! !END!
! X =       333.0000,     5151.897,     274,       0 ! !END!
! X =       327.0000,     5152.397,     120,       0 ! !END!
! X =       327.5000,     5152.397,     161,       0 ! !END!
! X =       328.0000,     5152.397,     184,       0 ! !END!
! X =       328.5000,     5152.397,     197,       0 ! !END!
! X =       329.0000,     5152.397,     208,       0 ! !END!
! X =       329.5000,     5152.397,     229,       0 ! !END!
! X =       330.0000,     5152.397,     246,       0 ! !END!
! X =       330.5000,     5152.397,     251,       0 ! !END!
! X =       331.0000,     5152.397,     255,       0 ! !END!
! X =       331.5000,     5152.397,     261,       0 ! !END!
! X =       332.0000,     5152.397,     271,       0 ! !END!
! X =       332.5000,     5152.397,     274,       0 ! !END!
! X =       333.0000,     5152.397,     272,       0 ! !END!
! X =       326.5000,     5152.897,     113,       0 ! !END!
! X =       327.0000,     5152.897,     127,       0 ! !END!
! X =       327.5000,     5152.897,     152,       0 ! !END!
! X =       328.0000,     5152.897,     173,       0 ! !END!
! X =       328.5000,     5152.897,     194,       0 ! !END!
! X =       329.0000,     5152.897,     209,       0 ! !END!
! X =       329.5000,     5152.897,     211,       0 ! !END!
! X =       330.0000,     5152.897,     212,       0 ! !END!
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3758 ! X =       330.5000,     5152.897,     224,       0 ! !END!
3759 ! X =       331.0000,     5152.897,     244,       0 ! !END!
3760 ! X =       331.5000,     5152.897,     249,       0 ! !END!
3761 ! X =       332.0000,     5152.897,     258,       0 ! !END!
3762 ! X =       332.5000,     5152.897,     259,       0 ! !END!
3763 ! X =       333.0000,     5152.897,     261,       0 ! !END!
3764 ! X =       326.5000,     5153.397,     113,       0 ! !END!
3765 ! X =       327.0000,     5153.397,     148,       0 ! !END!
3766 ! X =       327.5000,     5153.397,     152,       0 ! !END!
3767 ! X =       328.0000,     5153.397,     152,       0 ! !END!
3768 ! X =       328.5000,     5153.397,     179,       0 ! !END!
3769 ! X =       329.0000,     5153.397,     227,       0 ! !END!
3770 ! X =       329.5000,     5153.397,     212,       0 ! !END!
3771 ! X =       330.0000,     5153.397,     212,       0 ! !END!
3772 ! X =       330.5000,     5153.397,     212,       0 ! !END!
3773 ! X =       331.0000,     5153.397,     212,       0 ! !END!
3774 ! X =       331.5000,     5153.397,     213,       0 ! !END!
3775 ! X =       332.0000,     5153.397,     235,       0 ! !END!
3776 ! X =       332.5000,     5153.397,     246,       0 ! !END!
3777 ! X =       333.0000,     5153.397,     250,       0 ! !END!
3778 ! X =       327.0000,     5153.897,     165,       0 ! !END!
3779 ! X =       327.5000,     5153.897,     162,       0 ! !END!
3780 ! X =       328.0000,     5153.897,     155,       0 ! !END!
3781 ! X =       328.5000,     5153.897,     152,       0 ! !END!
3782 ! X =       329.0000,     5153.897,     196,       0 ! !END!
3783 ! X =       329.5000,     5153.897,     243,       0 ! !END!
3784 ! X =       330.0000,     5153.897,     237,       0 ! !END!
3785 ! X =       330.5000,     5153.897,     215,       0 ! !END!
3786 ! X =       331.0000,     5153.897,     213,       0 ! !END!
3787 ! X =       331.5000,     5153.897,     213,       0 ! !END!
3788 ! X =       332.0000,     5153.897,     212,       0 ! !END!
3789 ! X =       332.5000,     5153.897,     212,       0 ! !END!
3790 ! X =       333.0000,     5153.897,     217,       0 ! !END!
3791 ! X =       327.0000,     5154.397,     183,       0 ! !END!
3792 ! X =       327.5000,     5154.397,     172,       0 ! !END!
3793 ! X =       328.0000,     5154.397,     163,       0 ! !END!
3794 ! X =       328.5000,     5154.397,     161,       0 ! !END!
3795 ! X =       329.0000,     5154.397,     174,       0 ! !END!
3796 ! X =       329.5000,     5154.397,     202,       0 ! !END!
3797 ! X =       330.0000,     5154.397,     243,       0 ! !END!
3798 ! X =       330.5000,     5154.397,     241,       0 ! !END!
3799 ! X =       331.0000,     5154.397,     226,       0 ! !END!
3800 ! X =       331.5000,     5154.397,     225,       0 ! !END!
3801 ! X =       332.0000,     5154.397,     214,       0 ! !END!
3802 ! X =       332.5000,     5154.397,     213,       0 ! !END!
3803 ! X =       333.0000,     5154.397,     212,       0 ! !END!
3804 ! X =       327.0000,     5154.897,     199,       0 ! !END!
3805 ! X =       327.5000,     5154.897,     184,       0 ! !END!
3806 ! X =       328.0000,     5154.897,     173,       0 ! !END!
3807 ! X =       328.5000,     5154.897,     172,       0 ! !END!
3808 ! X =       329.0000,     5154.897,     175,       0 ! !END!
3809 ! X =       329.5000,     5154.897,     180,       0 ! !END!
3810 ! X =       330.0000,     5154.897,     230,       0 ! !END!
3811 ! X =       330.5000,     5154.897,     243,       0 ! !END!
3812 ! X =       331.0000,     5154.897,     243,       0 ! !END!
3813 ! X =       331.5000,     5154.897,     244,       0 ! !END!
3814 ! X =       332.0000,     5154.897,     244,       0 ! !END!
3815 ! X =       332.5000,     5154.897,     224,       0 ! !END!
3816 ! X =       333.0000,     5154.897,     213,       0 ! !END!
3817 ! X =       326.5000,     5155.397,     232,       0 ! !END!
3818 ! X =       327.0000,     5155.397,     240,       0 ! !END!
3819 ! X =       327.5000,     5155.397,     205,       0 ! !END!
3820 ! X =       328.0000,     5155.397,     183,       0 ! !END!
3821 ! X =       328.5000,     5155.397,     176,       0 ! !END!
3822 ! X =       329.0000,     5155.397,     177,       0 ! !END!
3823 ! X =       329.5000,     5155.397,     179,       0 ! !END!
3824 ! X =       330.0000,     5155.397,     182,       0 ! !END!
3825 ! X =       330.5000,     5155.397,     236,       0 ! !END!
3826 ! X =       331.0000,     5155.397,     244,       0 ! !END!
3827 ! X =       331.5000,     5155.397,     244,       0 ! !END!
3828 ! X =       332.0000,     5155.397,     244,       0 ! !END!
3829 ! X =       332.5000,     5155.397,     244,       0 ! !END!
3830 ! X =       333.0000,     5155.397,     235,       0 ! !END!
3831 ! X =       326.0000,     5155.897,     189,       0 ! !END!
3832 ! X =       326.5000,     5155.897,     215,       0 ! !END!
3833 ! X =       327.0000,     5155.897,     230,       0 ! !END!
3834 ! X =       327.5000,     5155.897,     211,       0 ! !END!
3835 ! X =       328.0000,     5155.897,     193,       0 ! !END!
```

```
3836 ! X =       328.5000,     5155.897,     181,       0 ! !END!
3837 ! X =       329.0000,     5155.897,     178,       0 ! !END!
3838 ! X =       329.5000,     5155.897,     179,       0 ! !END!
3839 ! X =       330.0000,     5155.897,     180,       0 ! !END!
3840 ! X =       330.5000,     5155.897,     184,       0 ! !END!
3841 ! X =       331.0000,     5155.897,     223,       0 ! !END!
3842 ! X =       331.5000,     5155.897,     238,       0 ! !END!
3843 ! X =       332.0000,     5155.897,     244,       0 ! !END!
3844 ! X =       332.5000,     5155.897,     244,       0 ! !END!
3845 ! X =       333.0000,     5155.897,     244,       0 ! !END!
3846 ! X =       326.0000,     5156.397,     203,       0 ! !END!
3847 ! X =       326.5000,     5156.397,     212,       0 ! !END!
3848 ! X =       327.0000,     5156.397,     224,       0 ! !END!
3849 ! X =       327.5000,     5156.397,     212,       0 ! !END!
3850 ! X =       328.0000,     5156.397,     198,       0 ! !END!
3851 ! X =       328.5000,     5156.397,     186,       0 ! !END!
3852 ! X =       329.0000,     5156.397,     180,       0 ! !END!
3853 ! X =       329.5000,     5156.397,     179,       0 ! !END!
3854 ! X =       330.0000,     5156.397,     180,       0 ! !END!
3855 ! X =       330.5000,     5156.397,     181,       0 ! !END!
3856 ! X =       331.0000,     5156.397,     186,       0 ! !END!
3857 ! X =       331.5000,     5156.397,     231,       0 ! !END!
3858 ! X =       332.0000,     5156.397,     244,       0 ! !END!
3859 ! X =       332.5000,     5156.397,     244,       0 ! !END!
3860 ! X =       333.0000,     5156.397,     244,       0 ! !END!
3861 ! X =       325.5000,     5156.897,     187,       0 ! !END!
3862 ! X =       326.0000,     5156.897,     243,       0 ! !END!
3863 ! X =       326.5000,     5156.897,     217,       0 ! !END!
3864 ! X =       327.0000,     5156.897,     217,       0 ! !END!
3865 ! X =       327.5000,     5156.897,     213,       0 ! !END!
3866 ! X =       328.0000,     5156.897,     204,       0 ! !END!
3867 ! X =       328.5000,     5156.897,     192,       0 ! !END!
3868 ! X =       329.0000,     5156.897,     182,       0 ! !END!
3869 ! X =       329.5000,     5156.897,     180,       0 ! !END!
3870 ! X =       330.0000,     5156.897,     180,       0 ! !END!
3871 ! X =       330.5000,     5156.897,     180,       0 ! !END!
3872 ! X =       331.0000,     5156.897,     181,       0 ! !END!
3873 ! X =       331.5000,     5156.897,     200,       0 ! !END!
3874 ! X =       332.0000,     5156.897,     242,       0 ! !END!
3875 ! X =       332.5000,     5156.897,     244,       0 ! !END!
3876 ! X =       333.0000,     5156.897,     244,       0 ! !END!
3877 ! X =       325.5000,     5157.397,     208,       0 ! !END!
3878 ! X =       326.0000,     5157.397,     244,       0 ! !END!
3879 ! X =       326.5000,     5157.397,     244,       0 ! !END!
3880 ! X =       327.0000,     5157.397,     239,       0 ! !END!
3881 ! X =       327.5000,     5157.397,     219,       0 ! !END!
3882 ! X =       328.0000,     5157.397,     211,       0 ! !END!
3883 ! X =       328.5000,     5157.397,     203,       0 ! !END!
3884 ! X =       329.0000,     5157.397,     189,       0 ! !END!
3885 ! X =       329.5000,     5157.397,     182,       0 ! !END!
3886 ! X =       330.0000,     5157.397,     180,       0 ! !END!
3887 ! X =       330.5000,     5157.397,     180,       0 ! !END!
3888 ! X =       331.0000,     5157.397,     180,       0 ! !END!
3889 ! X =       331.5000,     5157.397,     182,       0 ! !END!
3890 ! X =       332.0000,     5157.397,     205,       0 ! !END!
3891 ! X =       332.5000,     5157.397,     244,       0 ! !END!
3892 ! X =       333.0000,     5157.397,     244,       0 ! !END!
3893 ! X =       325.5000,     5157.897,     217,       0 ! !END!
3894 ! X =       326.0000,     5157.897,     244,       0 ! !END!
3895 ! X =       326.5000,     5157.897,     244,       0 ! !END!
3896 ! X =       327.0000,     5157.897,     244,       0 ! !END!
3897 ! X =       327.5000,     5157.897,     244,       0 ! !END!
3898 ! X =       328.0000,     5157.897,     244,       0 ! !END!
3899 ! X =       328.5000,     5157.897,     219,       0 ! !END!
3900 ! X =       329.0000,     5157.897,     203,       0 ! !END!
3901 ! X =       329.5000,     5157.897,     188,       0 ! !END!
3902 ! X =       330.0000,     5157.897,     182,       0 ! !END!
3903 ! X =       330.5000,     5157.897,     180,       0 ! !END!
3904 ! X =       331.0000,     5157.897,     180,       0 ! !END!
3905 ! X =       331.5000,     5157.897,     181,       0 ! !END!
3906 ! X =       332.0000,     5157.897,     185,       0 ! !END!
3907 ! X =       332.5000,     5157.897,     214,       0 ! !END!
3908 ! X =       333.0000,     5157.897,     244,       0 ! !END!
3909 ! X =       325.5000,     5158.397,     218,       0 ! !END!
3910 ! X =       326.0000,     5158.397,     237,       0 ! !END!
3911 ! X =       326.5000,     5158.397,     244,       0 ! !END!
3912 ! X =       327.0000,     5158.397,     244,       0 ! !END!
3913 ! X =       327.5000,     5158.397,     244,       0 ! !END!
```

```
! X =      328.0000,     5158.397,     246,       0 ! !END!
! X =      328.5000,     5158.397,     247,       0 ! !END!
! X =      329.0000,     5158.397,     247,       0 ! !END!
! X =      329.5000,     5158.397,     211,       0 ! !END!
! X =      330.0000,     5158.397,     187,       0 ! !END!
! X =      330.5000,     5158.397,     182,       0 ! !END!
! X =      331.0000,     5158.397,     180,       0 ! !END!
! X =      331.5000,     5158.397,     180,       0 ! !END!
! X =      332.0000,     5158.397,     181,       0 ! !END!
! X =      332.5000,     5158.397,     191,       0 ! !END!
! X =      333.0000,     5158.397,     220,       0 ! !END!
! X =      324.5000,     5158.897,     261,       0 ! !END!
! X =      325.0000,     5158.897,     252,       0 ! !END!
! X =      325.5000,     5158.897,     253,       0 ! !END!
! X =      326.0000,     5158.897,     243,       0 ! !END!
! X =      326.5000,     5158.897,     243,       0 ! !END!
! X =      327.0000,     5158.897,     244,       0 ! !END!
! X =      327.5000,     5158.897,     244,       0 ! !END!
! X =      328.0000,     5158.897,     257,       0 ! !END!
! X =      328.5000,     5158.897,     263,       0 ! !END!
! X =      329.0000,     5158.897,     272,       0 ! !END!
! X =      329.5000,     5158.897,     259,       0 ! !END!
! X =      330.0000,     5158.897,     233,       0 ! !END!
! X =      330.5000,     5158.897,     186,       0 ! !END!
! X =      331.0000,     5158.897,     181,       0 ! !END!
! X =      331.5000,     5158.897,     180,       0 ! !END!
! X =      332.0000,     5158.897,     181,       0 ! !END!
! X =      332.5000,     5158.897,     182,       0 ! !END!
! X =      333.0000,     5158.897,     198,       0 ! !END!
! X =      324.0000,     5159.397,     261,       0 ! !END!
! X =      324.5000,     5159.397,     274,       0 ! !END!
! X =      325.0000,     5159.397,     271,       0 ! !END!
! X =      325.5000,     5159.397,     274,       0 ! !END!
! X =      326.0000,     5159.397,     274,       0 ! !END!
! X =      326.5000,     5159.397,     248,       0 ! !END!
! X =      327.0000,     5159.397,     274,       0 ! !END!
! X =      327.5000,     5159.397,     272,       0 ! !END!
! X =      328.0000,     5159.397,     270,       0 ! !END!
! X =      328.5000,     5159.397,     273,       0 ! !END!
! X =      329.0000,     5159.397,     274,       0 ! !END!
! X =      329.5000,     5159.397,     274,       0 ! !END!
! X =      330.0000,     5159.397,     274,       0 ! !END!
! X =      330.5000,     5159.397,     251,       0 ! !END!
! X =      331.0000,     5159.397,     184,       0 ! !END!
! X =      331.5000,     5159.397,     181,       0 ! !END!
! X =      332.0000,     5159.397,     181,       0 ! !END!
! X =      332.5000,     5159.397,     182,       0 ! !END!
! X =      333.0000,     5159.397,     186,       0 ! !END!
! X =      324.0000,     5159.897,     274,       0 ! !END!
! X =      324.5000,     5159.897,     274,       0 ! !END!
! X =      325.0000,     5159.897,     274,       0 ! !END!
! X =      325.5000,     5159.897,     274,       0 ! !END!
! X =      326.0000,     5159.897,     274,       0 ! !END!
! X =      326.5000,     5159.897,     269,       0 ! !END!
! X =      327.0000,     5159.897,     274,       0 ! !END!
! X =      327.5000,     5159.897,     274,       0 ! !END!
! X =      328.0000,     5159.897,     274,       0 ! !END!
! X =      328.5000,     5159.897,     274,       0 ! !END!
! X =      329.0000,     5159.897,     274,       0 ! !END!
! X =      329.5000,     5159.897,     274,       0 ! !END!
! X =      330.0000,     5159.897,     274,       0 ! !END!
! X =      330.5000,     5159.897,     274,       0 ! !END!
! X =      331.0000,     5159.897,     242,       0 ! !END!
! X =      331.5000,     5159.897,     183,       0 ! !END!
! X =      332.0000,     5159.897,     181,       0 ! !END!
! X =      332.5000,     5159.897,     181,       0 ! !END!
! X =      333.0000,     5159.897,     184,       0 ! !END!
! X =      324.0000,     5160.397,     274,       0 ! !END!
! X =      324.5000,     5160.397,     274,       0 ! !END!
! X =      325.0000,     5160.397,     274,       0 ! !END!
! X =      325.5000,     5160.397,     274,       0 ! !END!
! X =      326.0000,     5160.397,     274,       0 ! !END!
! X =      326.5000,     5160.397,     276,       0 ! !END!
! X =      327.0000,     5160.397,     277,       0 ! !END!
! X =      327.5000,     5160.397,     279,       0 ! !END!
! X =      328.0000,     5160.397,     277,       0 ! !END!
! X =      328.5000,     5160.397,     276,       0 ! !END!
! X =      329.0000,     5160.397,     275,       0 ! !END!
```

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3992 ! X =       329.5000,     5160.397,     275,       0 ! !END!
3993 ! X =       330.0000,     5160.397,     274,       0 ! !END!
3994 ! X =       330.5000,     5160.397,     274,       0 ! !END!
3995 ! X =       331.0000,     5160.397,     274,       0 ! !END!
3996 ! X =       331.5000,     5160.397,     220,       0 ! !END!
3997 ! X =       332.0000,     5160.397,     182,       0 ! !END!
3998 ! X =       332.5000,     5160.397,     182,       0 ! !END!
3999 ! X =       333.0000,     5160.397,     183,       0 ! !END!
4000 ! X =       322.0000,     5160.897,     271,       0 ! !END!
4001 ! X =       322.5000,     5160.897,     274,       0 ! !END!
4002 ! X =       323.0000,     5160.897,     274,       0 ! !END!
4003 ! X =       323.5000,     5160.897,     274,       0 ! !END!
4004 ! X =       324.0000,     5160.897,     274,       0 ! !END!
4005 ! X =       324.5000,     5160.897,     274,       0 ! !END!
4006 ! X =       325.0000,     5160.897,     274,       0 ! !END!
4007 ! X =       325.5000,     5160.897,     274,       0 ! !END!
4008 ! X =       326.0000,     5160.897,     274,       0 ! !END!
4009 ! X =       326.5000,     5160.897,     279,       0 ! !END!
4010 ! X =       327.0000,     5160.897,     281,       0 ! !END!
4011 ! X =       327.5000,     5160.897,     283,       0 ! !END!
4012 ! X =       328.0000,     5160.897,     280,       0 ! !END!
4013 ! X =       328.5000,     5160.897,     279,       0 ! !END!
4014 ! X =       329.0000,     5160.897,     278,       0 ! !END!
4015 ! X =       329.5000,     5160.897,     276,       0 ! !END!
4016 ! X =       330.0000,     5160.897,     275,       0 ! !END!
4017 ! X =       330.5000,     5160.897,     274,       0 ! !END!
4018 ! X =       331.0000,     5160.897,     274,       0 ! !END!
4019 ! X =       331.5000,     5160.897,     273,       0 ! !END!
4020 ! X =       332.0000,     5160.897,     200,       0 ! !END!
4021 ! X =       332.5000,     5160.897,     182,       0 ! !END!
4022 ! X =       333.0000,     5160.897,     183,       0 ! !END!
4023 ! X =       322.0000,     5161.397,     274,       0 ! !END!
4024 ! X =       322.5000,     5161.397,     274,       0 ! !END!
4025 ! X =       323.0000,     5161.397,     274,       0 ! !END!
4026 ! X =       323.5000,     5161.397,     274,       0 ! !END!
4027 ! X =       324.0000,     5161.397,     274,       0 ! !END!
4028 ! X =       324.5000,     5161.397,     274,       0 ! !END!
4029 ! X =       325.0000,     5161.397,     274,       0 ! !END!
4030 ! X =       325.5000,     5161.397,     274,       0 ! !END!
4031 ! X =       326.0000,     5161.397,     274,       0 ! !END!
4032 ! X =       326.5000,     5161.397,     281,       0 ! !END!
4033 ! X =       327.0000,     5161.397,     286,       0 ! !END!
4034 ! X =       327.5000,     5161.397,     287,       0 ! !END!
4035 ! X =       328.0000,     5161.397,     284,       0 ! !END!
4036 ! X =       328.5000,     5161.397,     282,       0 ! !END!
4037 ! X =       329.0000,     5161.397,     280,       0 ! !END!
4038 ! X =       329.5000,     5161.397,     279,       0 ! !END!
4039 ! X =       330.0000,     5161.397,     277,       0 ! !END!
4040 ! X =       330.5000,     5161.397,     276,       0 ! !END!
4041 ! X =       331.0000,     5161.397,     275,       0 ! !END!
4042 ! X =       331.5000,     5161.397,     274,       0 ! !END!
4043 ! X =       332.0000,     5161.397,     249,       0 ! !END!
4044 ! X =       332.5000,     5161.397,     185,       0 ! !END!
4045 ! X =       333.0000,     5161.397,     183,       0 ! !END!
4046 ! X =       322.0000,     5161.897,     274,       0 ! !END!
4047 ! X =       322.5000,     5161.897,     274,       0 ! !END!
4048 ! X =       323.0000,     5161.897,     274,       0 ! !END!
4049 ! X =       323.5000,     5161.897,     274,       0 ! !END!
4050 ! X =       324.0000,     5161.897,     274,       0 ! !END!
4051 ! X =       324.5000,     5161.897,     274,       0 ! !END!
4052 ! X =       325.0000,     5161.897,     274,       0 ! !END!
4053 ! X =       325.5000,     5161.897,     274,       0 ! !END!
4054 ! X =       326.0000,     5161.897,     274,       0 ! !END!
4055 ! X =       326.5000,     5161.897,     283,       0 ! !END!
4056 ! X =       327.0000,     5161.897,     291,       0 ! !END!
4057 ! X =       327.5000,     5161.897,     292,       0 ! !END!
4058 ! X =       328.0000,     5161.897,     287,       0 ! !END!
4059 ! X =       328.5000,     5161.897,     285,       0 ! !END!
4060 ! X =       329.0000,     5161.897,     284,       0 ! !END!
4061 ! X =       329.5000,     5161.897,     283,       0 ! !END!
4062 ! X =       330.0000,     5161.897,     281,       0 ! !END!
4063 ! X =       330.5000,     5161.897,     278,       0 ! !END!
4064 ! X =       331.0000,     5161.897,     277,       0 ! !END!
4065 ! X =       331.5000,     5161.897,     275,       0 ! !END!
4066 ! X =       332.0000,     5161.897,     274,       0 ! !END!
4067 ! X =       332.5000,     5161.897,     217,       0 ! !END!
4068 ! X =       333.0000,     5161.897,     183,       0 ! !END!
4069 ! X =       322.0000,     5162.397,     274,       0 ! !END!
```

```
4070 ! X =       322.5000,     5162.397,     274,       0 ! !END!
4071 ! X =       323.0000,     5162.397,     274,       0 ! !END!
4072 ! X =       323.5000,     5162.397,     274,       0 ! !END!
4073 ! X =       324.0000,     5162.397,     274,       0 ! !END!
4074 ! X =       324.5000,     5162.397,     274,       0 ! !END!
4075 ! X =       325.0000,     5162.397,     274,       0 ! !END!
4076 ! X =       325.5000,     5162.397,     274,       0 ! !END!
4077 ! X =       326.0000,     5162.397,     274,       0 ! !END!
4078 ! X =       326.5000,     5162.397,     282,       0 ! !END!
4079 ! X =       327.0000,     5162.397,     294,       0 ! !END!
4080 ! X =       327.5000,     5162.397,     296,       0 ! !END!
4081 ! X =       328.0000,     5162.397,     292,       0 ! !END!
4082 ! X =       328.5000,     5162.397,     290,       0 ! !END!
4083 ! X =       329.0000,     5162.397,     289,       0 ! !END!
4084 ! X =       329.5000,     5162.397,     287,       0 ! !END!
4085 ! X =       330.0000,     5162.397,     284,       0 ! !END!
4086 ! X =       330.5000,     5162.397,     283,       0 ! !END!
4087 ! X =       331.0000,     5162.397,     282,       0 ! !END!
4088 ! X =       331.5000,     5162.397,     281,       0 ! !END!
4089 ! X =       332.0000,     5162.397,     278,       0 ! !END!
4090 ! X =       332.5000,     5162.397,     271,       0 ! !END!
4091 ! X =       333.0000,     5162.397,     195,       0 ! !END!
4092 ! X =       322.5000,     5162.897,     274,       0 ! !END!
4093 ! X =       323.0000,     5162.897,     274,       0 ! !END!
4094 ! X =       323.5000,     5162.897,     274,       0 ! !END!
4095 ! X =       324.0000,     5162.897,     274,       0 ! !END!
4096 ! X =       324.5000,     5162.897,     274,       0 ! !END!
4097 ! X =       325.0000,     5162.897,     274,       0 ! !END!
4098 ! X =       325.5000,     5162.897,     274,       0 ! !END!
4099 ! X =       326.0000,     5162.897,     274,       0 ! !END!
4100 ! X =       326.5000,     5162.897,     282,       0 ! !END!
4101 ! X =       327.0000,     5162.897,     295,       0 ! !END!
4102 ! X =       327.5000,     5162.897,     302,       0 ! !END!
4103 ! X =       328.0000,     5162.897,     295,       0 ! !END!
4104 ! X =       328.5000,     5162.897,     293,       0 ! !END!
4105 ! X =       329.0000,     5162.897,     293,       0 ! !END!
4106 ! X =       329.5000,     5162.897,     292,       0 ! !END!
4107 ! X =       330.0000,     5162.897,     290,       0 ! !END!
4108 ! X =       330.5000,     5162.897,     290,       0 ! !END!
4109 ! X =       331.0000,     5162.897,     292,       0 ! !END!
4110 ! X =       331.5000,     5162.897,     292,       0 ! !END!
4111 ! X =       332.0000,     5162.897,     289,       0 ! !END!
4112 ! X =       332.5000,     5162.897,     280,       0 ! !END!
4113 ! X =       333.0000,     5162.897,     230,       0 ! !END!
4114 ! X =       322.5000,     5163.397,     274,       0 ! !END!
4115 ! X =       323.0000,     5163.397,     274,       0 ! !END!
4116 ! X =       323.5000,     5163.397,     274,       0 ! !END!
4117 ! X =       324.0000,     5163.397,     274,       0 ! !END!
4118 ! X =       324.5000,     5163.397,     274,       0 ! !END!
4119 ! X =       325.0000,     5163.397,     274,       0 ! !END!
4120 ! X =       325.5000,     5163.397,     274,       0 ! !END!
4121 ! X =       326.0000,     5163.397,     274,       0 ! !END!
4122 ! X =       326.5000,     5163.397,     280,       0 ! !END!
4123 ! X =       327.0000,     5163.397,     291,       0 ! !END!
4124 ! X =       327.5000,     5163.397,     303,       0 ! !END!
4125 ! X =       328.0000,     5163.397,     299,       0 ! !END!
4126 ! X =       328.5000,     5163.397,     297,       0 ! !END!
4127 ! X =       329.0000,     5163.397,     298,       0 ! !END!
4128 ! X =       329.5000,     5163.397,     297,       0 ! !END!
4129 ! X =       330.0000,     5163.397,     294,       0 ! !END!
4130 ! X =       330.5000,     5163.397,     294,       0 ! !END!
4131 ! X =       331.0000,     5163.397,     298,       0 ! !END!
4132 ! X =       331.5000,     5163.397,     303,       0 ! !END!
4133 ! X =       332.0000,     5163.397,     303,       0 ! !END!
4134 ! X =       332.5000,     5163.397,     285,       0 ! !END!
4135 ! X =       333.0000,     5163.397,     250,       0 ! !END!
4136 ! X =       322.5000,     5163.897,     274,       0 ! !END!
4137 ! X =       323.0000,     5163.897,     274,       0 ! !END!
4138 ! X =       323.5000,     5163.897,     274,       0 ! !END!
4139 ! X =       324.0000,     5163.897,     274,       0 ! !END!
4140 ! X =       324.5000,     5163.897,     274,       0 ! !END!
4141 ! X =       325.0000,     5163.897,     274,       0 ! !END!
4142 ! X =       325.5000,     5163.897,     274,       0 ! !END!
4143 ! X =       326.0000,     5163.897,     274,       0 ! !END!
4144 ! X =       326.5000,     5163.897,     278,       0 ! !END!
4145 ! X =       327.0000,     5163.897,     287,       0 ! !END!
4146 ! X =       327.5000,     5163.897,     296,       0 ! !END!
4147 ! X =       328.0000,     5163.897,     302,       0 ! !END!
```

```
4148 ! X =       328.5000,     5163.897,     301,       0 ! !END!
4149 ! X =       329.0000,     5163.897,     301,       0 ! !END!
4150 ! X =       329.5000,     5163.897,     302,       0 ! !END!
4151 ! X =       330.0000,     5163.897,     299,       0 ! !END!
4152 ! X =       330.5000,     5163.897,     299,       0 ! !END!
4153 ! X =       331.0000,     5163.897,     301,       0 ! !END!
4154 ! X =       331.5000,     5163.897,     304,       0 ! !END!
4155 ! X =       332.0000,     5163.897,     301,       0 ! !END!
4156 ! X =       332.5000,     5163.897,     282,       0 ! !END!
4157 ! X =       333.0000,     5163.897,     248,       0 ! !END!
4158 ! X =       322.5000,     5164.397,     274,       0 ! !END!
4159 ! X =       323.0000,     5164.397,     274,       0 ! !END!
4160 ! X =       323.5000,     5164.397,     274,       0 ! !END!
4161 ! X =       324.0000,     5164.397,     274,       0 ! !END!
4162 ! X =       324.5000,     5164.397,     274,       0 ! !END!
4163 ! X =       325.0000,     5164.397,     274,       0 ! !END!
4164 ! X =       325.5000,     5164.397,     275,       0 ! !END!
4165 ! X =       326.0000,     5164.397,     278,       0 ! !END!
4166 ! X =       326.5000,     5164.397,     281,       0 ! !END!
4167 ! X =       327.0000,     5164.397,     287,       0 ! !END!
4168 ! X =       327.5000,     5164.397,     294,       0 ! !END!
4169 ! X =       328.0000,     5164.397,     301,       0 ! !END!
4170 ! X =       328.5000,     5164.397,     304,       0 ! !END!
4171 ! X =       329.0000,     5164.397,     303,       0 ! !END!
4172 ! X =       329.5000,     5164.397,     304,       0 ! !END!
4173 ! X =       330.0000,     5164.397,     304,       0 ! !END!
4174 ! X =       330.5000,     5164.397,     303,       0 ! !END!
4175 ! X =       331.0000,     5164.397,     304,       0 ! !END!
4176 ! X =       331.5000,     5164.397,     304,       0 ! !END!
4177 ! X =       332.0000,     5164.397,     303,       0 ! !END!
4178 ! X =       332.5000,     5164.397,     290,       0 ! !END!
4179 ! X =       333.0000,     5164.397,     278,       0 ! !END!
4180 ! X =       322.5000,     5164.897,     274,       0 ! !END!
4181 ! X =       323.0000,     5164.897,     276,       0 ! !END!
4182 ! X =       323.5000,     5164.897,     276,       0 ! !END!
4183 ! X =       324.0000,     5164.897,     277,       0 ! !END!
4184 ! X =       324.5000,     5164.897,     279,       0 ! !END!
4185 ! X =       325.0000,     5164.897,     281,       0 ! !END!
4186 ! X =       325.5000,     5164.897,     282,       0 ! !END!
4187 ! X =       326.0000,     5164.897,     284,       0 ! !END!
4188 ! X =       326.5000,     5164.897,     287,       0 ! !END!
4189 ! X =       327.0000,     5164.897,     290,       0 ! !END!
4190 ! X =       327.5000,     5164.897,     295,       0 ! !END!
4191 ! X =       328.0000,     5164.897,     299,       0 ! !END!
4192 ! X =       328.5000,     5164.897,     304,       0 ! !END!
4193 ! X =       329.0000,     5164.897,     305,       0 ! !END!
4194 ! X =       329.5000,     5164.897,     304,       0 ! !END!
4195 ! X =       330.0000,     5164.897,     304,       0 ! !END!
4196 ! X =       330.5000,     5164.897,     304,       0 ! !END!
4197 ! X =       331.0000,     5164.897,     304,       0 ! !END!
4198 ! X =       331.5000,     5164.897,     304,       0 ! !END!
4199 ! X =       332.0000,     5164.897,     304,       0 ! !END!
4200 ! X =       332.5000,     5164.897,     294,       0 ! !END!
4201 ! X =       333.0000,     5164.897,     283,       0 ! !END!
4202 ! X =       322.5000,     5165.397,     274,       0 ! !END!
4203 ! X =       323.0000,     5165.397,     278,       0 ! !END!
4204 ! X =       323.5000,     5165.397,     279,       0 ! !END!
4205 ! X =       324.0000,     5165.397,     278,       0 ! !END!
4206 ! X =       324.5000,     5165.397,     282,       0 ! !END!
4207 ! X =       325.0000,     5165.397,     285,       0 ! !END!
4208 ! X =       325.5000,     5165.397,     287,       0 ! !END!
4209 ! X =       326.0000,     5165.397,     289,       0 ! !END!
4210 ! X =       326.5000,     5165.397,     292,       0 ! !END!
4211 ! X =       327.0000,     5165.397,     295,       0 ! !END!
4212 ! X =       327.5000,     5165.397,     297,       0 ! !END!
4213 ! X =       328.0000,     5165.397,     300,       0 ! !END!
4214 ! X =       328.5000,     5165.397,     302,       0 ! !END!
4215 ! X =       329.0000,     5165.397,     304,       0 ! !END!
4216 ! X =       329.5000,     5165.397,     304,       0 ! !END!
4217 ! X =       330.0000,     5165.397,     304,       0 ! !END!
4218 ! X =       330.5000,     5165.397,     304,       0 ! !END!
4219 ! X =       331.0000,     5165.397,     304,       0 ! !END!
4220 ! X =       331.5000,     5165.397,     304,       0 ! !END!
4221 ! X =       332.0000,     5165.397,     303,       0 ! !END!
4222 ! X =       332.5000,     5165.397,     293,       0 ! !END!
4223 ! X =       333.0000,     5165.397,     284,       0 ! !END!
4224 ! X =       322.5000,     5165.897,     274,       0 ! !END!
4225 ! X =       323.0000,     5165.897,     279,       0 ! !END!
```

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4226 ! X =       323.5000,     5165.897,     281,       0 ! !END!
4227 ! X =       324.0000,     5165.897,     279,       0 ! !END!
4228 ! X =       324.5000,     5165.897,     283,       0 ! !END!
4229 ! X =       325.0000,     5165.897,     287,       0 ! !END!
4230 ! X =       325.5000,     5165.897,     290,       0 ! !END!
4231 ! X =       326.0000,     5165.897,     294,       0 ! !END!
4232 ! X =       326.5000,     5165.897,     297,       0 ! !END!
4233 ! X =       327.0000,     5165.897,     300,       0 ! !END!
4234 ! X =       327.5000,     5165.897,     300,       0 ! !END!
4235 ! X =       328.0000,     5165.897,     301,       0 ! !END!
4236 ! X =       328.5000,     5165.897,     303,       0 ! !END!
4237 ! X =       329.0000,     5165.897,     303,       0 ! !END!
4238 ! X =       329.5000,     5165.897,     304,       0 ! !END!
4239 ! X =       330.0000,     5165.897,     304,       0 ! !END!
4240 ! X =       330.5000,     5165.897,     304,       0 ! !END!
4241 ! X =       331.0000,     5165.897,     304,       0 ! !END!
4242 ! X =       331.5000,     5165.897,     304,       0 ! !END!
4243 ! X =       332.0000,     5165.897,     299,       0 ! !END!
4244 ! X =       332.5000,     5165.897,     291,       0 ! !END!
4245 ! X =       333.0000,     5165.897,     284,       0 ! !END!
4246 ! X =       322.5000,     5166.397,     274,       0 ! !END!
4247 ! X =       323.0000,     5166.397,     280,       0 ! !END!
4248 ! X =       323.5000,     5166.397,     283,       0 ! !END!
4249 ! X =       324.0000,     5166.397,     278,       0 ! !END!
4250 ! X =       324.5000,     5166.397,     283,       0 ! !END!
4251 ! X =       325.0000,     5166.397,     287,       0 ! !END!
4252 ! X =       325.5000,     5166.397,     291,       0 ! !END!
4253 ! X =       326.0000,     5166.397,     295,       0 ! !END!
4254 ! X =       326.5000,     5166.397,     299,       0 ! !END!
4255 ! X =       327.0000,     5166.397,     303,       0 ! !END!
4256 ! X =       327.5000,     5166.397,     304,       0 ! !END!
4257 ! X =       328.0000,     5166.397,     304,       0 ! !END!
4258 ! X =       328.5000,     5166.397,     304,       0 ! !END!
4259 ! X =       329.0000,     5166.397,     304,       0 ! !END!
4260 ! X =       329.5000,     5166.397,     304,       0 ! !END!
4261 ! X =       330.0000,     5166.397,     304,       0 ! !END!
4262 ! X =       330.5000,     5166.397,     304,       0 ! !END!
4263 ! X =       331.0000,     5166.397,     304,       0 ! !END!
4264 ! X =       331.5000,     5166.397,     303,       0 ! !END!
4265 ! X =       332.0000,     5166.397,     297,       0 ! !END!
4266 ! X =       332.5000,     5166.397,     291,       0 ! !END!
4267 ! X =       333.0000,     5166.397,     284,       0 ! !END!
4268 ! X =       322.5000,     5166.897,     274,       0 ! !END!
4269 ! X =       323.0000,     5166.897,     280,       0 ! !END!
4270 ! X =       323.5000,     5166.897,     286,       0 ! !END!
4271 ! X =       324.0000,     5166.897,     279,       0 ! !END!
4272 ! X =       324.5000,     5166.897,     283,       0 ! !END!
4273 ! X =       325.0000,     5166.897,     287,       0 ! !END!
4274 ! X =       325.5000,     5166.897,     291,       0 ! !END!
4275 ! X =       326.0000,     5166.897,     295,       0 ! !END!
4276 ! X =       326.5000,     5166.897,     299,       0 ! !END!
4277 ! X =       327.0000,     5166.897,     303,       0 ! !END!
4278 ! X =       327.5000,     5166.897,     304,       0 ! !END!
4279 ! X =       328.0000,     5166.897,     304,       0 ! !END!
4280 ! X =       328.5000,     5166.897,     304,       0 ! !END!
4281 ! X =       329.0000,     5166.897,     304,       0 ! !END!
4282 ! X =       329.5000,     5166.897,     305,       0 ! !END!
4283 ! X =       330.0000,     5166.897,     304,       0 ! !END!
4284 ! X =       330.5000,     5166.897,     304,       0 ! !END!
4285 ! X =       331.0000,     5166.897,     304,       0 ! !END!
4286 ! X =       331.5000,     5166.897,     303,       0 ! !END!
4287 ! X =       332.0000,     5166.897,     297,       0 ! !END!
4288 ! X =       332.5000,     5166.897,     291,       0 ! !END!
4289 ! X =       333.0000,     5166.897,     284,       0 ! !END!
4290 ! X =       322.5000,     5167.397,     274,       0 ! !END!
4291 ! X =       323.0000,     5167.397,     279,       0 ! !END!
4292 ! X =       323.5000,     5167.397,     288,       0 ! !END!
4293 ! X =       324.0000,     5167.397,     280,       0 ! !END!
4294 ! X =       324.5000,     5167.397,     285,       0 ! !END!
4295 ! X =       325.0000,     5167.397,     289,       0 ! !END!
4296 ! X =       325.5000,     5167.397,     293,       0 ! !END!
4297 ! X =       326.0000,     5167.397,     296,       0 ! !END!
4298 ! X =       326.5000,     5167.397,     299,       0 ! !END!
4299 ! X =       327.0000,     5167.397,     302,       0 ! !END!
4300 ! X =       327.5000,     5167.397,     304,       0 ! !END!
4301 ! X =       328.0000,     5167.397,     304,       0 ! !END!
4302 ! X =       328.5000,     5167.397,     304,       0 ! !END!
4303 ! X =       329.0000,     5167.397,     304,       0 ! !END!
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! X =       329.5000,     5167.397,     304,       0 ! !END!
! X =       330.0000,     5167.397,     304,       0 ! !END!
! X =       330.5000,     5167.397,     304,       0 ! !END!
! X =       331.0000,     5167.397,     304,       0 ! !END!
! X =       331.5000,     5167.397,     303,       0 ! !END!
! X =       332.0000,     5167.397,     297,       0 ! !END!
! X =       332.5000,     5167.397,     291,       0 ! !END!
! X =       333.0000,     5167.397,     285,       0 ! !END!
! X =       322.5000,     5167.897,     274,       0 ! !END!
! X =       323.0000,     5167.897,     279,       0 ! !END!
! X =       323.5000,     5167.897,     289,       0 ! !END!
! X =       324.0000,     5167.897,     281,       0 ! !END!
! X =       324.5000,     5167.897,     289,       0 ! !END!
! X =       325.0000,     5167.897,     292,       0 ! !END!
! X =       325.5000,     5167.897,     296,       0 ! !END!
! X =       326.0000,     5167.897,     300,       0 ! !END!
! X =       326.5000,     5167.897,     302,       0 ! !END!
! X =       327.0000,     5167.897,     304,       0 ! !END!
! X =       327.5000,     5167.897,     304,       0 ! !END!
! X =       328.0000,     5167.897,     304,       0 ! !END!
! X =       328.5000,     5167.897,     304,       0 ! !END!
! X =       329.0000,     5167.897,     304,       0 ! !END!
! X =       329.5000,     5167.897,     304,       0 ! !END!
! X =       330.0000,     5167.897,     305,       0 ! !END!
! X =       330.5000,     5167.897,     305,       0 ! !END!
! X =       331.0000,     5167.897,     304,       0 ! !END!
! X =       331.5000,     5167.897,     303,       0 ! !END!
! X =       332.0000,     5167.897,     297,       0 ! !END!
! X =       332.5000,     5167.897,     291,       0 ! !END!
! X =       333.0000,     5167.897,     285,       0 ! !END!
! X =       322.5000,     5168.397,     273,       0 ! !END!
! X =       323.0000,     5168.397,     279,       0 ! !END!
! X =       323.5000,     5168.397,     290,       0 ! !END!
! X =       324.0000,     5168.397,     282,       0 ! !END!
! X =       324.5000,     5168.397,     293,       0 ! !END!
! X =       325.0000,     5168.397,     296,       0 ! !END!
! X =       325.5000,     5168.397,     299,       0 ! !END!
! X =       326.0000,     5168.397,     303,       0 ! !END!
! X =       326.5000,     5168.397,     304,       0 ! !END!
! X =       327.0000,     5168.397,     304,       0 ! !END!
! X =       327.5000,     5168.397,     304,       0 ! !END!
! X =       328.0000,     5168.397,     304,       0 ! !END!
! X =       328.5000,     5168.397,     304,       0 ! !END!
! X =       329.0000,     5168.397,     304,       0 ! !END!
! X =       329.5000,     5168.397,     319,       0 ! !END!
! X =       330.0000,     5168.397,     316,       0 ! !END!
! X =       330.5000,     5168.397,     311,       0 ! !END!
! X =       331.0000,     5168.397,     305,       0 ! !END!
! X =       331.5000,     5168.397,     303,       0 ! !END!
! X =       332.0000,     5168.397,     294,       0 ! !END!
! X =       332.5000,     5168.397,     289,       0 ! !END!
! X =       333.0000,     5168.397,     284,       0 ! !END!
! X =       322.5000,     5168.897,     273,       0 ! !END!
! X =       323.0000,     5168.897,     277,       0 ! !END!
! X =       323.5000,     5168.897,     287,       0 ! !END!
! X =       324.0000,     5168.897,     281,       0 ! !END!
! X =       324.5000,     5168.897,     297,       0 ! !END!
! X =       325.0000,     5168.897,     299,       0 ! !END!
! X =       325.5000,     5168.897,     301,       0 ! !END!
! X =       326.0000,     5168.897,     304,       0 ! !END!
! X =       326.5000,     5168.897,     304,       0 ! !END!
! X =       327.0000,     5168.897,     304,       0 ! !END!
! X =       327.5000,     5168.897,     304,       0 ! !END!
! X =       328.0000,     5168.897,     304,       0 ! !END!
! X =       328.5000,     5168.897,     304,       0 ! !END!
! X =       329.0000,     5168.897,     304,       0 ! !END!
! X =       329.5000,     5168.897,     336,       0 ! !END!
! X =       330.0000,     5168.897,     333,       0 ! !END!
! X =       330.5000,     5168.897,     323,       0 ! !END!
! X =       331.0000,     5168.897,     312,       0 ! !END!
! X =       331.5000,     5168.897,     304,       0 ! !END!
! X =       332.0000,     5168.897,     291,       0 ! !END!
! X =       332.5000,     5168.897,     287,       0 ! !END!
! X =       333.0000,     5168.897,     283,       0 ! !END!
! X =       322.5000,     5169.397,     264,       0 ! !END!
! X =       323.0000,     5169.397,     275,       0 ! !END!
! X =       323.5000,     5169.397,     281,       0 ! !END!
! X =       324.0000,     5169.397,     281,       0 ! !END!
```

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! X =      324.5000,     5169.397,     300,       0 ! !END!
! X =      325.0000,     5169.397,     301,       0 ! !END!
! X =      325.5000,     5169.397,     302,       0 ! !END!
! X =      326.0000,     5169.397,     304,       0 ! !END!
! X =      326.5000,     5169.397,     304,       0 ! !END!
! X =      327.0000,     5169.397,     304,       0 ! !END!
! X =      327.5000,     5169.397,     304,       0 ! !END!
! X =      328.0000,     5169.397,     304,       0 ! !END!
! X =      328.5000,     5169.397,     304,       0 ! !END!
! X =      329.0000,     5169.397,     305,       0 ! !END!
! X =      329.5000,     5169.397,     346,       0 ! !END!
! X =      330.0000,     5169.397,     351,       0 ! !END!
! X =      330.5000,     5169.397,     331,       0 ! !END!
! X =      331.0000,     5169.397,     315,       0 ! !END!
! X =      331.5000,     5169.397,     304,       0 ! !END!
! X =      332.0000,     5169.397,     287,       0 ! !END!
! X =      332.5000,     5169.397,     284,       0 ! !END!
! X =      333.0000,     5169.397,     281,       0 ! !END!
! X =      322.5000,     5169.897,     251,       0 ! !END!
! X =      323.0000,     5169.897,     270,       0 ! !END!
! X =      323.5000,     5169.897,     276,       0 ! !END!
! X =      324.0000,     5169.897,     281,       0 ! !END!
! X =      324.5000,     5169.897,     303,       0 ! !END!
! X =      325.0000,     5169.897,     287,       0 ! !END!
! X =      325.5000,     5169.897,     287,       0 ! !END!
! X =      326.0000,     5169.897,     291,       0 ! !END!
! X =      326.5000,     5169.897,     295,       0 ! !END!
! X =      327.0000,     5169.897,     303,       0 ! !END!
! X =      327.5000,     5169.897,     304,       0 ! !END!
! X =      328.0000,     5169.897,     304,       0 ! !END!
! X =      328.5000,     5169.897,     304,       0 ! !END!
! X =      329.0000,     5169.897,     317,       0 ! !END!
! X =      329.5000,     5169.897,     328,       0 ! !END!
! X =      330.0000,     5169.897,     332,       0 ! !END!
! X =      330.5000,     5169.897,     322,       0 ! !END!
! X =      331.0000,     5169.897,     312,       0 ! !END!
! X =      331.5000,     5169.897,     305,       0 ! !END!
! X =      332.0000,     5169.897,     283,       0 ! !END!
! X =      332.5000,     5169.897,     281,       0 ! !END!
! X =      333.0000,     5169.897,     279,       0 ! !END!
! X =      321.5000,     5170.397,     241,       0 ! !END!
! X =      322.0000,     5170.397,     242,       0 ! !END!
! X =      322.5000,     5170.397,     243,       0 ! !END!
! X =      323.0000,     5170.397,     248,       0 ! !END!
! X =      323.5000,     5170.397,     263,       0 ! !END!
! X =      324.0000,     5170.397,     274,       0 ! !END!
! X =      324.5000,     5170.397,     278,       0 ! !END!
! X =      325.0000,     5170.397,     263,       0 ! !END!
! X =      325.5000,     5170.397,     270,       0 ! !END!
! X =      326.0000,     5170.397,     274,       0 ! !END!
! X =      326.5000,     5170.397,     274,       0 ! !END!
! X =      327.0000,     5170.397,     298,       0 ! !END!
! X =      327.5000,     5170.397,     305,       0 ! !END!
! X =      328.0000,     5170.397,     304,       0 ! !END!
! X =      328.5000,     5170.397,     304,       0 ! !END!
! X =      329.0000,     5170.397,     314,       0 ! !END!
! X =      329.5000,     5170.397,     320,       0 ! !END!
! X =      330.0000,     5170.397,     318,       0 ! !END!
! X =      330.5000,     5170.397,     314,       0 ! !END!
! X =      331.0000,     5170.397,     309,       0 ! !END!
! X =      331.5000,     5170.397,     305,       0 ! !END!
! X =      332.0000,     5170.397,     280,       0 ! !END!
! X =      332.5000,     5170.397,     280,       0 ! !END!
! X =      333.0000,     5170.397,     281,       0 ! !END!
! X =      321.5000,     5170.897,     242,       0 ! !END!
! X =      322.0000,     5170.897,     242,       0 ! !END!
! X =      322.5000,     5170.897,     242,       0 ! !END!
! X =      323.0000,     5170.897,     243,       0 ! !END!
! X =      323.5000,     5170.897,     244,       0 ! !END!
! X =      324.0000,     5170.897,     244,       0 ! !END!
! X =      324.5000,     5170.897,     244,       0 ! !END!
! X =      325.0000,     5170.897,     244,       0 ! !END!
! X =      325.5000,     5170.897,     245,       0 ! !END!
! X =      326.0000,     5170.897,     246,       0 ! !END!
! X =      326.5000,     5170.897,     276,       0 ! !END!
! X =      327.0000,     5170.897,     293,       0 ! !END!
! X =      327.5000,     5170.897,     304,       0 ! !END!
! X =      328.0000,     5170.897,     304,       0 ! !END!
```

```
! X =      328.5000,     5170.897,     304,       0 ! !END!
! X =      329.0000,     5170.897,     310,       0 ! !END!
! X =      329.5000,     5170.897,     316,       0 ! !END!
! X =      330.0000,     5170.897,     312,       0 ! !END!
! X =      330.5000,     5170.897,     309,       0 ! !END!
! X =      331.0000,     5170.897,     306,       0 ! !END!
! X =      331.5000,     5170.897,     304,       0 ! !END!
! X =      332.0000,     5170.897,     276,       0 ! !END!
! X =      332.5000,     5170.897,     282,       0 ! !END!
! X =      333.0000,     5170.897,     288,       0 ! !END!
! X =      321.5000,     5171.397,     243,       0 ! !END!
! X =      322.0000,     5171.397,     245,       0 ! !END!
! X =      322.5000,     5171.397,     244,       0 ! !END!
! X =      323.0000,     5171.397,     245,       0 ! !END!
! X =      323.5000,     5171.397,     245,       0 ! !END!
! X =      324.0000,     5171.397,     249,       0 ! !END!
! X =      324.5000,     5171.397,     255,       0 ! !END!
! X =      325.0000,     5171.397,     267,       0 ! !END!
! X =      325.5000,     5171.397,     273,       0 ! !END!
! X =      326.0000,     5171.397,     244,       0 ! !END!
! X =      326.5000,     5171.397,     273,       0 ! !END!
! X =      327.0000,     5171.397,     287,       0 ! !END!
! X =      327.5000,     5171.397,     303,       0 ! !END!
! X =      328.0000,     5171.397,     304,       0 ! !END!
! X =      328.5000,     5171.397,     304,       0 ! !END!
! X =      329.0000,     5171.397,     307,       0 ! !END!
! X =      329.5000,     5171.397,     312,       0 ! !END!
! X =      330.0000,     5171.397,     308,       0 ! !END!
! X =      330.5000,     5171.397,     304,       0 ! !END!
! X =      331.0000,     5171.397,     303,       0 ! !END!
! X =      331.5000,     5171.397,     280,       0 ! !END!
! X =      332.0000,     5171.397,     274,       0 ! !END!
! X =      332.5000,     5171.397,     280,       0 ! !END!
! X =      333.0000,     5171.397,     288,       0 ! !END!
! X =      321.5000,     5171.897,     254,       0 ! !END!
! X =      322.0000,     5171.897,     261,       0 ! !END!
! X =      322.5000,     5171.897,     259,       0 ! !END!
! X =      323.0000,     5171.897,     256,       0 ! !END!
! X =      323.5000,     5171.897,     257,       0 ! !END!
! X =      324.0000,     5171.897,     263,       0 ! !END!
! X =      324.5000,     5171.897,     273,       0 ! !END!
! X =      325.0000,     5171.897,     274,       0 ! !END!
! X =      325.5000,     5171.897,     274,       0 ! !END!
! X =      326.0000,     5171.897,     262,       0 ! !END!
! X =      326.5000,     5171.897,     248,       0 ! !END!
! X =      327.0000,     5171.897,     279,       0 ! !END!
! X =      327.5000,     5171.897,     302,       0 ! !END!
! X =      328.0000,     5171.897,     304,       0 ! !END!
! X =      328.5000,     5171.897,     304,       0 ! !END!
! X =      329.0000,     5171.897,     305,       0 ! !END!
! X =      329.5000,     5171.897,     307,       0 ! !END!
! X =      330.0000,     5171.897,     301,       0 ! !END!
! X =      330.5000,     5171.897,     289,       0 ! !END!
! X =      331.0000,     5171.897,     290,       0 ! !END!
! X =      331.5000,     5171.897,     274,       0 ! !END!
! X =      332.0000,     5171.897,     275,       0 ! !END!
! X =      332.5000,     5171.897,     284,       0 ! !END!
! X =      333.0000,     5171.897,     290,       0 ! !END!
! X =      322.0000,     5172.397,     274,       0 ! !END!
! X =      322.5000,     5172.397,     274,       0 ! !END!
! X =      323.0000,     5172.397,     271,       0 ! !END!
! X =      323.5000,     5172.397,     269,       0 ! !END!
! X =      324.0000,     5172.397,     273,       0 ! !END!
! X =      324.5000,     5172.397,     274,       0 ! !END!
! X =      325.0000,     5172.397,     274,       0 ! !END!
! X =      325.5000,     5172.397,     274,       0 ! !END!
! X =      326.0000,     5172.397,     274,       0 ! !END!
! X =      326.5000,     5172.397,     245,       0 ! !END!
! X =      327.0000,     5172.397,     269,       0 ! !END!
! X =      327.5000,     5172.397,     289,       0 ! !END!
! X =      328.0000,     5172.397,     302,       0 ! !END!
! X =      328.5000,     5172.397,     292,       0 ! !END!
! X =      329.0000,     5172.397,     283,       0 ! !END!
! X =      329.5000,     5172.397,     276,       0 ! !END!
! X =      330.0000,     5172.397,     274,       0 ! !END!
! X =      330.5000,     5172.397,     274,       0 ! !END!
! X =      331.0000,     5172.397,     274,       0 ! !END!
! X =      331.5000,     5172.397,     274,       0 ! !END!
```

```
! X =      332.0000,     5172.397,     275,       0 ! !END!
! X =      332.5000,     5172.397,     289,       0 ! !END!
! X =      333.0000,     5172.397,     293,       0 ! !END!
! X =      322.0000,     5172.897,     274,       0 ! !END!
! X =      322.5000,     5172.897,     274,       0 ! !END!
! X =      323.0000,     5172.897,     274,       0 ! !END!
! X =      323.5000,     5172.897,     274,       0 ! !END!
! X =      324.0000,     5172.897,     274,       0 ! !END!
! X =      324.5000,     5172.897,     274,       0 ! !END!
! X =      325.0000,     5172.897,     274,       0 ! !END!
! X =      325.5000,     5172.897,     274,       0 ! !END!
! X =      326.0000,     5172.897,     274,       0 ! !END!
! X =      326.5000,     5172.897,     266,       0 ! !END!
! X =      327.0000,     5172.897,     268,       0 ! !END!
! X =      327.5000,     5172.897,     272,       0 ! !END!
! X =      328.0000,     5172.897,     274,       0 ! !END!
! X =      328.5000,     5172.897,     274,       0 ! !END!
! X =      329.0000,     5172.897,     274,       0 ! !END!
! X =      329.5000,     5172.897,     277,       0 ! !END!
! X =      330.0000,     5172.897,     291,       0 ! !END!
! X =      330.5000,     5172.897,     286,       0 ! !END!
! X =      331.0000,     5172.897,     282,       0 ! !END!
! X =      331.5000,     5172.897,     283,       0 ! !END!
! X =      332.0000,     5172.897,     286,       0 ! !END!
! X =      332.5000,     5172.897,     295,       0 ! !END!
! X =      333.0000,     5172.897,     299,       0 ! !END!
! X =      322.0000,     5173.397,     274,       0 ! !END!
! X =      322.5000,     5173.397,     274,       0 ! !END!
! X =      323.0000,     5173.397,     274,       0 ! !END!
! X =      323.5000,     5173.397,     274,       0 ! !END!
! X =      324.0000,     5173.397,     274,       0 ! !END!
! X =      324.5000,     5173.397,     274,       0 ! !END!
! X =      325.0000,     5173.397,     274,       0 ! !END!
! X =      325.5000,     5173.397,     274,       0 ! !END!
! X =      326.0000,     5173.397,     275,       0 ! !END!
! X =      326.5000,     5173.397,     277,       0 ! !END!
! X =      327.0000,     5173.397,     277,       0 ! !END!
! X =      327.5000,     5173.397,     275,       0 ! !END!
! X =      328.0000,     5173.397,     281,       0 ! !END!
! X =      328.5000,     5173.397,     283,       0 ! !END!
! X =      329.0000,     5173.397,     304,       0 ! !END!
! X =      329.5000,     5173.397,     304,       0 ! !END!
! X =      330.0000,     5173.397,     304,       0 ! !END!
! X =      330.5000,     5173.397,     304,       0 ! !END!
! X =      331.0000,     5173.397,     297,       0 ! !END!
! X =      331.5000,     5173.397,     296,       0 ! !END!
! X =      332.0000,     5173.397,     299,       0 ! !END!
! X =      332.5000,     5173.397,     301,       0 ! !END!
! X =      333.0000,     5173.397,     304,       0 ! !END!
! X =      321.0000,     5173.897,     274,       0 ! !END!
! X =      321.5000,     5173.897,     274,       0 ! !END!
! X =      322.0000,     5173.897,     274,       0 ! !END!
! X =      322.5000,     5173.897,     274,       0 ! !END!
! X =      323.0000,     5173.897,     274,       0 ! !END!
! X =      323.5000,     5173.897,     274,       0 ! !END!
! X =      324.0000,     5173.897,     274,       0 ! !END!
! X =      324.5000,     5173.897,     275,       0 ! !END!
! X =      325.0000,     5173.897,     275,       0 ! !END!
! X =      325.5000,     5173.897,     276,       0 ! !END!
! X =      326.0000,     5173.897,     280,       0 ! !END!
! X =      326.5000,     5173.897,     289,       0 ! !END!
! X =      327.0000,     5173.897,     296,       0 ! !END!
! X =      327.5000,     5173.897,     301,       0 ! !END!
! X =      328.0000,     5173.897,     304,       0 ! !END!
! X =      328.5000,     5173.897,     304,       0 ! !END!
! X =      329.0000,     5173.897,     304,       0 ! !END!
! X =      329.5000,     5173.897,     304,       0 ! !END!
! X =      330.0000,     5173.897,     306,       0 ! !END!
! X =      330.5000,     5173.897,     308,       0 ! !END!
! X =      331.0000,     5173.897,     308,       0 ! !END!
! X =      331.5000,     5173.897,     307,       0 ! !END!
! X =      332.0000,     5173.897,     308,       0 ! !END!
! X =      332.5000,     5173.897,     307,       0 ! !END!
! X =      333.0000,     5173.897,     311,       0 ! !END!
! X =      321.0000,     5174.397,     274,       0 ! !END!
! X =      321.5000,     5174.397,     274,       0 ! !END!
! X =      322.0000,     5174.397,     274,       0 ! !END!
! X =      322.5000,     5174.397,     274,       0 ! !END!
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4616 ! X =       323.0000,     5174.397,     277,       0 ! !END!
4617 ! X =       323.5000,     5174.397,     279,       0 ! !END!
4618 ! X =       324.0000,     5174.397,     280,       0 ! !END!
4619 ! X =       324.5000,     5174.397,     281,       0 ! !END!
4620 ! X =       325.0000,     5174.397,     282,       0 ! !END!
4621 ! X =       325.5000,     5174.397,     283,       0 ! !END!
4622 ! X =       326.0000,     5174.397,     288,       0 ! !END!
4623 ! X =       326.5000,     5174.397,     297,       0 ! !END!
4624 ! X =       327.0000,     5174.397,     303,       0 ! !END!
4625 ! X =       327.5000,     5174.397,     304,       0 ! !END!
4626 ! X =       328.0000,     5174.397,     305,       0 ! !END!
4627 ! X =       328.5000,     5174.397,     304,       0 ! !END!
4628 ! X =       329.0000,     5174.397,     304,       0 ! !END!
4629 ! X =       329.5000,     5174.397,     310,       0 ! !END!
4630 ! X =       330.0000,     5174.397,     312,       0 ! !END!
4631 ! X =       330.5000,     5174.397,     315,       0 ! !END!
4632 ! X =       331.0000,     5174.397,     316,       0 ! !END!
4633 ! X =       331.5000,     5174.397,     314,       0 ! !END!
4634 ! X =       332.0000,     5174.397,     315,       0 ! !END!
4635 ! X =       332.5000,     5174.397,     316,       0 ! !END!
4636 ! X =       333.0000,     5174.397,     318,       0 ! !END!
4637 ! X =       321.0000,     5174.897,     274,       0 ! !END!
4638 ! X =       321.5000,     5174.897,     274,       0 ! !END!
4639 ! X =       322.0000,     5174.897,     274,       0 ! !END!
4640 ! X =       322.5000,     5174.897,     274,       0 ! !END!
4641 ! X =       323.0000,     5174.897,     279,       0 ! !END!
4642 ! X =       323.5000,     5174.897,     284,       0 ! !END!
4643 ! X =       324.0000,     5174.897,     286,       0 ! !END!
4644 ! X =       324.5000,     5174.897,     287,       0 ! !END!
4645 ! X =       325.0000,     5174.897,     289,       0 ! !END!
4646 ! X =       325.5000,     5174.897,     292,       0 ! !END!
4647 ! X =       326.0000,     5174.897,     297,       0 ! !END!
4648 ! X =       326.5000,     5174.897,     302,       0 ! !END!
4649 ! X =       327.0000,     5174.897,     304,       0 ! !END!
4650 ! X =       327.5000,     5174.897,     304,       0 ! !END!
4651 ! X =       328.0000,     5174.897,     307,       0 ! !END!
4652 ! X =       328.5000,     5174.897,     308,       0 ! !END!
4653 ! X =       329.0000,     5174.897,     309,       0 ! !END!
4654 ! X =       329.5000,     5174.897,     315,       0 ! !END!
4655 ! X =       330.0000,     5174.897,     318,       0 ! !END!
4656 ! X =       330.5000,     5174.897,     321,       0 ! !END!
4657 ! X =       331.0000,     5174.897,     324,       0 ! !END!
4658 ! X =       331.5000,     5174.897,     323,       0 ! !END!
4659 ! X =       332.0000,     5174.897,     323,       0 ! !END!
4660 ! X =       332.5000,     5174.897,     323,       0 ! !END!
4661 ! X =       333.0000,     5174.897,     324,       0 ! !END!
4662 ! X =       321.0000,     5175.397,     274,       0 ! !END!
4663 ! X =       321.5000,     5175.397,     274,       0 ! !END!
4664 ! X =       322.0000,     5175.397,     274,       0 ! !END!
4665 ! X =       322.5000,     5175.397,     274,       0 ! !END!
4666 ! X =       323.0000,     5175.397,     281,       0 ! !END!
4667 ! X =       323.5000,     5175.397,     288,       0 ! !END!
4668 ! X =       324.0000,     5175.397,     291,       0 ! !END!
4669 ! X =       324.5000,     5175.397,     294,       0 ! !END!
4670 ! X =       325.0000,     5175.397,     296,       0 ! !END!
4671 ! X =       325.5000,     5175.397,     299,       0 ! !END!
4672 ! X =       326.0000,     5175.397,     304,       0 ! !END!
4673 ! X =       326.5000,     5175.397,     305,       0 ! !END!
4674 ! X =       327.0000,     5175.397,     305,       0 ! !END!
4675 ! X =       327.5000,     5175.397,     307,       0 ! !END!
4676 ! X =       328.0000,     5175.397,     314,       0 ! !END!
4677 ! X =       328.5000,     5175.397,     314,       0 ! !END!
4678 ! X =       329.0000,     5175.397,     316,       0 ! !END!
4679 ! X =       329.5000,     5175.397,     320,       0 ! !END!
4680 ! X =       330.0000,     5175.397,     324,       0 ! !END!
4681 ! X =       330.5000,     5175.397,     328,       0 ! !END!
4682 ! X =       331.0000,     5175.397,     332,       0 ! !END!
4683 ! X =       331.5000,     5175.397,     330,       0 ! !END!
4684 ! X =       332.0000,     5175.397,     330,       0 ! !END!
4685 ! X =       332.5000,     5175.397,     331,       0 ! !END!
4686 ! X =       333.0000,     5175.397,     332,       0 ! !END!
4687 ! X =       321.0000,     5175.897,     274,       0 ! !END!
4688 ! X =       321.5000,     5175.897,     274,       0 ! !END!
4689 ! X =       322.0000,     5175.897,     274,       0 ! !END!
4690 ! X =       322.5000,     5175.897,     274,       0 ! !END!
4691 ! X =       323.0000,     5175.897,     279,       0 ! !END!
4692 ! X =       323.5000,     5175.897,     294,       0 ! !END!
4693 ! X =       324.0000,     5175.897,     297,       0 ! !END!
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4694 ! X =       324.5000,     5175.897,     300,       0 ! !END!
4695 ! X =       325.0000,     5175.897,     303,       0 ! !END!
4696 ! X =       325.5000,     5175.897,     306,       0 ! !END!
4697 ! X =       326.0000,     5175.897,     310,       0 ! !END!
4698 ! X =       326.5000,     5175.897,     311,       0 ! !END!
4699 ! X =       327.0000,     5175.897,     313,       0 ! !END!
4700 ! X =       327.5000,     5175.897,     314,       0 ! !END!
4701 ! X =       328.0000,     5175.897,     321,       0 ! !END!
4702 ! X =       328.5000,     5175.897,     321,       0 ! !END!
4703 ! X =       329.0000,     5175.897,     325,       0 ! !END!
4704 ! X =       329.5000,     5175.897,     327,       0 ! !END!
4705 ! X =       330.0000,     5175.897,     330,       0 ! !END!
4706 ! X =       330.5000,     5175.897,     332,       0 ! !END!
4707 ! X =       331.0000,     5175.897,     336,       0 ! !END!
4708 ! X =       331.5000,     5175.897,     338,       0 ! !END!
4709 ! X =       332.0000,     5175.897,     345,       0 ! !END!
4710 ! X =       332.5000,     5175.897,     350,       0 ! !END!
4711 ! X =       333.0000,     5175.897,     353,       0 ! !END!
4712 ! X =       321.0000,     5176.397,     274,       0 ! !END!
4713 ! X =       321.5000,     5176.397,     274,       0 ! !END!
4714 ! X =       322.0000,     5176.397,     274,       0 ! !END!
4715 ! X =       322.5000,     5176.397,     274,       0 ! !END!
4716 ! X =       323.0000,     5176.397,     280,       0 ! !END!
4717 ! X =       323.5000,     5176.397,     298,       0 ! !END!
4718 ! X =       324.0000,     5176.397,     301,       0 ! !END!
4719 ! X =       324.5000,     5176.397,     304,       0 ! !END!
4720 ! X =       325.0000,     5176.397,     304,       0 ! !END!
4721 ! X =       325.5000,     5176.397,     312,       0 ! !END!
4722 ! X =       326.0000,     5176.397,     316,       0 ! !END!
4723 ! X =       326.5000,     5176.397,     318,       0 ! !END!
4724 ! X =       327.0000,     5176.397,     320,       0 ! !END!
4725 ! X =       327.5000,     5176.397,     323,       0 ! !END!
4726 ! X =       328.0000,     5176.397,     328,       0 ! !END!
4727 ! X =       328.5000,     5176.397,     329,       0 ! !END!
4728 ! X =       329.0000,     5176.397,     332,       0 ! !END!
4729 ! X =       329.5000,     5176.397,     333,       0 ! !END!
4730 ! X =       330.0000,     5176.397,     335,       0 ! !END!
4731 ! X =       330.5000,     5176.397,     334,       0 ! !END!
4732 ! X =       331.0000,     5176.397,     343,       0 ! !END!
4733 ! X =       331.5000,     5176.397,     354,       0 ! !END!
4734 ! X =       332.0000,     5176.397,     360,       0 ! !END!
4735 ! X =       332.5000,     5176.397,     365,       0 ! !END!
4736 ! X =       333.0000,     5176.397,     365,       0 ! !END!
4737 ! X =       321.0000,     5176.897,     274,       0 ! !END!
4738 ! X =       321.5000,     5176.897,     274,       0 ! !END!
4739 ! X =       322.0000,     5176.897,     274,       0 ! !END!
4740 ! X =       322.5000,     5176.897,     274,       0 ! !END!
4741 ! X =       323.0000,     5176.897,     280,       0 ! !END!
4742 ! X =       323.5000,     5176.897,     302,       0 ! !END!
4743 ! X =       324.0000,     5176.897,     304,       0 ! !END!
4744 ! X =       324.5000,     5176.897,     304,       0 ! !END!
4745 ! X =       325.0000,     5176.897,     304,       0 ! !END!
4746 ! X =       325.5000,     5176.897,     317,       0 ! !END!
4747 ! X =       326.0000,     5176.897,     321,       0 ! !END!
4748 ! X =       326.5000,     5176.897,     325,       0 ! !END!
4749 ! X =       327.0000,     5176.897,     328,       0 ! !END!
4750 ! X =       327.5000,     5176.897,     333,       0 ! !END!
4751 ! X =       328.0000,     5176.897,     335,       0 ! !END!
4752 ! X =       328.5000,     5176.897,     336,       0 ! !END!
4753 ! X =       329.0000,     5176.897,     339,       0 ! !END!
4754 ! X =       329.5000,     5176.897,     345,       0 ! !END!
4755 ! X =       330.0000,     5176.897,     349,       0 ! !END!
4756 ! X =       330.5000,     5176.897,     348,       0 ! !END!
4757 ! X =       331.0000,     5176.897,     341,       0 ! !END!
4758 ! X =       331.5000,     5176.897,     365,       0 ! !END!
4759 ! X =       332.0000,     5176.897,     365,       0 ! !END!
4760 ! X =       332.5000,     5176.897,     365,       0 ! !END!
4761 ! X =       333.0000,     5176.897,     364,       0 ! !END!
4762 ! X =       321.0000,     5177.397,     272,       0 ! !END!
4763 ! X =       321.5000,     5177.397,     269,       0 ! !END!
4764 ! X =       322.0000,     5177.397,     272,       0 ! !END!
4765 ! X =       322.5000,     5177.397,     274,       0 ! !END!
4766 ! X =       323.0000,     5177.397,     277,       0 ! !END!
4767 ! X =       323.5000,     5177.397,     304,       0 ! !END!
4768 ! X =       324.0000,     5177.397,     304,       0 ! !END!
4769 ! X =       324.5000,     5177.397,     304,       0 ! !END!
4770 ! X =       325.0000,     5177.397,     304,       0 ! !END!
4771 ! X =       325.5000,     5177.397,     321,       0 ! !END!
```

```
4772 ! X =       326.0000,     5177.397,     328,       0 ! !END!
4773 ! X =       326.5000,     5177.397,     331,       0 ! !END!
4774 ! X =       327.0000,     5177.397,     334,       0 ! !END!
4775 ! X =       327.5000,     5177.397,     341,       0 ! !END!
4776 ! X =       328.0000,     5177.397,     346,       0 ! !END!
4777 ! X =       328.5000,     5177.397,     346,       0 ! !END!
4778 ! X =       329.0000,     5177.397,     348,       0 ! !END!
4779 ! X =       329.5000,     5177.397,     354,       0 ! !END!
4780 ! X =       330.0000,     5177.397,     361,       0 ! !END!
4781 ! X =       330.5000,     5177.397,     365,       0 ! !END!
4782 ! X =       331.0000,     5177.397,     359,       0 ! !END!
4783 ! X =       331.5000,     5177.397,     359,       0 ! !END!
4784 ! X =       332.0000,     5177.397,     362,       0 ! !END!
4785 ! X =       332.5000,     5177.397,     346,       0 ! !END!
4786 ! X =       333.0000,     5177.397,     299,       0 ! !END!
4787 ! X =       320.5000,     5177.897,     244,       0 ! !END!
4788 ! X =       321.0000,     5177.897,     244,       0 ! !END!
4789 ! X =       321.5000,     5177.897,     244,       0 ! !END!
4790 ! X =       322.0000,     5177.897,     247,       0 ! !END!
4791 ! X =       322.5000,     5177.897,     266,       0 ! !END!
4792 ! X =       323.0000,     5177.897,     272,       0 ! !END!
4793 ! X =       323.5000,     5177.897,     274,       0 ! !END!
4794 ! X =       324.0000,     5177.897,     277,       0 ! !END!
4795 ! X =       324.5000,     5177.897,     303,       0 ! !END!
4796 ! X =       325.0000,     5177.897,     304,       0 ! !END!
4797 ! X =       325.5000,     5177.897,     323,       0 ! !END!
4798 ! X =       326.0000,     5177.897,     333,       0 ! !END!
4799 ! X =       326.5000,     5177.897,     338,       0 ! !END!
4800 ! X =       327.0000,     5177.897,     344,       0 ! !END!
4801 ! X =       327.5000,     5177.897,     351,       0 ! !END!
4802 ! X =       328.0000,     5177.897,     357,       0 ! !END!
4803 ! X =       328.5000,     5177.897,     355,       0 ! !END!
4804 ! X =       329.0000,     5177.897,     356,       0 ! !END!
4805 ! X =       329.5000,     5177.897,     359,       0 ! !END!
4806 ! X =       330.0000,     5177.897,     363,       0 ! !END!
4807 ! X =       330.5000,     5177.897,     370,       0 ! !END!
4808 ! X =       331.0000,     5177.897,     367,       0 ! !END!
4809 ! X =       331.5000,     5177.897,     340,       0 ! !END!
4810 ! X =       332.0000,     5177.897,     329,       0 ! !END!
4811 ! X =       332.5000,     5177.897,     301,       0 ! !END!
4812 ! X =       333.0000,     5177.897,     274,       0 ! !END!
4813 ! X =       320.5000,     5178.397,     244,       0 ! !END!
4814 ! X =       321.0000,     5178.397,     244,       0 ! !END!
4815 ! X =       321.5000,     5178.397,     250,       0 ! !END!
4816 ! X =       322.0000,     5178.397,     259,       0 ! !END!
4817 ! X =       322.5000,     5178.397,     270,       0 ! !END!
4818 ! X =       323.0000,     5178.397,     274,       0 ! !END!
4819 ! X =       323.5000,     5178.397,     282,       0 ! !END!
4820 ! X =       324.0000,     5178.397,     291,       0 ! !END!
4821 ! X =       324.5000,     5178.397,     304,       0 ! !END!
4822 ! X =       325.0000,     5178.397,     314,       0 ! !END!
4823 ! X =       325.5000,     5178.397,     329,       0 ! !END!
4824 ! X =       326.0000,     5178.397,     341,       0 ! !END!
4825 ! X =       326.5000,     5178.397,     349,       0 ! !END!
4826 ! X =       327.0000,     5178.397,     355,       0 ! !END!
4827 ! X =       327.5000,     5178.397,     360,       0 ! !END!
4828 ! X =       328.0000,     5178.397,     366,       0 ! !END!
4829 ! X =       328.5000,     5178.397,     365,       0 ! !END!
4830 ! X =       329.0000,     5178.397,     365,       0 ! !END!
4831 ! X =       329.5000,     5178.397,     363,       0 ! !END!
4832 ! X =       330.0000,     5178.397,     365,       0 ! !END!
4833 ! X =       330.5000,     5178.397,     375,       0 ! !END!
4834 ! X =       331.0000,     5178.397,     367,       0 ! !END!
4835 ! X =       331.5000,     5178.397,     322,       0 ! !END!
4836 ! X =       332.0000,     5178.397,     298,       0 ! !END!
4837 ! X =       332.5000,     5178.397,     274,       0 ! !END!
4838 ! X =       333.0000,     5178.397,     274,       0 ! !END!
4839 ! X =       320.5000,     5178.897,     244,       0 ! !END!
4840 ! X =       321.0000,     5178.897,     251,       0 ! !END!
4841 ! X =       321.5000,     5178.897,     263,       0 ! !END!
4842 ! X =       322.0000,     5178.897,     273,       0 ! !END!
4843 ! X =       322.5000,     5178.897,     285,       0 ! !END!
4844 ! X =       323.0000,     5178.897,     294,       0 ! !END!
4845 ! X =       323.5000,     5178.897,     303,       0 ! !END!
4846 ! X =       324.0000,     5178.897,     315,       0 ! !END!
4847 ! X =       324.5000,     5178.897,     327,       0 ! !END!
4848 ! X =       325.0000,     5178.897,     334,       0 ! !END!
4849 ! X =       325.5000,     5178.897,     338,       0 ! !END!
```

```
4850 ! X =       326.0000,     5178.897,     347,       0 ! !END!
4851 ! X =       326.5000,     5178.897,     356,       0 ! !END!
4852 ! X =       327.0000,     5178.897,     364,       0 ! !END!
4853 ! X =       327.5000,     5178.897,     371,       0 ! !END!
4854 ! X =       328.0000,     5178.897,     372,       0 ! !END!
4855 ! X =       328.5000,     5178.897,     369,       0 ! !END!
4856 ! X =       329.0000,     5178.897,     366,       0 ! !END!
4857 ! X =       329.5000,     5178.897,     365,       0 ! !END!
4858 ! X =       330.0000,     5178.897,     365,       0 ! !END!
4859 ! X =       330.5000,     5178.897,     367,       0 ! !END!
4860 ! X =       331.0000,     5178.897,     341,       0 ! !END!
4861 ! X =       331.5000,     5178.897,     296,       0 ! !END!
4862 ! X =       332.0000,     5178.897,     274,       0 ! !END!
4863 ! X =       332.5000,     5178.897,     274,       0 ! !END!
4864 ! X =       333.0000,     5178.897,     274,       0 ! !END!
4865 ! X =       320.5000,     5179.397,     257,       0 ! !END!
4866 ! X =       321.0000,     5179.397,     269,       0 ! !END!
4867 ! X =       321.5000,     5179.397,     278,       0 ! !END!
4868 ! X =       322.0000,     5179.397,     289,       0 ! !END!
4869 ! X =       322.5000,     5179.397,     303,       0 ! !END!
4870 ! X =       323.0000,     5179.397,     313,       0 ! !END!
4871 ! X =       323.5000,     5179.397,     327,       0 ! !END!
4872 ! X =       324.0000,     5179.397,     340,       0 ! !END!
4873 ! X =       324.5000,     5179.397,     342,       0 ! !END!
4874 ! X =       325.0000,     5179.397,     344,       0 ! !END!
4875 ! X =       325.5000,     5179.397,     347,       0 ! !END!
4876 ! X =       326.0000,     5179.397,     353,       0 ! !END!
4877 ! X =       326.5000,     5179.397,     361,       0 ! !END!
4878 ! X =       327.0000,     5179.397,     379,       0 ! !END!
4879 ! X =       327.5000,     5179.397,     390,       0 ! !END!
4880 ! X =       328.0000,     5179.397,     385,       0 ! !END!
4881 ! X =       328.5000,     5179.397,     374,       0 ! !END!
4882 ! X =       329.0000,     5179.397,     366,       0 ! !END!
4883 ! X =       329.5000,     5179.397,     365,       0 ! !END!
4884 ! X =       330.0000,     5179.397,     365,       0 ! !END!
4885 ! X =       330.5000,     5179.397,     365,       0 ! !END!
4886 ! X =       331.0000,     5179.397,     299,       0 ! !END!
4887 ! X =       331.5000,     5179.397,     274,       0 ! !END!
4888 ! X =       332.0000,     5179.397,     274,       0 ! !END!
4889 ! X =       332.5000,     5179.397,     274,       0 ! !END!
4890 ! X =       333.0000,     5179.397,     274,       0 ! !END!
```

---

a
Data for each receptor are treated as a separate input subgroup and therefore must end with an input group terminator.

b
Receptor height above ground is optional. If no value is entered, the receptor is placed on the ground.

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Appendix E

Example CALPOST Input File

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Appendix E
Example CALPOST Input File

```
WTP Air Dispersion Modeling - Vapor Concentration
2005 Met Data. Site Wide Receptors (All Grids)
Effluent Management Facility (EMF)
---------------- Run title (3 lines) ----------------------------------------

                    CALPOST MODEL CONTROL FILE
                    --------------------------

------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names
--------------

Input Files
-----------

File                       Default File Name
----                       -----------------
Conc/Dep Flux File         MODEL.DAT          ! MODDAT = ..\CONC.DAT   !
Relative Humidity File     VISB.DAT           * VISDAT = ..\VISB.DAT  *
Background Data File       BACK.DAT           *BACKDAT =   *
Transmissometer or         VSRN.DAT           *VSRDAT =   *
Nephelometer Data File      or
DATSAV Weather Data File    or
Prognostic Weather  File

Single-point Met File      SURFACE.DAT        * MET1DAT =   *
 (Used ONLY to identify CALM hours for plume model
  output averaging when MCALMPRO option is used)


Output Files
------------

File                       Default File Name
----                       -----------------
List File                  CALPOST.LST        ! PSTLST = CalPost.lst  !

Pathname for Timeseries Files   (blank)       * TSPATH =   *
(activate with exclamation points only if
providing NON-BLANK character string)

Pathname for Plot Files   (blank)             * PLPATH =   *
(activate with exclamation points only if
 providing NON-BLANK character string)

User Character String (U) to augment default filenames
(activate with exclamation points only if
 providing NON-BLANK character string)

Timeseries          TSERIES_ASPEC_ttHR_CONC_TSUNAM.DAT
Peak Value          PEAKVAL_ASPEC_ttHR_CONC_TSUNAM.DAT

                                              * TSUNAM =   *

Top Nth Rank Plot   RANK(ALL)_ASPEC_ttHR_CONC_TUNAM.DAT
                 or RANK(ii)_ASPEC_ttHR_CONC_TUNAM.GRD

                                              ! TUNAM = ECV !
```

```
Exceedance Plot      EXCEED_ASPEC_ttHR_CONC_XUNAM.DAT
                 or  EXCEED_ASPEC_ttHR_CONC_XUNAM.GRD

                                              * XUNAM =   *

Echo Plot
(Specific Days)
           yyyy_Mmm_Ddd_hhmm(UTCszzzz)_L00_ASPEC_ttHR_CONC.DAT
     or    yyyy_Mmm_Ddd_hhmm(UTCszzzz)_L00_ASPEC_ttHR_CONC.GRD


Visibility Plot      DAILY_VISIB_VUNAM.DAT   * VUNAM =    *
(Daily Peak Summary)



Auxiliary Output Files
----------------------

File                       Default File Name
----                       -----------------
Visibility Change          DELVIS.DAT           * DVISDAT =   *

-------------------------------------------------------------------------------
All file names will be converted to lower case if LCFILES = T
Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
         T = lower case      ! LCFILES = T !
         F = UPPER CASE
NOTE: (1) file/path names can be up to 132 characters in length
NOTE: (2) Filenames for ALL PLOT and TIMESERIES FILES are constructed
          using a template that includes a pathname, user-supplied
          character(s), and context-specific strings, where
             ASPEC = Species Name
              CONC = CONC Or WFLX Or DFLX Or TFLX
                tt = Averaging Period (e.g. 03)
                ii = Rank (e.g. 02)
                hh = Hour(ending) in LST
             szzzz = LST time zone shift (EST is -0500)
              yyyy = Year(LST)
                mm = Month(LST)
                dd = day of month (LST)
          are determined internally based on selections made below.
          If a path or user-supplied character(s) are supplied, each
          must contain at least 1 non-blank character.

!END!
-------------------------------------------------------------------------------

INPUT GROUP: 1 -- General run control parameters
--------------

     Option to run all periods found
     in the met. file(s)  (METRUN)        Default: 0   ! METRUN =   1  !

         METRUN = 0 - Run period explicitly defined below
         METRUN = 1 - Run all periods in CALPUFF data file(s)

     Starting date:    Year   (ISYR)  --    No default   ! ISYR  =  1990  !
                       Month  (ISMO)  --    No default   ! ISMO  =  0  !
                       Day    (ISDY)  --    No default   ! ISDY  =  0  !
     Starting time:    Hour   (ISHR)  --    No default   ! ISHR  =  0  !
                       Minute (ISMIN) --    No default   ! ISMIN =  0  !
                       Second (ISSEC) --    No default   ! ISSEC =  0  !

     Ending date:      Year   (IEYR)  --    No default   ! IEYR  =  0  !
```

```
                    Month  (IEMO)  --    No default   ! IEMO  =  0  !
                    Day    (IEDY)  --    No default   ! IEDY  =  0  !
     Ending time:   Hour   (IEHR)  --    No default   ! IEHR  =  0  !
                    Minute (IEMIN) --    No default   ! IEMIN =  0  !
                    Second (IESEC) --    No default   ! IESEC =  0  !


     (These are only used if METRUN = 0)

     All times are in the base time zone of the CALPUFF simulation.
     CALPUFF Dataset Version 2.1 contains the zone, but earlier versions
     do not, and the zone must be specified here.  The zone is the
     number of hours that must be ADDED to the time to obtain UTC (or GMT).
     Identify the Base Time Zone for the CALPUFF simulation
                            (BTZONE) -- No default   ! BTZONE = 8 !

     Process every period of data?
                              (NREP) -- Default: 1   ! NREP  =  1  !
      (1 = every period processed,
       2 = every 2nd period processed,
       5 = every 5th period processed, etc.)

Species & Concentration/Deposition Information
----------------------------------------------

      Species to process (ASPEC)       -- No default   ! ASPEC =  EMFV   !
      (ASPEC = VISIB for visibility processing)

      Layer/deposition code (ILAYER)   -- Default: 1   ! ILAYER =  1  !
        '1'  for CALPUFF concentrations,
        '-1' for dry deposition fluxes,
        '-2' for wet deposition fluxes,
        '-3' for wet+dry deposition fluxes.

      Scaling factors of the form:     -- Defaults:    ! A =  0  !
            X(new) = X(old) * A + B         A = 0.0    ! B =  0  !
        (NOT applied if A = B = 0.0)        B = 0.0

      Add Hourly Background Concentrations/Fluxes?
                            (LBACK)  -- Default: F   ! LBACK =  F !

      Source of NO2 when ASPEC=NO2 (above) or LVNO2=T (Group 2) may be
      from CALPUFF NO2 concentrations OR from a fraction of CALPUFF NOx
      concentrations.  Specify the fraction of NOx that is treated as NO2
      either as a constant or as a table of fractions that depend on the
      magnitude of the NOx concentration:
                           (NO2CALC) -- Default: 1   ! NO2CALC =   0  !
         0 =  Use NO2 directly (NO2 must be in file)
         1 =  Specify a single NO2/NOx ratio (RNO2NOX)
         2 =  Specify a table NO2/NOx ratios (TNO2NOX)
              (NOTE: Scaling Factors must NOT be used with NO2CALC=2)

      Single NO2/NOx ratio (0.0 to 1.0) for treating some
      or all NOx as NO2, where [NO2] = [NOX] * RNO2NOX
      (used only if NO2CALC = 1)
                           (RNO2NOX) -- Default: 1.0 * RNO2NOX = 1.0 *

      Table of NO2/NOx ratios that vary with NOx concentration.
      Provide 14 NOx concentrations (ug/m**3) and the corresponding
      NO2/NOx ratio, with NOx increasing in magnitude.  The ratio used
      for a particular NOx concentration is interpolated from the values
      provided in the table.  The ratio for the smallest tabulated NOx
      concentration (the first) is used for all NOx concentrations less
      than the smallest tabulated value, and the ratio for the largest
      tabulated NOx concentration (the last) is used for all NOx
```

```
      concentrations greater than the largest tabulated value.
      (used only if NO2CALC = 2)

       NOx concentration(ug / m3)
                              (CNOX)    -- No default
         * CNOX = 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0,
                  8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 14.0 *

       NO2/NOx ratio for each NOx concentration:
                              (TNO2NOX) -- No default
         * TNO2NOX = 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
                     1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0 *


Source Information
------------------

  Option to process source contributions:
         0 =  Process only total reported contributions
         1 =  Sum all individual source contributions and process
         2 =  Run in TRACEBACK mode to identify source
              contributions at a SINGLE receptor
                              (MSOURCE) -- Default: 0   ! MSOURCE =  0  !

Plume Model Output Processing Options
-------------------------------------

  Output from models other than CALPUFF and CALGRID can be written in
  the CONC.DAT format and processed by CALPOST.  Plume models such as
  AERMOD typically do not treat CALM hours, and do not include such hours
  in multiple-hour averages, with specific rules about how many calm hours
  can be removed from an average.  This treatment is known as CALM
  PROCESSING.  Calm periods are identified from wind speeds in the
  meteorological data file for the application, which must be identified
  in Input Group 0 as the single-point meteorological data file MET1DAT.
         0 =  Option is not used for CALPUFF/CALGRID output files
         1 =  Apply CALM processing procedures to multiple-hour averages
                            (MCALMPRO) -- Default: 0   ! MCALMPRO =  0  !

  Format of Single-point Met File
         1 =  AERMOD/AERMET SURFACE file
                             (MET1FMT) -- Default: 1   ! MET1FMT =  1  !

Receptor information
--------------------

  Gridded receptors processed?    (LG) -- Default: F   ! LG  = F  !
  Discrete receptors processed?   (LD) -- Default: F   ! LD  = T  !
  CTSG Complex terrain receptors processed?
                                 (LCT) -- Default: F   ! LCT = F  !

--Report results by DISCRETE receptor RING?
  (only used when LD = T)     (LDRING) -- Default: F   ! LDRING = F  !

--Select range of DISCRETE receptors (only used when LD = T):

  Select ALL DISCRETE receptors by setting NDRECP flag to -1;
                                 OR
  Select SPECIFIC DISCRETE receptors by entering a flag (0,1) for each
     0 = discrete receptor not processed
     1 = discrete receptor processed
  using repeated value notation to select blocks of receptors:
     23*1, 15*0, 12*1
  Flag for all receptors after the last one assigned is set to 0
  (NDRECP) -- Default: -1
```

```
                                                  ! NDRECP =  -1  !

--Select range of GRIDDED receptors (only used when LG = T):

       X index of LL corner (IBGRID) -- Default: -1     ! IBGRID = -1  !
           (-1 OR 1 <= IBGRID <= NX)

       Y index of LL corner (JBGRID) -- Default: -1     ! JBGRID = -1  !
           (-1 OR 1 <= JBGRID <= NY)

       X index of UR corner (IEGRID) -- Default: -1     ! IEGRID = -1  !
           (-1 OR 1 <= IEGRID <= NX)

       Y index of UR corner (JEGRID) -- Default: -1     ! JEGRID = -1  !
           (-1 OR 1 <= JEGRID <= NY)

  Note: Entire grid is processed if IBGRID=JBGRID=IEGRID=JEGRID=-1


--Specific gridded receptors can also be excluded from CALPOST
  processing by filling a processing grid array with 0s and 1s.  If the
  processing flag for receptor index (i,j) is 1 (ON), that receptor
  will be processed if it lies within the range delineated by IBGRID,
  JBGRID,IEGRID,JEGRID and if LG=T. If it is 0 (OFF), it will not be
  processed in the run.  By default, all array values are set to 1 (ON).

  Number of gridded receptor rows provided in Subgroup (1a) to
  identify specific gridded receptors to process
                           (NGONOFF) -- Default: 0      ! NGONOFF =  0  !

!END!


--------------
Subgroup (1a) -- Specific gridded receptors included/excluded
--------------

    Specific gridded receptors are excluded from CALPOST processing
    by filling a processing grid array with 0s and 1s.  A total of
    NGONOFF lines are read here.  Each line corresponds to one 'row'
    in the sampling grid, starting with the NORTHERNMOST row that
    contains receptors that you wish to exclude, and finishing with
    row 1 to the SOUTH (no intervening rows may be skipped).  Within
    a row, each receptor position is assigned either a 0 or 1,
    starting with the westernmost receptor.
       0 = gridded receptor not processed
       1 = gridded receptor processed

    Repeated value notation may be used to select blocks of receptors:
       23*1, 15*0, 12*1

    Because all values are initially set to 1, any receptors north of
    the first row entered, or east of the last value provided in a row,
    remain ON.

    (NGXRECP) -- Default: 1


-------------------------------------------------------------------------------

INPUT GROUP: 2 -- Visibility Parameters (ASPEC = VISIB)
--------------

    Test visibility options specified to see
```

```
    if they conform to FLAG 2010 configuration?
                         (MVISCHECK) -- Default: 1   ! MVISCHECK =  0 !
         0 =  NO checks are made
         1 =  Technical options must conform to FLAG 2010 visibility guidance
                ASPEC = VISIB
                LVNO2 = T
                NO2CALC = 1
                RNO2NOX = 1.0
                MVISBK = 8
                M8_MODE = 5

    Some of the data entered for use with the FLAG 2010 configuration
    are specific to the Class I area being evaluated. These values can
    be checked within the CALPOST user interface when the name of the
    Class I area is provided.

    Name of Class I Area (used for QA purposes only)
                           (AREANAME) -- Default: User  * AREANAME =  USER *
    Particle growth curve f(RH) for hygroscopic species
                              (MFRH) -- Default: 2   ! MFRH   =  2  !

         1 =  IWAQM (1998) f(RH) curve (originally used with MVISBK=1)
         2 =  FLAG (2000) f(RH) tabulation
         3 =  EPA (2003) f(RH) tabulation
         4 =  IMPROVE (2006) f(RH) tabulations for sea salt, and for small and
              large SULFATE and NITRATE particles;
              Used in Visibility Method 8 (MVISBK = 8 with M8_MODE = 1, 2, or 3)

    Maximum relative humidity (%) used in particle growth curve
                             (RHMAX) -- Default: 98   ! RHMAX  = 98  !

    Modeled species to be included in computing the light extinction
     Include SULFATE?          (LVSO4) -- Default: T   ! LVSO4  = T  !
     Include NITRATE?          (LVNO3) -- Default: T   ! LVNO3  = T  !
     Include ORGANIC CARBON?   (LVOC)  -- Default: T   ! LVOC   = F  !
     Include COARSE PARTICLES? (LVPMC) -- Default: T   ! LVPMC  = F  !
     Include FINE PARTICLES?   (LVPMF) -- Default: T   ! LVPMF  = F  !
     Include ELEMENTAL CARBON? (LVEC)  -- Default: T   ! LVEC   = F  !
     Include NO2 absorption?   (LVNO2) -- Default: F   ! LVNO2  = F  !

    And, when ranking for TOP-N, TOP-50, and Exceedance tables,
     Include BACKGROUND?       (LVBK)  -- Default: T   ! LVBK   = T  !

    Species name used for particulates in MODEL.DAT file
                   COARSE    (SPECPMC) -- Default: PMC * SPECPMC = PMC  *
                   FINE      (SPECPMF) -- Default: PMF * SPECPMF = PMF  *

Extinction Efficiency (1/Mm per ug/m**3)
----------------------------------------
    MODELED particulate species:
               PM  COARSE      (EEPMC) -- Default: 0.6 ! EEPMC  = 0.6 !
               PM  FINE        (EEPMF) -- Default: 1.0 ! EEPMF  = 1.0 !
    BACKGROUND particulate species:
               PM  COARSE    (EEPMCBK) -- Default: 0.6 ! EEPMCBK = 0.6 !
    Other species:
              AMMONIUM SULFATE (EESO4) -- Default: 3.0 ! EESO4  = 3. !
              AMMONIUM NITRATE (EENO3) -- Default: 3.0 ! EENO3  = 3. !
              ORGANIC CARBON   (EEOC)  -- Default: 4.0 ! EEOC   = 4. !
              SOIL             (EESOIL)-- Default: 1.0 ! EESOIL = 1. !
              ELEMENTAL CARBON (EEEC)  -- Default: 10. ! EEEC   = 10. !
              NO2 GAS          (EENO2) -- Default: .1755 ! EENO2  = 0.1755 !
    Visibility Method 8:
              AMMONIUM SULFATE (EESO4S)   Set Internally (small)
              AMMONIUM SULFATE (EESO4L)   Set Internally (large)
              AMMONIUM NITRATE (EENO3S)   Set Internally (small)
```

```
              AMMONIUM NITRATE (EENO3L)   Set Internally (large)
              ORGANIC CARBON   (EEOCS)    Set Internally (small)
              ORGANIC CARBON   (EEOCL)    Set Internally (large)
              SEA SALT         (EESALT)   Set Internally

Background Extinction Computation
---------------------------------

    Method used for the 24h-average of percent change of light extinction:
    Hourly ratio of source light extinction / background light extinction
    is averaged?               (LAVER) -- Default: F   ! LAVER = F  !


    Method used for background light extinction
                             (MVISBK) -- Default: 8   ! MVISBK =  2  !
                                         FLAG (2008)

         1 =  Supply single light extinction and hygroscopic fraction
              - Hourly F(RH) adjustment applied to hygroscopic background
                and modeled sulfate and nitrate
         2 =  Background extinction from speciated PM concentrations (A)
              - Hourly F(RH) adjustment applied to observed and modeled sulfate
                and nitrate
              - F(RH) factor is capped at F(RHMAX)
         3 =  Background extinction from speciated PM concentrations (B)
              - Hourly F(RH) adjustment applied to observed and modeled sulfate
                and nitrate
              - Receptor-hour excluded if RH>RHMAX
              - Receptor-day excluded if fewer than 6 valid receptor-hours
         4 =  Read hourly transmissometer background extinction measurements
              - Hourly F(RH) adjustment applied to modeled sulfate and nitrate
              - Hour excluded if measurement invalid (missing, interference,
                or large RH)
              - Receptor-hour excluded if RH>RHMAX
              - Receptor-day excluded if fewer than 6 valid receptor-hours
         5 =  Read hourly nephelometer background extinction measurements
              - Rayleigh extinction value (BEXTRAY) added to measurement
              - Hourly F(RH) adjustment applied to modeled sulfate and nitrate
              - Hour excluded if measurement invalid (missing, interference,
                or large RH)
              - Receptor-hour excluded if RH>RHMAX
              - Receptor-day excluded if fewer than 6 valid receptor-hours
         6 =  Background extinction from speciated PM concentrations
              - FLAG (2000) monthly RH adjustment factor applied to observed and
                and modeled sulfate and nitrate
         7 =  Use observed weather or prognostic weather information for
              background extinction during weather events; otherwise, use Method
2
              - Hourly F(RH) adjustment applied to modeled sulfate and nitrate
              - F(RH) factor is capped at F(RHMAX)
              - During observed weather events, compute Bext from visual range
                if using an observed weather data file, or
              - During prognostic weather events, use Bext from the prognostic
                weather file
              - Use Method 2 for hours without a weather event
         8 =  Background extinction from speciated PM concentrations using
              the IMPROVE (2006) variable extinction efficiency formulation
              (MFRH must be set to 4)
              - Split between small and large particle concentrations of
                SULFATES, NITRATES, and ORGANICS is a function of concentration
                and different extinction efficiencies are used for each
              - Source-induced change in visibility includes the increase in
                extinction of the background aerosol due to the change in the
                extinction efficiency that now depends on total concentration.
              - Fsmall(RH) and Flarge(RH) adjustments for small and large
```

```
            particles are applied to observed and modeled sulfate and
            nitrate concentrations
          - Fsalt(RH) adjustment for sea salt is applied to background
            sea salt concentrations
          - F(RH) factors are capped at F(RHMAX)
          - RH for Fsmall(RH), Flarge(RH), and Fsalt(RH) may be obtained
            from hourly data as in Method 2 or from the FLAG monthly RH
            adjustment factor used for Method 6 where EPA F(RH) tabulation
            is used to infer RH, or monthly Fsmall, Flarge, and Fsalt RH
            adjustment factors can be directly entered.
            Furthermore, a monthly RH factor may be applied to either hourly
            concentrations or daily concentrations to obtain the 24-hour
            extinction.
            These choices are made using the M8_MODE selection.

Additional inputs used for MVISBK = 1:
--------------------------------------
 Background light extinction (1/Mm)
                          (BEXTBK) -- No default   * BEXTBK = 12 *
 Percentage of particles affected by relative humidity
                          (RHFRAC) -- No default   * RHFRAC = 10 *

Additional inputs used for MVISBK = 6,8:
----------------------------------------
 Extinction coefficients for hygroscopic species (modeled and
 background) are computed using a monthly RH adjustment factor
 in place of an hourly RH factor (VISB.DAT file is NOT needed).
 Enter the 12 monthly factors here (RHFAC).  Month 1 is January.

 (RHFAC)  -- No default     ! RHFAC = 0.0, 0.0, 0.0, 0.0,
                                      0.0, 0.0, 0.0, 0.0,
                                      0.0, 0.0, 0.0, 0.0 !

Additional inputs used for MVISBK = 7:
--------------------------------------
 The weather data file (DATSAV abbreviated space-delimited) that
 is identified as VSRN.DAT may contain data for more than one
 station.  Identify the stations that are needed in the order in
 which they will be used to obtain valid weather and visual range.
 The first station that contains valid data for an hour will be
 used.  Enter up to MXWSTA (set in PARAMS file) integer station IDs
 of up to 6 digits each as variable IDWSTA, and enter the corresponding
 time zone for each, as variable TZONE (= UTC-LST).

 A prognostic weather data file with Bext for weather events may be used
 in place of the observed weather file.  Identify this as the VSRN.DAT
 file and use a station ID of IDWSTA = 999999, and TZONE = 0.

 NOTE:  TZONE identifies the time zone used in the dataset.  The
        DATSAV abbreviated space-delimited data usually are prepared
        with UTC time rather than local time, so TZONE is typically
        set to zero.

 (IDWSTA)   -- No default   * IDWSTA = 000000 *
 (TZONE)    -- No default   * TZONE =      0. *

Additional inputs used for MVISBK = 2,3,6,7,8:
----------------------------------------------
 Background extinction coefficients are computed from monthly
 CONCENTRATIONS of ammonium sulfate (BKSO4), ammonium nitrate (BKNO3),
 coarse particulates (BKPMC), organic carbon (BKOC), soil (BKSOIL), and
 elemental carbon (BKEC).  Month 1 is January.
 (ug/m**3)

 (BKSO4)  -- No default     ! BKSO4 = 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 !
```

```
 (BKNO3)  -- No default     ! BKNO3 = 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 !
 (BKPMC)  -- No default     ! BKPMC = 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 !
 (BKOC)   -- No default     ! BKOC  = 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 !
 (BKSOIL) -- No default     ! BKSOIL= 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 !
 (BKEC)   -- No default     ! BKEC  = 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 !

Additional inputs used for MVISBK = 8:
--------------------------------------
 Extinction coefficients for hygroscopic species (modeled and
 background) may be computed using hourly RH values and hourly
 modeled concentrations, or using monthly RH values inferred from
 the RHFAC adjustment factors and either hourly or daily modeled
 concentrations, or using monthly RHFSML, RHFLRG, and RHFSEA adjustment
 factors and either hourly or daily modeled concentrations.

 (M8_MODE) -- Default: 5     * M8_MODE=  5   *
              FLAG (2010)

      1 = Use hourly RH values from VISB.DAT file with hourly
          modeled and monthly background concentrations.
      2 = Use monthly RH from monthly RHFAC and EPA (2003) f(RH) tabulation
          with hourly modeled and monthly background concentrations.
          (VISB.DAT file is NOT needed).
      3 = Use monthly RH from monthly RHFAC with EPA (2003) f(RH) tabulation
          with daily modeled and monthly background concentrations.
          (VISB.DAT file is NOT needed).
      4 = Use monthly RHFSML, RHFLRG, and RHFSEA with hourly modeled
          and monthly background concentrations.
          (VISB.DAT file is NOT needed).
      5 = Use monthly RHFSML, RHFLRG, and RHFSEA with daily modeled
          and monthly background concentrations.
          (VISB.DAT file is NOT needed).

 Background extinction coefficients are computed from monthly
 CONCENTRATIONS of sea salt (BKSALT).  Month 1 is January.
 (ug/m**3)

 (BKSALT) -- No default     ! BKSALT= 0, 0, 0, 0,
                                      0, 0, 0, 0,
                                      0, 0, 0, 0 !

 Extinction coefficients for hygroscopic species (modeled and
 background) can be computed using monthly RH adjustment factors
 in place of an hourly RH factor (VISB.DAT file is NOT needed).
 Enter the 12 monthly factors here (RHFSML,RHFLRG,RHFSEA).
 Month 1 is January.  (Used if M8_MODE = 4 or 5)

 Small ammonium sulfate and ammonium nitrate particle sizes
 (RHFSML) -- No default     ! RHFSML= 0, 0, 0, 0,
                                      0, 0, 0, 0,
                                      0, 0, 0, 0 !

 Large ammonium sulfate and ammonium nitrate particle sizes
 (RHFLRG) -- No default     ! RHFLRG= 0, 0, 0, 0,
                                      0, 0, 0, 0,
                                      0, 0, 0, 0 !

 Sea salt particles
 (RHFSEA) -- No default     ! RHFSEA= 0, 0, 0, 0,
                                      0, 0, 0, 0,
                                      0, 0, 0, 0 !


Additional inputs used for MVISBK = 2,3,5,6,7,8:
------------------------------------------------
```

```
     Extinction due to Rayleigh scattering is added (1/Mm)
                            (BEXTRAY) -- Default: 10.0 ! BEXTRAY = 10  !

!END!
-------------------------------------------------------------------------------

INPUT GROUP: 3 -- Output options
--------------

Documentation
-------------

    Documentation records contained in the header of the
    CALPUFF output file may be written to the list file.
    Print documentation image?
                               (LDOC) -- Default: F   !  LDOC =  F  !

Output Units
------------
    Units for All Output       (IPRTU) -- Default: 1   ! IPRTU =  3   !
                    for            for
                Concentration    Deposition
       1 =         g/m**3         g/m**2/s
       2 =        mg/m**3        mg/m**2/s
       3 =        ug/m**3        ug/m**2/s
       4 =        ng/m**3        ng/m**2/s
       5 =      Odour Units

    Visibility: extinction expressed in 1/Mega-meters (IPRTU is ignored)


Averaging time(s) reported
--------------------------

    1-pd averages           (L1PD) -- Default: T   !   L1PD = F  !
    (pd = averaging period of model output)

    1-hr averages           (L1HR) -- Default: T   !   L1HR = T  !

    3-hr averages           (L3HR) -- Default: T   !   L3HR =  F  !

    24-hr averages         (L24HR) -- Default: T   !  L24HR =  F  !

    Run-length averages    (LRUNL) -- Default: T   !  LRUNL =  T  !

    User-specified averaging time in hours, minutes, seconds
    - results for this averaging time are reported if it is not zero

                           (NAVGH) -- Default: 0   !   NAVGH =  0  !
                           (NAVGM) -- Default: 0   !   NAVGM =  0  !
                           (NAVGS) -- Default: 0   !   NAVGS =  0  !


Types of tabulations reported
-----------------------------

   1) Visibility: daily visibility tabulations are always reported
                  for the selected receptors when ASPEC = VISIB.
                  In addition, any of the other tabulations listed
                  below may be chosen to characterize the light
                  extinction coefficients.
                  [List file or Plot/Analysis File]


   2) Top 50 table for each averaging time selected
```

```
   [List file only]
                        (LT50) -- Default: T   !   LT50 = F  !

3) Top 'N' table for each averaging time selected
   [List file or Plot file]
                      (LTOPN) -- Default: F   !  LTOPN = T  !

     -- Number of 'Top-N' values at each receptor
        selected (NTOP must be <= 4)
                        (NTOP) -- Default: 4   ! NTOP =  2  !

     -- Specific ranks of 'Top-N' values reported
        (NTOP values must be entered)
                (ITOP(4) array) -- Default:     ! ITOP =  1, 2 !


4) Threshold exceedance counts for each receptor and each averaging
   time selected
   [List file or Plot file]
                      (LEXCD) -- Default: F   !  LEXCD = F  !

     -- Identify the threshold for each averaging time by assigning a
        non-negative value (output units).

                                -- Default: -1.0
        Threshold for  1-hr averages   (THRESH1) !  THRESH1 = -1.0  !
        Threshold for  3-hr averages   (THRESH3) !  THRESH3 = -1.0  !
        Threshold for 24-hr averages  (THRESH24) ! THRESH24 = -1.0  !
        Threshold for NAVG-hr averages (THRESHN) !  THRESHN = -1.0  !


     -- Counts for the shortest averaging period selected can be
        tallied daily, and receptors that experience more than NCOUNT
        counts over any NDAY period will be reported.  This type of
        exceedance violation output is triggered only if NDAY > 0.

        Accumulation period(Days)
                        (NDAY) -- Default: 0   !    NDAY =  0  !
        Number of exceedances allowed
                     (NCOUNT) -- Default: 1   !  NCOUNT =  1  !


5) Selected day table(s)

   Echo Option -- Many records are written each averaging period
   selected and output is grouped by day
   [List file or Plot file]
                      (LECHO) -- Default: F   !  LECHO = F  !

   Timeseries Option -- Averages at all selected receptors for
   each selected averaging period are written to timeseries files.
   Each file contains one averaging period, and all receptors are
   written to a single record each averaging time.
   [TSERIES_ASPEC_ttHR_CONC_TSUNAM.DAT files]
                      (LTIME) -- Default: F   !  LTIME = F  !

   Peak Value Option -- Averages at all selected receptors for
   each selected averaging period are screened and the peak value
   each period is written to timeseries files.
   Each file contains one averaging period.
   [PEAKVAL_ASPEC_ttHR_CONC_TSUNAM.DAT files]
                      (LPEAK) -- Default: F   !  LPEAK = F  !


     -- Days selected for output
```

```
                    (IECHO(366)) -- Default: 366*0
          ! IECHO  = 366*0  !
          (366 values must be entered)

Plot output options
-------------------

     Plot files can be created for the Top-N, Exceedance, and Echo
     tables selected above.  Two formats for these files are available,
     DATA and GRID.  In the DATA format, results at all receptors are
     listed along with the receptor location [x,y,val1,val2,...].
     In the GRID format, results at only gridded receptors are written,
     using a compact representation.  The gridded values are written in
     rows (x varies), starting with the most southern row of the grid.
     The GRID format is given the .GRD extension, and includes headers
     compatible with the SURFER(R) plotting software.

     A plotting and analysis file can also be created for the daily
     peak visibility summary output, in DATA format only.

     Generate Plot file output in addition to writing tables
     to List file?
                              (LPLT) -- Default: F   ! LPLT  = T !

     Use GRID format rather than DATA format,
     when available?
                              (LGRD) -- Default: F   ! LGRD  = F !


Auxiliary Output Files (for subsequent analyses)
------------------------------------------------

      Visibility

      A separate output file may be requested that contains the change
      in visibility at each selected receptor when ASPEC = VISIB.  This
      file can be processed to construct visibility measures that are
      not available in CALPOST.

      Output file with the visibility change at each receptor?
                             (MDVIS) -- Default: 0   ! MDVIS  = 0 !

           0 =  Do Not create file
           1 =  Create file of DAILY (24 hour) Delta-Deciview
           2 =  Create file of DAILY (24 hour) Extinction Change (%)
           3 =  Create file of HOURLY Delta-Deciview
           4 =  Create file of HOURLY Extinction Change (%)



Additional Debug Output
-----------------------

   Output selected information to List file
    for debugging?
                            (LDEBUG) -- Default: F  ! LDEBUG  = F !

   Output hourly extinction information to REPORT.HRV?
    (Visibility Method 7)
                           (LVEXTHR) -- Default: F  ! LVEXTHR = F !

!END!
```

Appendix F

Meteorological Data Substitution Guidance

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Appendix F
Meteorological Data Substitution Guidance

Procedures for Substituting Values for Missing NWS Meteorological Data for Use in Regulatory Air Quality Models

Dennis Atkinson and Russell F. Lee

7/07/92

Introduction

The Meteorological data required for short-term air quality dispersion modeling consist of hourly surface observations, and morning and afternoon mixing heights. The RAMMET meteorological pre-processor program requires surface data in the CD144 format, and mixing height data in the TD9689 format. In order for the RAMMET program to function properly, these data must be 100% complete. Data acquired from the National Climatic Data Center (NCDC) occasionally have periods of missing data. If the lengths of these periods are not excessive, reasonable values may be substituted without seriously degrading the modeling results.

As with on-site data, a data set which is less than 90% complete should not be used for air quality modeling purposes. Substitutions for missing data should only be made to complete the data set for modeling applications, and should not be used to achieve the 90% criterion. Note that, for purposes of achieving the 90% criterion, cloud cover is valid for a given hour if a value for EITHER opaque cloud cover or total cloud cover is available.

The procedure for providing substitute values for missing data has two parts. The first part is an objective procedure, which applies to single isolated hours with missing surface data and single isolated days of missing mixing height data. Substitutions for those data are accomplished using procedures described below.

The second part is a subjective procedure which applies to longer sequences of missing data. Substitutions for those data require judgement, and should be accomplished by an air quality meteorologist based on scientific knowledge and professional experience. The procedures, described in detail below, are generally consistent with procedures used historically by EPA.

Step 1: The Objective Procedure

Surface Data

Hourly surface weather observations of opaque cloud cover, ceiling height, temperature, wind direction, and wind speed are required. Substitutions for missing surface data are made as follows:

* If opaque cloud cover is missing, then total cloud cover is used. If total cloud cover is also missing, then a "0" is used for opaque cloud cover if the ceiling is greater than 7000 feet (high level clouds are generally not opaque), and a "7" if the ceiling is less than or equal to

7000 feet. If the opaque cloud cover, total cloud cover, and ceiling are all missing, values of ceiling and opaque (or total) cloud cover from the preceding hour are used, provided that values from both the preceding and the succeeding hours are present (i.e., only a single hour is missing). If two or more consecutive hours of cloud cover (both opaque and total) are missing, then the subjective procedure outlined below should be used.

* If ceiling height is missing, and either the opaque cloud cover or the total cloud cover is less than or equal to 5, then "---" (the code for unlimited ceiling) is used. Otherwise, if the ceiling height is missing, but values for both the preceding and succeeding hours are present, then the value from the preceding hour is used. If two or more consecutive hours of ceiling height are missing, then the subjective procedure outlined below is used.

* If temperature is missing, then a value interpolated between the preceding hour and the succeeding valid hour is substituted. If two or more consecutive hours of temperatures are missing, then the subjective procedure outlined below is followed.

* If a single hour of wind direction and speed is missing then the average direction and average speed from the four hours surrounding that hour is substituted. Except for the first two and last two hours of the year, this average is derived from the two hours before and two hours after the hour of the missing value. In the interest of simplicity, the average wind direction is obtained from the mean unit vector wind. If two or more consecutive hours of either wind direction or wind speed are missing, then the subjective procedure outlined below should be used.

Mixing Height Data

Both a morning mixing height and an afternoon mixing height are required for each day of the year. Objective substitutions for missing mixing heights are made as follows:

* If a single afternoon mixing height is missing, the value interpolated between the preceding and successive afternoon mixing heights are used. Similarly, if a single morning mixing height is missing, the value interpolated between the preceding and succeeding morning mixing heights is used.

* If two or more consecutive afternoon mixing heights or two or more consecutive morning mixing heights are missing, then the subjective procedure outlined below is used.

Step 2: The Subjective Procedure

When the objective procedure does not provide a substitute value for some parameter, the data are reviewed by an air quality meteorologist. If technically appropriate, a substitute value is identified, based on the following procedure, using sound scientific knowledge and professional experience.

Surface Data

The following procedures are recommended for substituting values for missing surface data when the objective procedure described above is not appropriate. Sound meteorological judgment and professional experience is required to developing appropriate substitute data values.

If a ceiling height value is missing, then the five ceiling height values before and after that hour are reviewed to obtain appropriate values to substitute. For an opaque cloud cover of 5 or less, the value for ceiling height must be "---" to indicate unlimited ceiling (by definition, the ceiling is unlimited when the cloud cover is 5/10 or less). If the opaque value is 6 or greater, the values before and after that hour are reviewed to derive appropriate ceiling values.

If temperature is missing, then the temperature values on either side of the data void are reviewed. Often an interpolation can be made for up to a few hours. However, these values may need to be adjusted to be consistent with the other meteorological factors. Near times of daily maxima or minima, one can adequately simulate daily maxima or minima for other days of similar meteorological conditions.

If a wind direction value is missing, the data values a few hours (perhaps five or so) on either side of the data void are reviewed. It is important to maintain not only consistency of wind direction, but also some consistency of wind variability. Otherwise, a few hours with the wind from the same direction will result, which can produce unreasonably high estimates of 8-hour and 24-hour average concentrations.

If wind speed is missing, the five values both before and after the data void are reviewed. Any obvious patterns of wind speed should be continued and adjusted, if needed, to make the substitute data realistic from an air quality modeling viewpoint.

Mixing Height Data

The following procedure is recommended for substituting values for missing morning or afternoon mixing height values, when the objective procedure described above is not appropriate. The procedure with mixing height data, as with surface data, requires careful meteorological judgment and professional experience in order to derive appropriate substitute values.

As a general rule, a sequence of missing mixing heights of five days or more are not filled in. Also, any missing sequence of four days which does not have adequate continuity (at least five full days on either side of the data void) is also not filled in. Such files cannot be used as input to the RAMMET (or PCRAMMET) preprocessor, since doing so produces values of zero for the mixing height, resulting in unrealistic modeling results.

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Attachment 6
19-ECD-0066
REISSUE
(30 Pages Excluding Cover Sheet)

Risk Assessment Work Plan for the Direct Feed Low Activity Waste Configuration

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Acronyms

ADD	Average daily dose
AHQ	acute hazard quotient
AIEC	acute inhalation exposure criteria
BOF	Balance of Facilities
CCN	correspondence control number
COPC	constituent of potential concern
CSF	cancer slope factor
DEP	Direct Feed Low-Activity Waste Effluent Management Facility Process System
DFLAW	Direct Feed Low-Activity Waste
DOE	US Department of Energy
DVP	Direct Feed Low-Activity Waste Effluent Management Facility Vessel Vent Process System
DWP	Dangerous Waste Permit
EC	exposure concentration
Ecology	Washington State Department of Ecology
EMF	Effluent Management Facility
EPA	US Environmental Protection Agency
ESQ	ecological screening quotient
FRA	final risk assessment
HEPA	high-efficiency particulate air (filter)
HHRAP	*Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*
HI	hazard index
HQ	hazard quotient
ILCR	incremental lifetime cancer risk
Lab	Analytical Laboratory
LADD	lifetime average daily dose
LAW	Low-Activity Waste (Facility)
PCDD	polychlorinated dibenzodioxin
PCDF	polychlorinated dibenzofuran
PRA	predemonstration test risk assessment
PT	Pretreatment (Facility)
RAWP	*Environmental Risk Assessment Work Plan for the Hanford Tank Waste and Immobilization Plant*
SLRA	screening-level risk assessment
SLERA	screening-level ecological risk assessment
TRV	toxicity reference value
WAC	Washington Administrative Code
WTP	Hanford Tank Waste Treatment and Immobilization Plant

1 Introduction

This report presents the risk assessment protocol for evaluating potential risks to human health and ecological resources from the Hanford Tank Waste Treatment and Immobilization Plant (WTP) in the Direct Feed Low-Activity Waste (DFLAW) configuration at the Hanford Site. This report is required to satisfy, in part, requirements established by Condition III.10.C.11 of permit WA7890008967 (Dangerous Waste Permit [DWP]) (Ecology 2017), as well as addressing provisions in WAC 173-303-680, *Dangerous Waste Regulations – Miscellaneous Units*.

The Hanford Site is in southeastern Washington State, is owned by the US government, and is managed by the US Department of Energy (DOE), the Bureau of Land Management, the US Fish and Wildlife Service, and the Washington Department of Fish and Wildlife. WTP will include waste vitrification facilities and an Effluent Management Facility (EMF), and will be built in the 200 East Area of the Hanford Site.

Refer to report 24590-WTP-RPT-ENV-14-002, *Environmental Risk Assessment Work Plan for the Hanford Tank Waste and Immobilization Plant* (RAWP), for the evaluation of potential risks to human health and ecological resources from the WTP full configuration and further description as noted in specific sections of this report.

2 WTP Facility/Process Description

Hanford tank waste consists of approximately 54 million US gallons of highly radioactive and mixed hazardous wastes stored in underground storage tanks at DOE's Hanford Site. WTP is being constructed to treat mixed wastes from underground storage tanks. WTP is located at the eastern end of the 200 East Area of the Hanford Site, near the former Grout Treatment Facility, 241-AP Tank Farm Complex, and Plutonium Uranium Extraction Plant. After the tank waste is received from the Hanford double-shell tank system it will be immobilized using a process called "vitrification." Vitrification is a thermal process that converts the waste materials into a durable glass. The vitrified wastes and secondary wastes resulting from the WTP processes will be transferred to permitted treatment, storage, or disposal units for disposition. The following subsection provides an overview of the mixed waste treatment processes that will be used in the DFLAW configuration. Readers should consult Chapter 4 of the DWP (Ecology 2017) for additional detail on WTP engineering and waste treatment processes and for information on the WTP baseline configuration.

2.1 Direct Feed Low-Activity Waste Process Overview

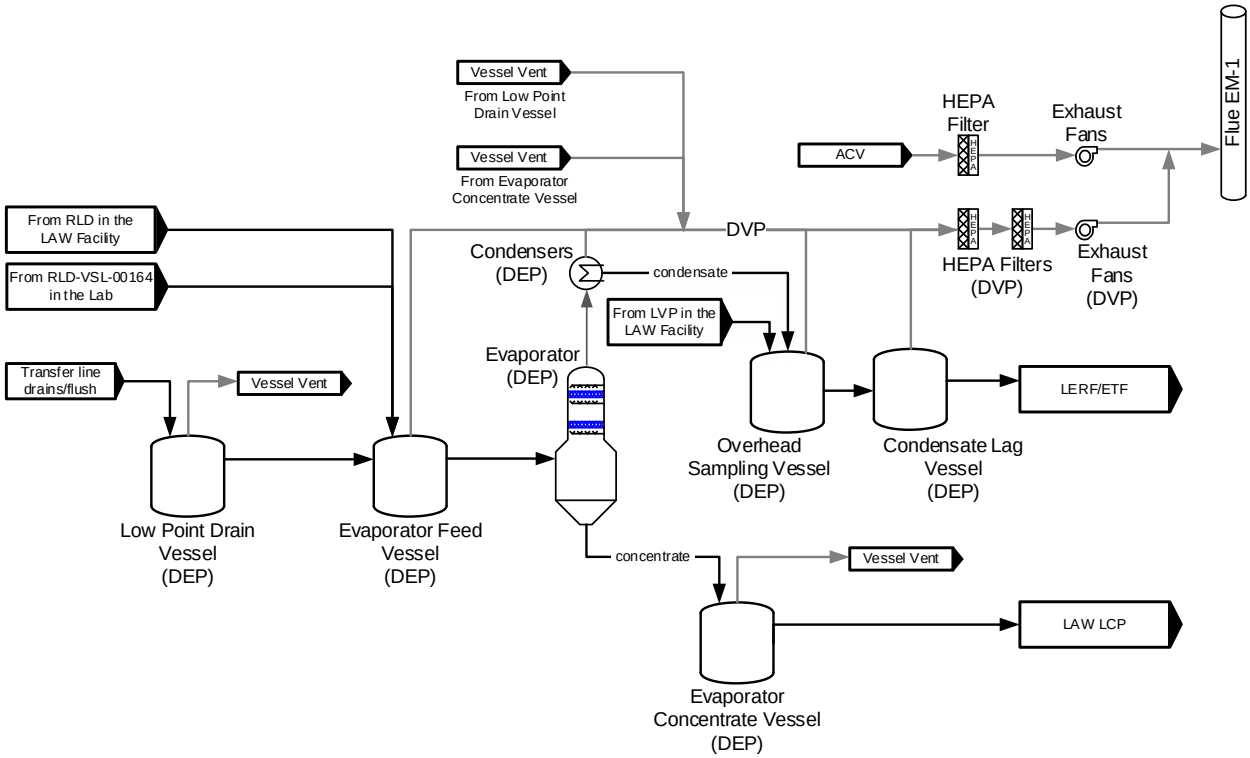
WTP may be operated in two processing configurations: the baseline WTP configuration and the DFLAW configuration. To facilitate the processing of tank waste into glass as soon as possible, an DFLAW configuration is being implemented. The DFLAW configuration allows for the operation of the Low-Activity Waste (LAW) Facility and Analytical Laboratory (Lab) before operation of the Pretreatment (PT) Facility. In this configuration, pretreated low-activity waste will have the cesium removed and will be fed from the Hanford Tank Farms to the LAW Facility, bypassing the PT Facility. As such, the replication of some PT Facility functions is required. The EMF is in place to replicate activities conducted in the baseline configuration (primarily effluent evaporation and condensation)—including the management and treatment of the liquid effluent from the LAW Facility's and Lab's

radioactive liquid waste disposal systems, and the management of the effluent from the LAW secondary offgas / vessel vent process system.

In the DFLAW configuration, the EMF will collect and treat the liquid effluents in an evaporator. The evaporator overheads (process condensate) will be transferred to the 200-Area Liquid Effluent Retention Facility / Effluent Treatment Facility for further processing. The residual EMF evaporator bottoms (process concentrate) is returned to the LAW Facility for vitrification (recycled). The concentrate may also be returned to Tank Farms or disposed at an alternate location via tanker truck. Figure 2-1 provides the process schematic of EMF.

It is planned that WTP will operate in the DFLAW configuration for 10 years until the PT and High-Level Waste facilities are operational. Support systems and utilities required for DFLAW to operate will continue to be provided via the existing Balance of Facilities (BOF).

Figure 2-1 Process Schematic of the Effluent Management Facility



ETF = Effluent Treatment Facility; LCP = LAW concentrate receipt process system; LERF = Liquid Effluent Retention Facility
RLD = radioactive liquid waste disposal system

2.2 Effluent Management Facility

The EMF, located north of the Lab, is comprised of four buildings, the LAW effluent process building (building 25), the LAW effluent drain tank building (building 25A), the LAW effluent electrical building (building 27), and the LAW effluent utility building (building 26). The EMF contains an evaporator system; nine major process vessels; three supporting reagent product storage tanks; heating, ventilation, and air conditioning equipment; and electrical utilities. The various buildings are described in more detail herein.

The building ventilation system that serves EMF is referred to as the "active confinement ventilation system." This system operates on a once-through ventilation strategy whereby air is cascaded from areas of lower contamination potential to areas of higher contamination potential before being exhausted from the facility. The EMF ventilation system uses the cascade principle with the direction of airflow from areas of low or no contamination to areas of higher potential contamination. Conditioned air supplied to EMF cascades through these areas and exits via the active confinement ventilation exhaust system's single-stage, high-efficiency particulate air (HEPA) filtered exhaust.

Building 25 – LAW Effluent Process Building

The LAW effluent process building houses the Direct Feed Low-Activity Waste Effluent Management Facility Process System (DEP) and Direct Feed Low-Activity Waste Effluent Management Facility Vessel Vent Process System (DVP). The DEP system is the main process system for EMF and consists of vessels and ancillary equipment used to support the collection, processing, and disposal of the mixed waste effluent from the LAW Facility and Lab. The DWP (Ecology 2017), Sections 4G.2 and 4G.3, provides a more-detailed discussion of the processes contained in this building. The DEP system evaporator separator will receive feed from the evaporator feed vessel that has passed through the evaporator reboiler. The evaporator will be operated under vacuum to lower the boiling point of the concentrate. The overhead vapors, mainly water, will pass through an impingement plate to remove entrained liquid, with the overhead vapor continuing to the primary condenser. The majority of the bottom liquid will be recycled through the reboiler, with a small amount sent to the evaporator concentrate vessels. Overhead vapor from the evaporator and steam from the steam-jet air ejectors will be condensed and collected in the overhead sampling vessels. Spent caustic scrubber solution from the LAW Facility offgas caustic scrubber will also be collected in the EMF overhead sampling vessels. The overhead sampling vessel effluent is then transferred to the existing Hanford Site 200 Area Liquid Effluent Retention Facility / Effluent Treatment Facility.

The DVP system provides vessel ventilation for the DEP system vessels.

Building 25A – LAW Effluent Drain Tank Building

The LAW effluent drain tank building consists of the low-point drain vessel and the drain tank maintenance area. The low-point drain vessel is sized to handle flushing of the DFLAW underground waste transfer lines, between the Hanford tank farms and the LAW Vitrification Facility and the effluent lines between the LAW Facility, Lab, and EMF.

Building 26 – LAW Effluent Utility Building

The LAW effluent utility building contains the building heating, ventilation, and air conditioning HEPA filters and fans, and the BOF utility pumps and storage vessels. The LAW effluent utility building shares a ventilation system with the LAW effluent process building (building 25). The treated DVP offgas from the LAW effluent process building ties into the exhaust duct in the LAW effluent utility building and is discharged to the atmosphere through the 150 ft stack. The building does not contain equipment that manages dangerous or mixed waste.

Building 27 – LAW Effluent Electrical Building

The LAW effluent electrical building houses most of the EMF electrical equipment, which includes electrical batteries and control and instrumentation equipment. It has a separate power supply and exhaust system. The building does not contain equipment that manages dangerous or mixed waste.

2.2.1 Direct Feed Low-Activity Waste Effluent Management Facility Process System

Liquid effluents from the LAW Facility and Lab vessels will be transferred through the EMF evaporator feed vessel to the DEP system evaporator located in the LAW effluent process building (building 25). Liquid effluents from transfer line flush water from the EMF low-point drain vessel will also be transferred through the evaporator feed vessel. These liquid effluent streams pass through a prefilter before entering the feed vessel. The evaporator feed vessel will be purged with air drawn through the vessel head space and will be vented to the vessel vent header. This vessel will have the capability to receive sodium hydroxide for pH adjustment and demineralized water for flushing. Effluent will be continuously pumped from the feed vessel to the evaporator to maintain a constant liquid level in the evaporator.

The DEP system evaporator loop functions to reduce the volume of liquid effluent that is received from LAW Facility, Lab, and underground waste transfer line flushes, and to recycle the concentrate back to the LAW Facility. The design also supports the transfer of the concentrate to the Hanford Tank Farms and to the tanker truck loadout area. Condensate from the DEP system process can be disposed of at the Liquid Effluent Retention Facility / Effluent Treatment Facility.

The evaporator loop consists of the evaporator separator vessel, reboiler, condensers, and the recirculation piping. As the liquid effluent circulates through the reboiler, the temperature rises. Then, the liquid rises into the separator vessel, the hydrostatic head diminishes, and flash evaporation occurs near the liquid surface. The liquid stream recirculates in the closed loop while the vapor stream enters the evaporator overheads. The evaporator loop operates under a vacuum to reduce the boiling temperatures and minimize corrosion. Concentrate (bottoms) will be pumped from the evaporator to the evaporator concentrate vessels and recirculated through the evaporator reboiler to maintain a constant solution density in the evaporator and to prevent buildup of settled solids in the waste.

The reboiler is a tube-and-shell heat exchanger. High-pressure steam, supplied from the BOF, is used to heat a secondary steam loop that feeds the heat exchanger shell side, while the evaporator feed circulates through the heat exchanger tubes.

The DEP system process vessels and evaporator offgas are ventilated to the DVP system HEPA filters.

2.2.2 Direct Feed Low-Activity Waste Effluent Management Facility Vessel Vent Process System

The DVP system consists of two main parts, air inlet, and exhaust. The DVP system provides vessel ventilation for the DEP system vessels, the purpose of the DVP system is to direct vessel vent gases to emission control systems, and purge hydrogen to maintain the vessel hydrogen concentration below dangerous levels.

For the DEP system vessels in the LAW effluent process building (building 25), a purge air inbleed is used to meet the very-low required flow rates. The vessel vent is the exhaust portion of the DVP system and provides suction pressure on the vessel headspace, to draw in the purge air and mitigate hydrogen accumulation. The discharged air is sent through a preheater, two-stage HEPA filters, and an exhaust fan to discharge out the EMF stack. The DVP exhaust fans control and maintain the suction pressure inside the various process vessels, maintaining the continuous purge air inbleed.

3 Screening Level Risk Assessment Approach

This section describes the overall screening-level risk assessment (SLRA) scope and approach for DFLAW that will be used to estimate potential risks to human health and ecological resources associated with airborne releases resulting from processing Hanford tank waste into a stable, vitrified form.

Per condition III.10C.11a.i of the DWP airborne release is the only viable pathway for receptor exposure; therefore, the primary regulatory guidance followed for this risk assessment is found in EPA530-R-05-006, *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (HHRAP) (EPA 2005), and EPA530-D-99-001A, *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (EPA 1999a).

3.1 Scope of the Screening-Level Risk Assessment

The SLRA will evaluate exposure and risks to potential human and ecological receptors within a 50 km radius of WTP. Section 7 includes additional discussion of the human receptors and Section 8 provides additional detail of the ecological receptors.

The area within the 50 km radius of WTP is located predominantly within Benton County in Washington State, with smaller portions located in Franklin, Grant, Yakima, and Kittitas counties. The Tri-Cities (i.e., the combined cities of Richland, Kennewick, and Pasco) are adjacent to the southern edge of the Hanford Site. Per US Census Bureau information for 2016 (DOC 2016), the Tri-Cities area contains a population of approximately 210,000, the majority of which reside between 30 and 50 km from WTP. The population outside the Tri-Cities, but within 50 km of WTP, is sparse. There are no permanent residences on the Hanford Site. American Indian tribes have treaty rights to resources on the Hanford Site, and the SLRA includes potential risks from food gathering and other tribal-specific activities, as well as from inhalation and external exposures to WTP emissions.

A variety of ecological receptors inhabit the Hanford Site. They include terrestrial and aquatic plants; terrestrial, aquatic, and sediment-dwelling invertebrates; mammals and birds that eat terrestrial plants and animals; fish and other aquatic biota; and mammals and birds that eat fish and other aquatic biota. These ecological receptors are discussed in more detail in Section 8.

The SLRA (specifically, the pre-demonstration test risk assessment [PRA] and the final risk assessment [FRA]) will address the potential operating life of WTP in its baseline configuration and the DFLAW configuration. The PRA will provide an estimate of human health and ecological receptor risk based on engineering estimates of emissions from WTP units. The FRA will be conducted following collection of data from performance demonstration testing of WTP units, where estimated emission rates will be supplemented with the actual emissions results of the demonstration tests. The same basic risk methodology will be used for the PRA and the FRA—which will differ in that the PRA will use air, soil, and surface water concentrations modeled from estimated stack emissions; whereas the FRA will use air, soil, and surface water concentrations that are based on the results of a performance demonstration test using surrogate waste and estimated stack emissions. The WTP Project recognizes that there are significant limitations to using a limited performance demonstration test to predict the ability of the melter offgas systems to control emissions. However, proven thermal treatment approaches will be used to select test constituents that are representative of the worst-case constituents and operating conditions so that a conservative estimate of performance is obtained.

The current DWP (Ecology 2017) covers projected operations for both configurations at WTP. The SLRA, as applicable to the DFLAW configuration, assumes that the facility will operate at maximum capacity for its entire design life (10 years from the start of DFLAW). The SLRA, as applicable to the WTP baseline configuration (including the PT and High-Level Waste facilities), assumes WTP is operated at full capacity for 40 years. The two operating configurations will not be operated simultaneously, and will be assessed independently. Risks from the waste in the Hanford double-shell tank system, as well as cumulative risks from the Hanford Site, are outside the scope of the SLRA. The receptor exposure timelines evaluated in the preliminary risk assessment report are consistent with the timelines presented on Figure 7-3 of the DFLAW risk assessment work plan (24590-WTP-RPT-ENV-18-003) and on Figure 7-7 of the baseline risk assessment work plan (24590-WTP-RPT-ENV-14-002).

4 Constituents of Potential Concern

The HHRAP (EPA 2005) recommends that the selection of constituents of potential concern (COPC) focus on compounds that (1) are likely to be emitted because of the presence of the compound or its precursors in the waste feed, (2) are potential products of incomplete combustion, (3) are potentially toxic to humans, and (or) (4) have a definite propensity for bioaccumulating or bioconcentrating in human and ecological food chains. The process for identifying COPCs is described in 24590-WTP-RPT-ENV-10-001, *Constituents of Potential Concern for the WTP Air and Dangerous Waste Permits* (RAWP Supplement 1)

4.1 Identification of Constituents of Potential Concern and Radiological Constituents of Potential Concern for the Quantitative Predemonstration Test Risk Assessment

The COPCs identified in RAWP Supplement 1 include an extensive list of chemicals and radionuclides that are (1) potentially present in the waste to be processed or (2) potentially produced as products of incomplete combustion during the WTP processing of waste. The process of identifying of COPCs for the PRA-selected chemicals is in accordance with the recommendations in the HHRAP (EPA 2005).

Final COPCs carried through the quantitative risk assessment will be all those COPCs for which either of the following apply:

- Appropriate physical and (or) chemical parameters are available to quantitatively estimate potential emissions and fate and transport behavior of the constituent through the environment.
- Appropriate human health or ecological toxicity data is available to quantitatively evaluate potential effects of the constituent.

Constituents not included in the quantitative risk assessment will be discussed qualitatively as part of the uncertainty assessment.

4.1.1 Identification of Organic and Inorganic Constituents of Potential Concern for Inclusion in the Quantitative Pre-Demonstration Test Risk Assessment

The list of organic COPCs consists of many categories of volatile and semivolatile organic compounds. The US Environment Protection Agency (EPA) has identified several categories of WTP COPCs (e.g., dioxins and furans, polycyclic aromatic hydrocarbons, polychlorinated biphenyls, phthalates, other chlorinated organics, and nitroaromatics) as having the highest potential to cause increased risk to human health from chronic exposure—as stated in *Draft Exposure Assessment Guidance for RCRA Hazardous Waste Combustion Facilities*, Attachment A, Table 1, “Chemicals Recommended for Identification,” and

Table 2, "Chemicals for Potential Identification" (EPA 1994). The organic and inorganic COPCs that can be carried through the quantitative risk evaluation is identified in 24590-WTP-RPT-ENV-14-003, *Chemical Parameters and Toxicological Inputs for the Environmental Risk Assessment for the Hanford Tank Waste Treatment and Immobilization Plant* (RAWP Supplement 4). **Note:** The data available is continually changing; therefore, the PRA and FRA will update this information.

4.1.2 Identification of Radiological Constituents of Potential Concern for Inclusion in the Quantitative Predemonstration Test Risk Assessment

The preliminary radiological COPCs were identified per the method described in RAWP Supplement 1. RAWP Supplement 4 describes the available toxicity, physical, and chemical data appropriate for evaluating chronic human health, acute human health, and chronic ecological exposures to radionuclides. The 46 radionuclides that are identified in Supplement 1 of the RAWP are estimated to account for over 99% of the Hanford tank waste's activity (refer to HNF-SD-WM-TI-740, *Standard Inventories of Chemicals and Radionuclides in Hanford Site Tank Wastes* [LMHC 1997]).

5 Estimate of Emissions

WTP is being designed to vitrify radioactive, mixed waste. A bounding estimate of stack emissions from the DFLAW configuration has been developed to allow for numerical quantification of the human and ecological risks associated with airborne emissions. This bounding estimate was generated by process modeling a corresponding bounding feed vector (RAWP Supplement 2), applying upset factors (RAWP Section 5.3), applying detection limits for emissions estimated at rates below those limits (RAWP Section 5.2.2), and including cell emissions (RAWP Section 5.4). The emissions estimate individually considers 409 organic, inorganic, and radiological COPCs that could result from processing Hanford tank waste through the DFLAW configuration. Emissions from the LAW Facility and EMF are considered.

For more information and detail on the emissions estimate, refer to the RAWP (24590-WTP-RPT-ENV-14-002), Section 5, "Estimation of Emissions," and RAWP Supplement 2.

6 Environmental Modeling

Air-dispersion modeling will be used to determine COPC-specific concentrations and deposition rates resulting from WTP emissions during operations of the DFLAW configuration. The assessment area extends to a 50 km radius from WTP. These results will be used as input into the human health and ecological risk assessments.

The CALPUFF model (an advanced, non-steady-state, meteorological and air quality modeling system) will be used for the air-quality modeling task. The DFLAW emissions—determined by the design engineers and 5 years of upper-air and Hanford Site meteorological data collected by the Hanford Site Meteorological Station network—will be used as input into the model. The COPC-specific concentrations and deposition rates will be calculated at a gridded network of receptors and at specific sensitive receptors identified by the risk assessment analysts, as presented in 24590-WTP-RPT-ENV-08-001, *Hanford Tank Waste Treatment and Immobilization Plant Risk Assessment Air Quality Modeling Protocol* (RAWP Supplement 5).

Fate and transport modeling with the CALPUFF model will be used to estimate COPC concentrations and depositions at various receptor locations (exposure grids). The CALPUFF model is a multilayer, multispecies, non-steady-state, puff-dispersion model that simulates the effects of time- and space-varying meteorological conditions on pollution transport, transformation, and removal. The WTP Project will model a unitized emission rate of 1 gram per second (1 curie per second for radionuclides) with a combination of site-specific and default parameters to describe the movement of COPCs through the environment. The unitized CALPUFF model results will be combined with the COPC emissions estimates as an input to the WTP risk assessment model. The emission rates for inorganic, organic, and radiological COPCs are to be evaluated in the risk assessment model.

This modeling is predictive and cannot be confirmed by sampling environmental media because the emissions source does not yet exist. The uncertainty associated with this predictive modeling is addressed through the use of conservative assumptions whenever possible. Estimated media concentrations resulting from this modeling effort will be used in the exposure assessment for the human health (Section 7) and ecological (Section 8) risk assessments. Environmental modeling for the FRA will be updated at a later time with actual emissions data from the environmental performance demonstration testing.

7 Screening Human Health Risk Assessment

The human health risk assessment process includes four fundamental components: (1) data evaluation, (2) exposure assessment, (3) toxicity assessment, and (4) risk characterization. The data evaluation step is the selection of COPCs discussed in RAWP Supplement 1; the quantification of emissions discussed in it is presented in other supplements to the RAWP (24590-WTP-RPT-ENV-14-002). Each of the remaining three components is discussed in the following subsections:

- Exposure assessment (Section 7.1)
- Toxicity assessment (Section 7.2)
- Risk characterization (Section 7.3)

7.1 Exposure Assessment

Exposure assessment is the process of estimating the magnitude, frequency, duration, and type of potential exposures to COPCs. A human health conceptual exposure model identifies exposure scenarios that are defined by potentially exposed populations and exposure pathways. The conceptual exposure model used for this was developed from guidance and information obtained from the HHRAP (EPA 2005); DOE/RL-96-16, *Screening Assessment and Requirements for a Comprehensive Assessment, Columbia River Comprehensive Impact Assessment* (DOE 1998); and discussions with DOE Office of River Protection, Washington State Department of Ecology (Ecology), and EPA. The conceptual exposure model for human health assessment is shown as Figure 7-1.

7.1.1 Characterization of Exposure Setting

Characterizing the exposure setting is the first step in identifying potentially exposed populations. This characterization includes identifying the location of human populations within the study area and types of activities that can be expected under current and reasonable potential future land use.

The study area is defined as the area within a 50 km radius of WTP. Although it is possible for human populations to be exposed beyond this 50 km radius, the concentration of airborne and deposited

emissions will be orders of magnitude less than those within the study area, essentially approaching zero. EPA reports in the HHRAP (EPA 2005) that, at other facilities, the most-significant deposition of airborne emissions has been observed within a 3 km radius of a source. The Hanford Site boundary extends approximately 9 to 28 km from WTP. The Columbia River is located approximately 8 km to more than 20 km from WTP. Therefore, the potential for offsite impacts is expected to be minimal; however, because of the importance of the Columbia River as a potable water and recreational resource, it will be included in the quantitative risk assessment. No residential receptors are present at the Hanford Site and there will not be.

Characterization of the exposure setting includes the following:

- Characterization of the physical setting, including location of important physical features (e.g., Gable Mountain, surface water bodies, and watersheds)
- Characterization of potentially exposed populations—including identifying the location and activity patterns of current populations relative to the facility, determining plausible future land use, and identifying subpopulations of potential concern

Characterization will concentrate on the areas potentially most impacted by emissions, based on the results of the air-dispersion modeling and will include both current and future land use. The exposure assessment will focus on six locations of interest as described below:

- **Onsite ground maximum** – Location of maximum predicted ground-level concentrations of both airborne and deposited emissions. This location generally represents worst-case human and ecological exposures because very few receptors are expected to be present here. The onsite ground maximum location is a 2.4 by 2.4 km area represented by the point or points directly beyond the WTP fence line, centered on WTP, and predicted to have the highest concentration of airborne and deposited emissions. The grid covers the area in the immediate region downwind from WTP. Receptors who are likely to receive exposures at this location are limited to onsite workers.
- **Hanford offsite** – Location of predicted ground-level concentrations of both airborne and deposited emissions outside the Hanford Site boundary. This location represents a more-plausible location for most human receptors and is an important point of compliance. The grid spans a region that is predominately downwind of WTP, adjacent to the southeastern border of the Hanford Site. For conservatism, the residence of all receptors is assumed to occupy this grid.
- **Gable Mountain maximum** – Location of maximum predicted ground-level concentrations of both airborne and deposited emissions at Gable Mountain. This location is included due to its importance to American Indian populations in the area. For purposes of assessing potential risks due to WTP emissions, Gable Mountain represents a site of tribal ceremonial activities and, as such, receptor exposure is generally of a limited duration.
- **Columbia River maximum** – Location of maximum predicted ground-level concentrations of both airborne and deposited emissions at the Columbia River. This location is used to evaluate potential risks to aquatic ecological receptors—as a source of potable water for human receptors, and as a source of fish for human receptors. The Columbia River receptor grid is predominately downwind of WTP in the eastern region of the Hanford Site.
- **Hunter-and-gatherer area I** – Location of predicted ground-level concentrations of both airborne and deposited emissions for grazing game and native plant species. The subsistence-resident American Indian is assumed to consume food (wild game, wildfowl, wildfowl eggs, and wild plants) harvested on the Hanford Site. Although the home range of most game and wild fowl is located primarily along the riparian corridor of the Columbia River, deer and other game may browse

anywhere on the Hanford Site. The current exposure scenario hunter-and-gatherer area includes the Hanford Reach National Monument and Gable Mountain. This area includes the portions of the Hanford Site that could be used for grazing by game animals and wild fowl, and is most likely to be used by people for collecting wild plants. It excludes the interior area of the Hanford Site.

- **Hunter-and-gatherer area II** – Expanded location of predicted ground-level concentrations of both airborne and deposited emissions for grazing game and native plant species. The hunter and gatherer receptor grid in the future timeframe is presumed to exist after WTP shutdown. Like the current hunter-and-gatherer area assessed in current scenarios, this future area includes the riparian zones along the Columbia River, where game animals and important wild plants are likely to be present, and Gable Mountain. This future area also includes the area of maximum contaminant concentrations near WTP. This future hunter-and-gatherer area is intended to provide a more-conservative estimate of potential exposure and risk by including the area where concentrations are at their maximum. The hunter-and-gatherer area receptor grid does not include the exclusion area located at Hanford's central plateau or the industrial area east of the plateau.

Information describing current and future land use at Hanford is presented in DOE/EIS-0222-F, *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement* (DOE 1999a), and the preferred land-use alternative identified in DOE's article "Department of Energy – Record of Decision: Hanford Comprehensive Land-Use Plan Environmental Impact Statement (HCP EIS)" in the *Federal Register* (DOE 1999b). In DOE/EIS-0391 *Final Tank Closure and Waste Management Environmental Impact Statement*, DOE stated some portions of the Hanford site, continuing down to the soil would not be subject to use and be subject to access and use restrictions. Specific facilities identified are the tank systems which will be landfill closed and capped, facilities where above grade structures could be removed but below grade structures remain in place, and permanent disposal facilities. To compensate for this uncertainty, receptors are assumed to be present at the exposure grids regardless of actual land use at those locations. For example, a current residential scenario will be evaluated at the Hanford offsite location regardless of whether or not this location is presently in residential use or coincides with an air-modeling grid point. Using the highest discrete values of concentration and deposition will certainly result in the highest degree of conservatism. However, in large receptor exposure grids such as the offsite grid, the corresponding exposures to extreme depositions and air concentrations are improbable and could result in risk estimates that are highly improbable. Thus, the data from CALPOST (a postprocessing package of the CALPUFF modeling system) was evaluated to provide some quantitative information regarding the potential exposure to extreme air concentrations and depositions (refer to 24590-WTP-RPT-ENV-13-001, *CALPOST Data Evaluation to Support the Environmental Risk Assessment*). It was concluded that the 90th percentile of the predicted ground-level concentrations of both airborne and deposited emissions values for the Hanford offsite receptor exposure grid will sufficiently characterize exposures at that location. For the very large hunter-and-gatherer areas (where average exposures are of concern) the distribution-free, 95% upper confidence limit of the median provides a sufficiently conservative estimate of air concentration and deposition. For more-localized exposure grids (e.g., the onsite ground maximum, Columbia River, and Gable Mountain), the maximum predicted deposition or concentration provides a conservative estimate of exposure.

The subsistence-resident American Indian is assumed to consume food (wild game, wildfowl, wildfowl eggs, and wild plants) harvested on the Hanford Site. The hunter-and-gatherer areas for the subsistence-resident American Indian are based on the following assumptions:

- Although the exact collecting locations and types of plants collected are unknown, it is known that Gable Mountain is important for ceremonial activities and that plants are collected approximately once per year at the McGee Ranch west of the 200 areas.

- Although onsite hunting is currently limited to the area north of the Columbia River and the home range of deer at Hanford is located primarily along the riparian corridor of the Columbia River, deer and other game may browse anywhere on the Hanford Site.
- The traditional subsistence lifestyle is a communal lifestyle; therefore, the hunter-and-gatherer area must support more than a single individual or even a single family.
- A conservative scenario should include the locations of residency and the locations where it is known that some important activities occur (i.e., Gable Mountain maximum, Columbia River maximum).

To meet these needs, two hunter-and-gatherer areas have been identified (as previously described):

- The current exposure scenario hunter-and-gatherer area includes the Hanford Reach National Monument and Gable Mountain, an area most likely to be used for grazing by game animals and for collecting wild plants.
- The future exposure scenario hunter-and-gatherer area includes the entire Hanford Site, excluding the 200 Area industrial zones.

7.1.2 Identification of Receptor Types

EPA recommends in the HHRAP (EPA 2005) that the following receptor types be evaluated for assessing potential risks from thermal treatment facilities:

- Resident (adult and child)
- Subsistence-resident farmer (adult and child)
- Subsistence-resident fisher (adult and child)
- Nursing infant
- Acute risk

The nursing infant scenario, recommended by EPA guidance in the HHRAP (EPA 2005), addresses specific concerns regarding exposure to polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDF) because these chemicals are known to accumulate in human breast milk. The EPA guidance recommends inclusion of the nursing infant only for PCDDs/PCDFs; however, coplanar polychlorinated biphenyls will also be evaluated for this pathway due to their potential to behave, physiologically, like PCDDs/PCDFs. Because radionuclides are a major component of the waste to be treated at the facility, several radionuclides will also be evaluated for this pathway. Strontium (i.e., ^{90}Sr), iodine (i.e., ^{129}I), and cesium (i.e., ^{134}Cs and ^{137}Cs) will be evaluated for the nursing infant scenario, because of their toxicity and because they have the highest potential for accumulation in breast milk (refer to CCN 064327, *Ecology/EPA to WTP Regarding ROPCs for Nursing Infant Scenario*). If the potential risks or hazards for other COPCs in other exposure pathways approach unacceptable levels, further consideration will be given to incorporating those COPCs into the nursing infant scenario.

Special subpopulations are defined as individual human beings or subsets of the general population that may potentially be at higher risk due to lifestyle activities that cause higher exposures to COPCs. To address potentially sensitive subpopulations, the following additional exposure scenarios will be evaluated:

- Hanford Site industrial worker
- Subsistence-resident American Indian (adult and child)

Workers employed at WTP will not be included in the risk assessment because other regulations exist for occupational exposures within the WTP boundary (e.g., DOE standards for occupational safety and health). However, because of WTP's location within the Hanford Site, the closest and most-likely receptors are other Hanford Site workers located outside the WTP boundary. Therefore, the Hanford Site industrial worker scenario will be included in the risk assessment.

American Indian tribes (Nez Perce Tribe, Yakama Indian Nation, and Confederated Tribes of the Umatilla Indian Reservation) ceded the land currently occupied by the US government's Hanford Site. However, these tribes retained the rights to use the resources on this land. Representatives of these tribes have expressed a desire to be able to use this land to conduct a traditional lifestyle. A wide range of possible tribal activities related to traditional lifestyles exists. The subsistence-resident American Indian scenario will address a variety of potential exposures associated with food gathering (including hunting, fishing, and plant gathering) and cultural and social activities (e.g., using a sweat lodge).

7.1.3 Exposure Scenarios

The exposure scenarios included in the quantitative risk assessment are designed to cover a wide range of possible receptor activities, age groups, and lifestyles. These scenarios and the associated exposure routes are summarized in Table 7-1 and described in further detail in the RAWP Section 7.

Table 7-1 receptors represent the most highly exposed populations that could work or live near the Hanford Site, including those leading a subsistent lifestyle. The exposure assessment and risk characterization results for the selected receptors are designed to be protective of other populations and special subpopulations of interest. For example, the resident child receptor provides a bounding estimate for other child activities, such as children attending school or daycare. This scenario assumes a high level of potential exposure (e.g., the resident child is present 7 days per week, 24 hours per day and ingests homegrown produce) at an offsite location of elevated contaminant concentration. Hence, risk-management decisions based on these conservative assumptions will be protective of other child populations (e.g., at a school or daycare center where exposure would be less because a child may be present 5 days per week for less than 12 hours per day).

Table 7-1 does not include the resident subsistence American Indian hunter-gatherer exposure scenario that was developed for the TC&WM EIS (DOE 2012). For the EIS, DOE had negotiated a DOE American Indian scenario with the local tribes which modified some of the parameters in the Confederated Tribes of the Umatilla Indian Reservation and Yakama Indian Nation Native American scenarios to bring food consumption and inhalation rates more in line with other risk assessment inputs. DOE felt those changes were negotiated in good faith with the Tribal representatives. After publication of the EIS, DOE learned that Tribal scenarios could only be modified with approval from the Tribal Council, which had not been obtained. Two American Indian resident subsistence scenarios (American Indian #1 and American Indian #2) were assessed to represent more closely the lifestyle described by guidance documents issued by local tribes. DOE requested and invited the American Indian perspectives to ensure fair consideration of differing views and to inform the agency's decision-making process. DOE respects those views and considered them for the purposes of preparing this PRA. However, inclusion of these perspectives does not mean or imply that DOE is in agreement with them. As with other receptors, these scenarios assume a high level of potential exposure. These exposures are discussed in the RAWP, Section 7, and summarized in Table 7-2. Figure 7-2 presents the conceptual model for American Indians.

The purpose of the risk characterization is to evaluate the information obtained through the exposure, toxicity, and dose assessments to estimate the potential for receptors to experience adverse effects (cancer risks and noncancer hazards) because of exposure to media contaminated by emissions from operations of

the DFLAW configuration for 10 years. Exposure scenarios are defined for current and future land-use conditions. For the DFLAW configuration, current and future exposure scenarios are defined by the following timelines.

Current Exposure Scenarios: *Current* is defined as the 10-year operating period of WTP in the DFLAW configuration. For exposure durations of 10 years (or longer), the exposure is presumed to coincide with the operational period (and beyond for those exposure durations exceeding 10 years). For shorter exposure durations, the exposure time is presumed to coincide with the time of maximum concentration and deposition, which is 10 years. Figure 7-3 illustrates where current exposures will be assessed on the operational timeline.

Future Exposure Scenarios: *Future* is defined as the period beginning at the cessation of operations and beyond. During this time, emissions will have ceased and soil concentrations will have declined gradually because of various soil-loss mechanisms (air concentration and deposition rates are zero; thus, no surface-water accumulation occurs).

7.2 Toxicity Assessment

The toxicity assessment evaluates the potential for COPCs to cause adverse health effects in exposed individuals. Toxic effects have been evaluated extensively by EPA. Toxicity values will be used for evaluating COPCs in the PRA and the source and (or) rationale for the values.

Chronic toxicity values from these sources are provided in RAWP Supplement 4. RAWP Supplement 4 provides the toxicity value, its source, and whether the value has been extrapolated from another exposure pathway (i.e., oral to dermal). Chronic toxicity data has generally been obtained from the "Regional Screening Levels (RSLs) – Generic Tables (November 2017)" webpage on EPA's *Risk Assessment* website (EPA 2017). The RSL table is a living document that reflects the current state of the science of toxicology and risk assessment.

Oral noncarcinogenic effects of COPCs will be evaluated using an acceptable daily intake criterion (i.e., the reference dose) established by EPA in EPA/540/R/99/005, *Risk Assessment Guidance for Superfund: Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment)* (EPA 2004). The effects due to inhalation of noncarcinogenic COPCs will be evaluated using the inhalation reference value (i.e., the reference concentration). Dermal reference doses are estimated for COPCs from oral toxicity values multiplied by chemical-specific, gastrointestinal absorption factors to calculate the total absorbed dose.

Oral cancer risks are estimated using chemical- or radionuclide-specific cancer slope factors (CSF). For chemicals, the CSF is defined as a plausible upper-bound estimate of the probability of a response (e.g., cancer) per unit intake of a chemical over a lifetime, as described in EPA/540/1-89/002, *Risk Assessment Guidance for Superfund Volume I – Human Health Evaluation Manual (Part A)* (EPA 1989). The effects due to inhalation of carcinogenic chemicals will be evaluated using the inhalation unit risk factor. Dermal CSFs are estimated for COPCs from oral toxicity values divided by chemical-specific, gastrointestinal absorption factors to calculate the total absorbed dose.

Cancer risk from exposure to radionuclides through ingestion, inhalation, and external exposure to radionuclides in soil is estimated using a CSF.[1] The CSFs are taken from the *Health Effects Assessment Summary Tables (HEAST)* (EPA 2001), with an adjustment of the CSF for external soil exposure (for a 2 cm soil depth) as described in the RAWP (24590-WTP-RPT-ENV-14-002), Section 7.2.4.2, "Carcinogenic Toxicity of ROPCs."

Acute effects from direct inhalation of airborne COPCs (vapor and particulate) are evaluated by comparing modeled 1-hour maximum air concentrations to acute inhalation exposure criteria (AIEC). The AIEC is a reference value selected from a hierarchy of sources, from those acute reference values not likely to cause adverse effects in a human population and sensitive subgroups, to temporary levels of concern. Section 7.2.1.2 of the RAWP discusses the hierarchy of AIEC sources.

Refer to the RAWP, Section 7.2, "Toxicity Assessment," for more detail on toxicity assessment.

7.3 Risk Characterization

Oral noncarcinogenic effects of COPCs will be evaluated by dividing receptor intake or average daily dose by the reference dose. The effects due to inhalation of noncarcinogenic of COPCs will be evaluated by dividing the exposure concentration (EC) with the reference concentration. The average daily dose (ADD) will be divided by the dermal reference dose to estimate potential noncarcinogenic effects from an external environment, as applicable (e.g., sweat lodge exposures). These ratios represent the hazard quotient (HQ) and, when less than one, are interpreted to mean the chemical-specific average daily dose is below the level associated with adverse effect. The summation of pathway-specific HQ values will characterize the net impact to each receptor for an exposure scenario specific to a COPC.

A summation of HQ values for each COPC type—inorganic, organic, and radiological—will provide a hazard index (HI). The HI is likely to overestimate the true human health risks because many chemicals act on different target organs. If the target HI is exceeded, a segregation of the HI by toxicological endpoint will be considered in consultation with Ecology and EPA.

The oral risk, or cancer risk due to ingestion, will be quantified by multiplying the lifetime average daily dose from ingestion of a COPC to the appropriate oral CSF. The effects due to inhalation of carcinogenic chemicals will be evaluated by multiplying the EC by the appropriate an inhalation unit risk factor. Dermal CSFs will be used to estimate potential carcinogenic effect from the lifetime average daily dose (LADD) in an external environment, as applicable (e.g., sweat lodge exposures). In a similar means, cancer risk from exposure to radionuclides through ingestion, inhalation, and external exposure to radionuclides (in air and soil) is estimated as the product of the CSF specific to those exposure routes (including those CSF values adjusted for external soil exposure) and the lifetime average daily dose specific to those exposure routes. These products represent the incremental lifetime cancer risk (ILCR). Per the HHRAP (EPA 2005), the threshold for the total ILCR for COPCs, the total ILCR for radiological COPCs, and the constituent- and pathway-specific ILCR for COPCs and radiological COPCs is 1E−05 (or 1 in 100,000) exposed individuals. The total ILCR is the sum of all the constituent-specific ILCRs for COPCs and radiological COPCs of applicable pathways (inhalation, oral, and external) for each receptor.

[1] For external air exposure to radionuclides, the radionuclide-specific risk coefficient for morbidity for external air is used in lieu of the CSF. Refer to the RAWP (24590-WTP-RPT-ENV-14-002), Section 7.2.4.3, "Chronic Dermal Toxicity of ROPCs."

Potential health risks will be characterized separately for noncarcinogenic and carcinogenic endpoints, and chemical (i.e., nonradiological) and radiological cancer risks will be evaluated and presented separately.

Acute effects from direct inhalation of airborne COPCs (vapor and particulate) are evaluated by dividing the 1-hour maximum air concentrations by the AIEC to yield an acute hazard quotient (AHQ). An AHQ of 1.0 or less indicates that the maximum 1-hour air concentration is below the reference value. An AHQ threshold level of 1.0 is used to provide a conservative hazard evaluation per EPA (refer to CCN 063809, *Ecology/EPA to WTP Regarding Dioxin Slope Factor and Acute Hazard Threshold*).

Refer to the RAWP (24590-WTP-RPT-ENV-14-002), Section 7.4, “Risk Characterization,” for more detail on risk characterization.

Table 7-1 Human Receptor Populations and Exposure Pathways

		Exposure Pathways												
		Inhalation Routes		External Radiation		Ingestion								
Receptor	**Location**	Emissions [a]	Resuspended Soil	Radionuclides in air	Radionuclides in soil	Soil	Produce	Beef	Milk	Chicken & Eggs	Pork	Fish [b]	Drinking Water [b]	Breast milk [c]
Plausible Exposure Scenarios (evaluated in current and future timeframes)														
Hanford site industrial worker (adult)	Works at onsite ground maximum	X	X	X	X	X								X
	Resides at Hanford offsite location	X	X	X	X	X								
	Consumes homegrown produce (offsite)						X							
	Consumes water (Columbia River max)												X	
Resident (adult and child)	Resides at Hanford offsite location	X	X	X	X	X								X
	Consumes homegrown produce (offsite)						X							
	Consumes water (Columbia River max)												X	
Worst-Case Exposure Scenario (evaluated in current and future timeframes)														
Acute exposure	Acute maximum	X		X										
Resident subsistence farmer (adult and child)	Resides at Hanford offsite location	X	X	X	X	X								X
	Consumes homegrown produce/livestock (offsite)						X	X	X	X	X			
	Consumes water (Columbia River max)												X	
Resident subsistence fisher (adult and child)	Resides at Hanford offsite location	X	X	X	X	X								X
	Consumes homegrown produce (offsite)						X							
	Consumes fish and water (Columbia River max)											X	X	

X = complete exposure pathway for receptor.

[a] Includes direct inhalation of vapor phase and particulate emissions. Applicable to current timeframe only (during WTP emissions).

[b] Pathway attributable to exposure to water/fish from the Columbia River maximum.

[c] Includes nursing infant assessment - maternal exposures indicated.

Table 7-2 Resident Subsistence American Indian Exposure Pathways

		Exposure Pathways															
		Inhalation Routes			External radiation		Ingestion									Absorp-tion	
Receptor	**Location**	Emissions [a]	Resuspended Soil	Sweat Lodge Vapors [b]	Radionuclides in air	Radionuclides in soil	Soil	Produce	Beef [c]	Domestic Chicken & Eggs	Wild Produce	Wild Game	Wildfowl & Eggs	Fish [b]	Drinking Water [b]	Sweat Lodge Vapors [b]	Breast milk [d]
Resident Subsistence American Indian #1 (adult and child)	Resides at Hanford offsite location	X	X		X	X	X										X
	Consumes wild produce/game (hunter/gatherer area)										X	X	X	X			
	Consumes water (Columbia River max)			X											X	X	
Resident Subsistence American Indian #2 (adult and child)	Resides at Hanford offsite location	X	X		X	X	X										X
	Consumes homegrown produce/livestock (offsite)							X	X	X							
	Consumes wild produce/game (hunter/gatherer area)										X	X	X	X			
	Consumes water (Columbia River max)			X											X	X	

X = complete exposure pathway for receptor.

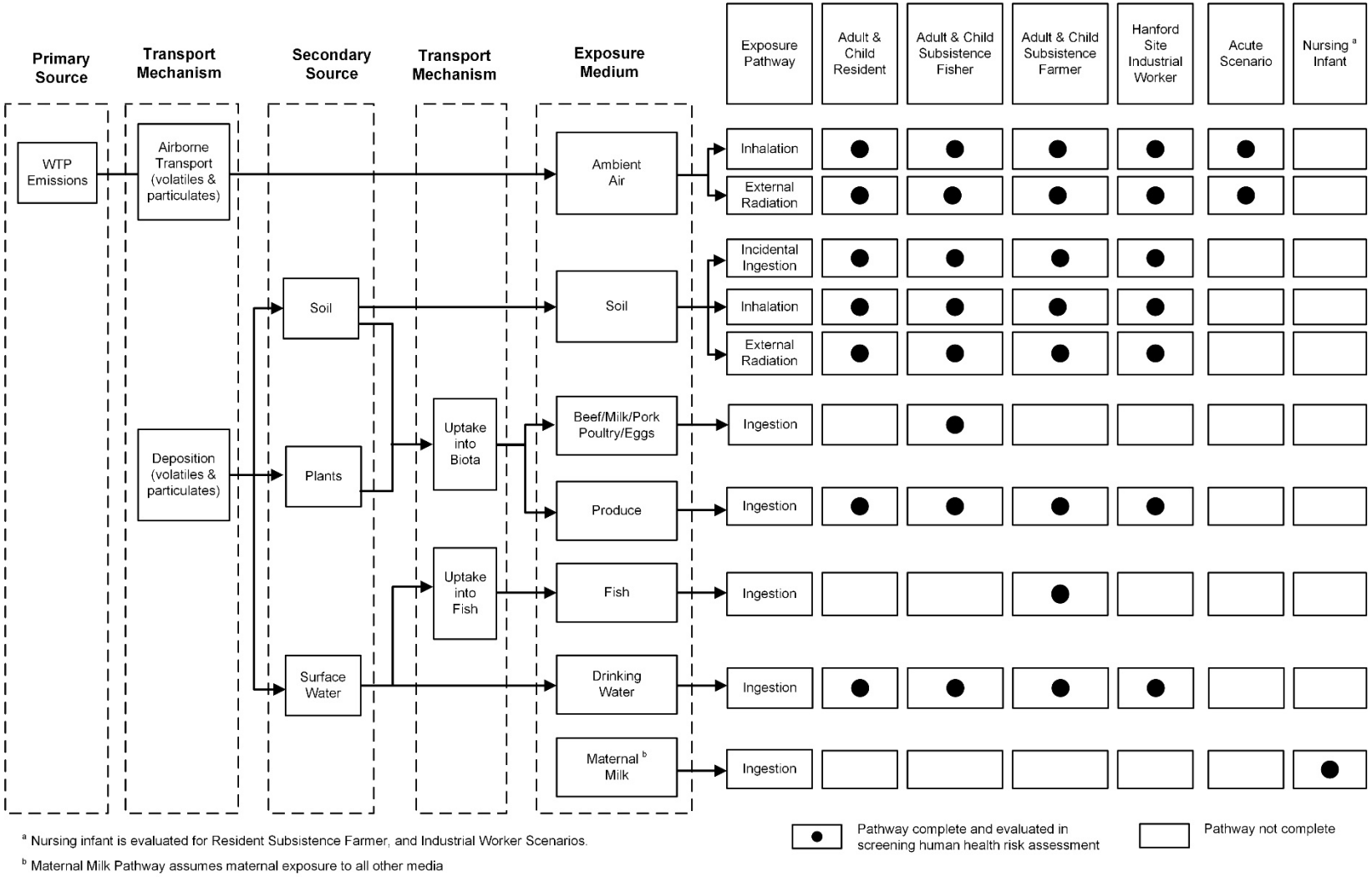
[d] Includes direct inhalation of vapor phase and particulate emissions. Applicable to current timeframe only (during WTP emissions).

[e] Pathway attributable to exposure to water/fish from the Columbia River maximum.

[f] Guidance used to develop the American Indian exposure scenario #2 made no distinction made for type of livestock so beef consumption is assumed (no pork consumption assumed).

[g] Includes nursing infant assessment - maternal exposures indicated.

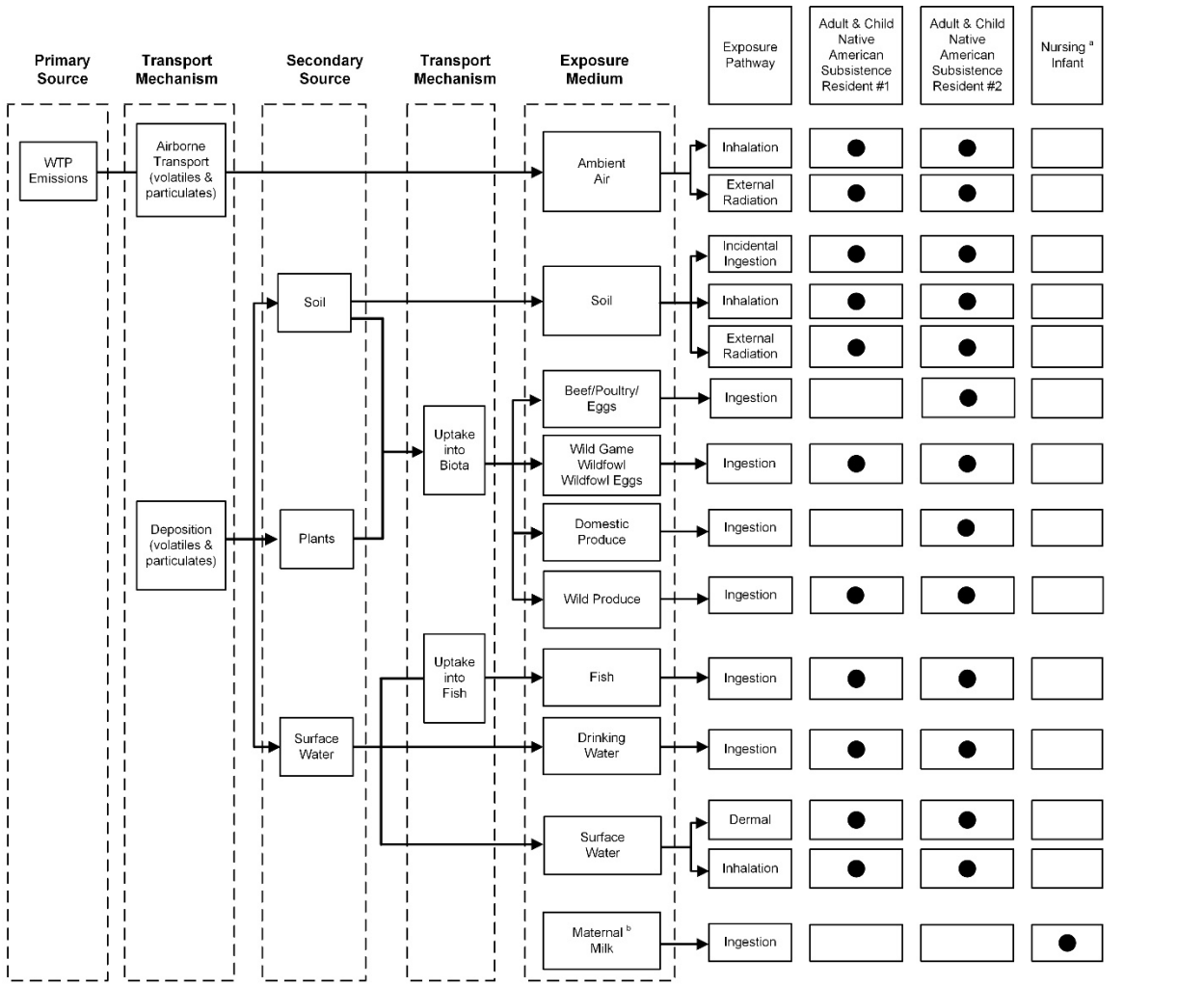
Figure 7-1 Human Health Conceptual Exposure Model



[a] Nursing infant is evaluated for Resident Subsistence Farmer, and Industrial Worker Scenarios.

[b] Maternal Milk Pathway assumes maternal exposure to all other media

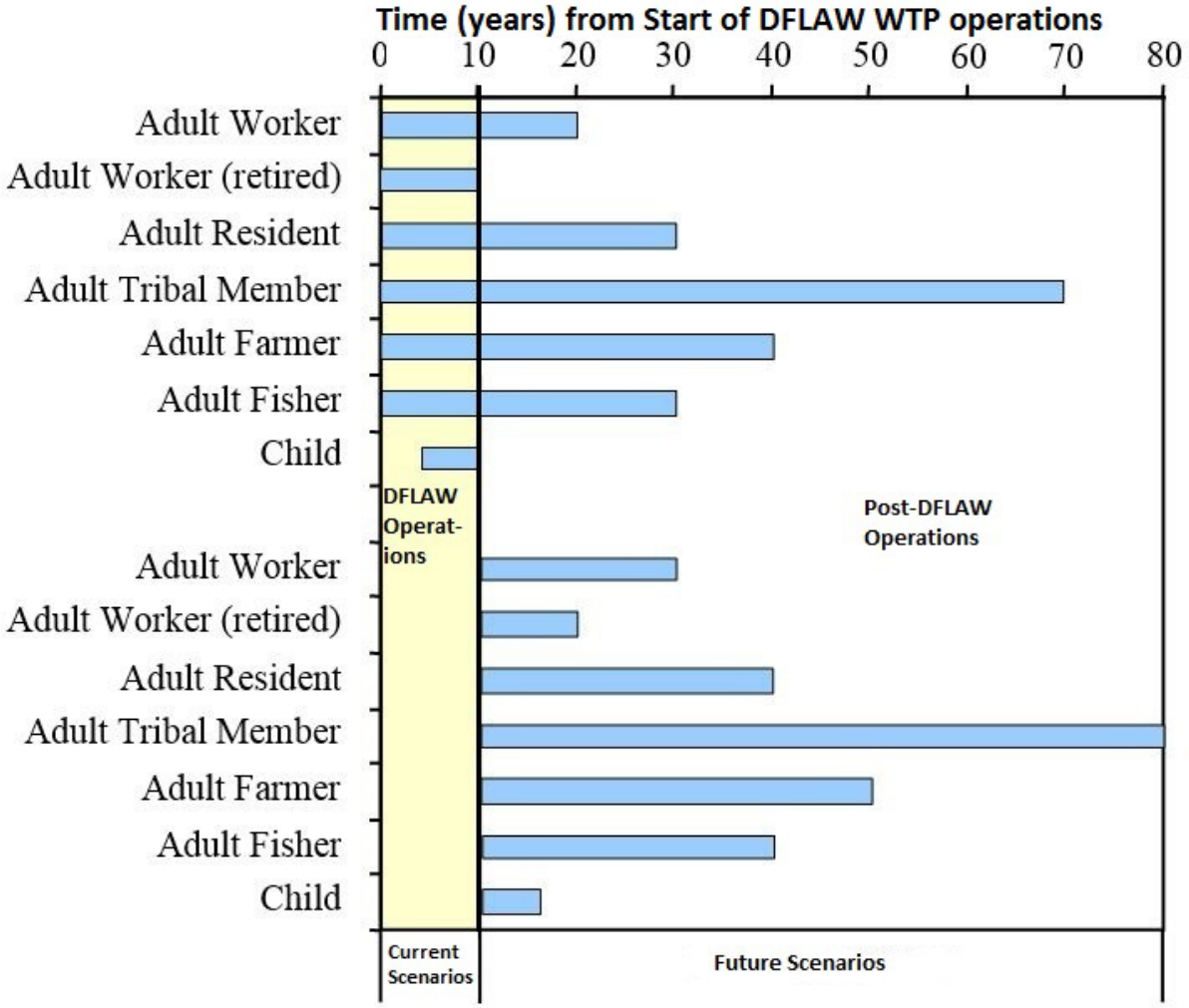
Figure 7-2 Human Health Conceptual Exposure Model for American Indians



[a] Nursing infant is evaluated for Native American Subsistence Resident Scenarios

[b] Maternal Milk Pathway assumes maternal exposure to all other media

Figure 7-3 Receptor Exposure Timeline



8 Screening-Level Ecological Risk Assessment

The screening-level ecological risk assessment (SLERA) incorporates four fundamental components of the ERA process: (1) problem formulation, (2) exposure assessment, (3) effects assessment, and (4) risk characterization. Selection of COPCs and radiological COPCs (discussed in Section 4 of this work plan), quantification of emissions (discussed in Section 5), and dispersion modeling (discussed in Section 6) feed critical information to this process. The SLERA is intended to meet the following three goals identified by EPA in EPA530-D-99-001A, *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (EPA 1999a):

- It provides the high end, conservative exposure estimate.
- It identifies which pathways are driving risks specific to a COPC and receptor.
- It allows risk management efforts to be prioritized.

A conceptual exposure model has been developed that identifies ecological receptors and complete exposure pathways (i.e., exposure scenarios). The conceptual exposure model is shown in Figure 8-1. The conceptual model focuses on identifying complete exposure pathways for potentially exposed receptor populations.

The following is a list of terrestrial ecological receptors selected for use in the SLERA:

- Plants (Trophic Level 1)[2]
- Terrestrial invertebrates (Trophic Level 2)[2]
- Herbivorous mammals (Trophic Level 2) – mule deer
- Herbivorous birds (Trophic Level 2) – mourning dove
- Omnivorous mammals (Trophic Level 3) – Great Basin pocket mouse
- Omnivorous birds (Trophic Level 3) – western meadowlark
- Carnivorous mammals (Trophic Level 4) – coyote
- Carnivorous birds (Trophic Level 4) – burrowing owl, red-tailed hawk

The conservative approach is to assume receptors are exposed to air, soil concentrations, and terrestrial plants at the onsite ground 90th percentile. This value represents a “high-end” ecological exposure, and was chosen to better represent the home range of the trophic level 4 receptors, whose exposure at a single discrete location is not probable. For simplicity, the Columbia River maximum was chosen for assessing water and sediment related exposures.

The aquatic ecological receptors selected for use in the SLERA are shown in bold on Figure 8-1 and are listed as follows:

- Plants (Trophic Level 1)[2]
- Benthic invertebrates (Trophic Level 2)[2]
- Aquatic organisms, fish, and other aquatic biota (Trophic Levels 2 through 4)[3] – bass, salmon, channel catfish, water fleas, other invertebrates

[2] Species-specific measurement receptors not identified because the group is evaluated on a community level.
[3] Species-specific measurement receptors are planktivorous, omnivorous, and carnivorous fish; however, when sufficient data is available (e.g., toxic response data), Trophic Level 4 carnivores are assessed as salmon.

- Herbivorous waterfowl (Trophic Level 2) – Canada goose
- Shorebirds (Trophic Level 3) – spotted sandpiper
- Piscivorous birds (Trophic Level 4) – great blue heron, bald eagle
- Piscivorous mammals (Trophic Level 4) – mink

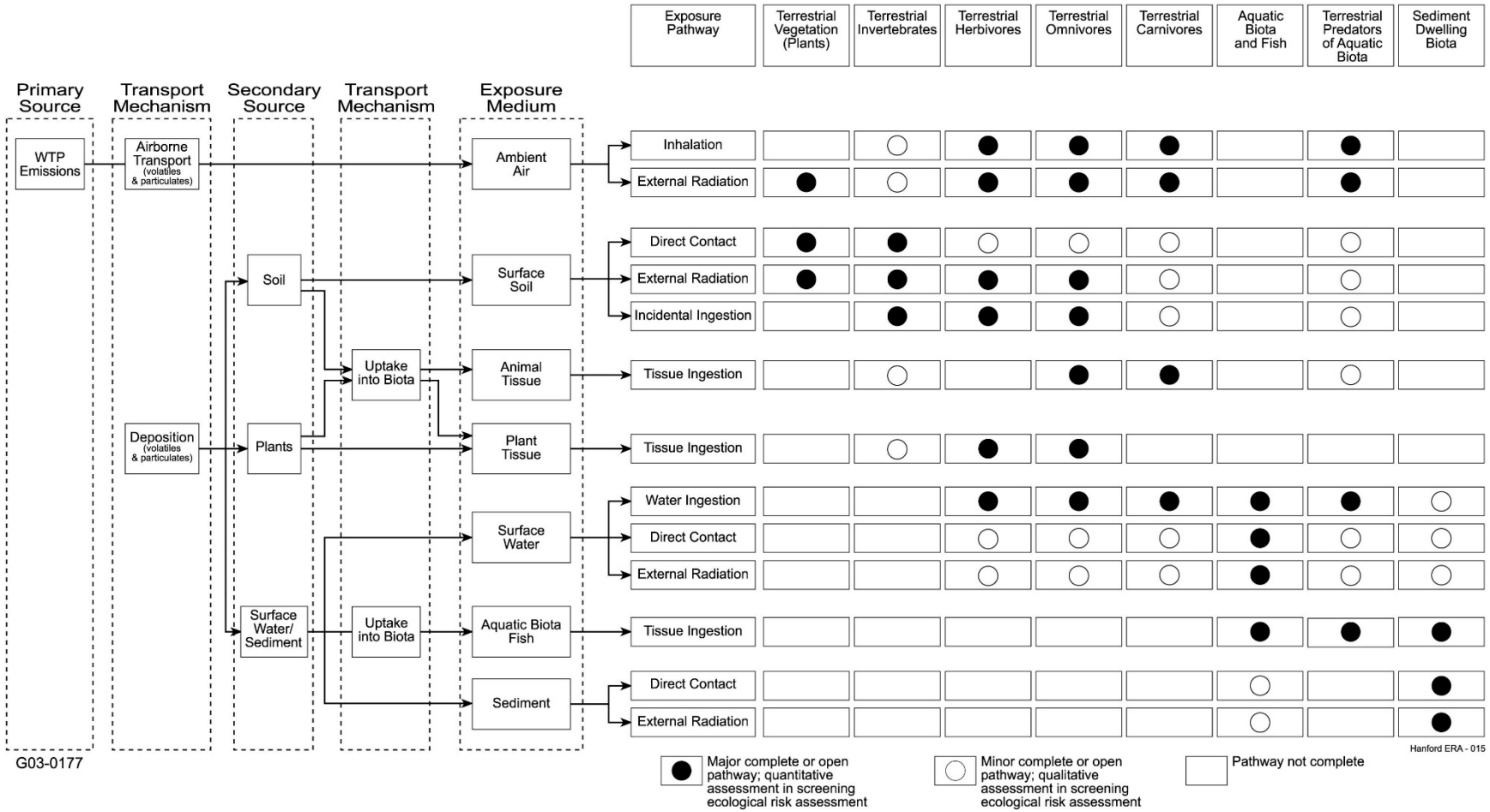
The reasons for selecting the representative receptors are provided herein. The conservative approach taken is to assume receptors are exposed to water, sediment concentrations, and aquatic plants at the Columbia River maximum.

Estimation of the risk to ecological receptors from COPCs in environmental media at an exposure location requires an estimate of exposure and a toxicity reference value (TRV). The estimated dose is the dose associated with the exposure media in lower trophic-level receptors. For higher trophic-level receptors, the estimated dose is the sum of the dose due to food (plants, prey, and associated radiation dose, as applicable) and the environment (which includes incidental ingestion of soil and sediment, water consumption, and external radiation dose from air, soil, and sediment). The TRVs are concentrations or doses of constituents that are associated with a specified level of adverse effect and are receptor- and constituent-specific (refer to RAWP Supplement 4). Risk estimates for a receptor at an exposure location are calculated as the ecological screening quotient (ESQ), which is the ratio of the estimated exposure level to the TRV. There is limited data for developing inhalation TRVs and very limited data for developing dermal TRVs. Therefore, inhalation and dermal absorption exposures will not be evaluated quantitatively. Excluding inhalation and dermal exposure in the SLERA is a source of uncertainty.

Refer to the RAWP (24590-WTP-RPT-ENV-14-002), Section 8, “Screening-Level Ecological Risk Assessment,” for more detail on risk characterization.

The total ESQ for a receptor at a given exposure location is the sum of the ESQs for all COPCs with similar modes of toxicity and is an index of the combined risk from exposure to multiple COPCs. However, for the SLERA, ESQs for all COPCs of a specific type (inorganic, organic, and radiological), regardless of mode of action, will be grouped and summed; such summing represents the most conservative case and serves as a screening tool. When the total ESQ by COPC type exceeds 0.25, additional ESQs by mode of action will be developed with the approval of Ecology if a scientific management decision so indicates. Such ESQ values, if more than 1.0, may indicate a need for further consideration of the underlying scientific basis for the ESQ, as described in EPA 600/R-98/137, *Methodology for Assessing Health Risks Associated with Multiple Pathways of Exposure to Combustor Emissions* (EPA 1999b). An ESQ for an ROPC is the ratio of estimated daily dose to its TRV. TRVs for ROPCs are 0.1 rad/d for higher trophic-level species (terrestrial and riparian mammals and birds) and 1.0 rad/d for lower trophic-level species (plants, aquatic biota, salmonids, and terrestrial and benthic invertebrates). The threshold (or limit) value for a radiological ESQ is 1, either for an ESQ for a single ROPC or for a total ESQ for multiple ROPCs. Total ESQ (also termed, “sum of fractions”) is the sum of ESQs for all single ROPCs.

Figure 8-1 Ecological Resources Conceptual Exposure Model



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DRAWINGS AND DOCUMENTS
OPERATING UNIT GROUP 10 – APPENDIX 6.3
PRE-DEMONSTRATION TEST RISK ASSESSMENT
FOR THE HANFORD TANK WASTE TREATMENT AND IMMOBILIZATION PLANT

The documents listed in the following table are incorporated by reference into this permit and are subject to the requirements set forth in Part I Standard Conditions, Part II General Facility Conditions, and Part III Operating Unit Group 10 Conditions. Upon request, copies of the documents can be viewed at the Nuclear Waste Program Resource Center located at 3100 Port of Benton Blvd. Richland, WA. Appointments for viewing can be scheduled by calling (509) 372-7950.

Appendix	Drawing/Document Number	Description
Appendix 6.3	24590-WTP-RPT-ENV-18-001, Rev. 0	Pre-Demonstration Test Risk Assessment for the Hanford Tank Waste Treatment and Immobilization Plant

Source documents (which do not include a “P” in the last set of numbers, e.g. “-P0001,” or “-TP001”) should be used in conjunction with any document change notices issued against them.

We are currently transitioning from permit documents (which do include a “P” in the last set of numbers to source documents. At the end of the transition period, permit submittals will contain source documents and will be incorporated into the permit as described in Ecology Publication # 07-05-006.

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Issued by
RPP-WTP PDC

Pre-Demonstration Test Risk Assessment for the Hanford Tank Waste Treatment and Immobilization Plant

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Approver's signature: Donna Yasek 7/16/19

Signature

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Notice

Please note that source, special nuclear, and byproduct materials, as defined in the *Atomic Energy Act of 1954* (AEA), are regulated at the US Department of Energy (DOE) facilities exclusively by DOE acting pursuant to its AEA authority. DOE asserts, that pursuant to the AEA, it has sole and exclusive responsibility and authority to regulate source, special nuclear, and byproduct materials at DOE-owned nuclear facilities. Information contained herein on radionuclides is provided for process description purposes only.

History Sheet

Rev	Reason for revision	Revised by
0	Initial Issue	D. Blumenkranz

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Acronyms iii

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Appendix D Sources of Uncertainty ..... D-i

Acronyms

2,3,7,8-TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
ADD	average daily dose
AIEC	acute inhalation exposure criteria
BLM	US Bureau of Land Management
BOF	Balance of Facilities
CASRN	Chemical Abstracts Service registry number
COPC	constituents of potential concern (includes both chemicals and radionuclides)
DD	daily dose
DF	decontamination factor
DFLAW	Direct Feed Low-Activity Waste
DOE	US Department of Energy
DST	double-shell tanks
DWP	Dangerous Waste Permit (WA7890008967)
EC	exposure concentration
Ecology	Washington State Department of Ecology
EEL	estimated exposure level
FW	fresh weight
EIS	Environmental Impact Statement
EMF	Effluent Management Facility
EPA	US Environmental Protection Agency
EPC	exposure point concentrations
ERA Model	Environmental Risk Assessment Model for the Hanford Tank Waste Treatment and Immobilization Plant
ESQ	ecological screening quotient
FRA	Final Risk Assessment
FWS	US Fish and Wildlife Service
HEME	high efficiency mist eliminator
HEPA	high-efficiency particulate air
HHRA	human health risk assessment
HHRAP	Human Health Risk Assessment Protocol (*Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA530-R-05-006)
HI	hazard index
HLW	high-level waste (Facility)
HMW	high molecular weight
HOP	HLW melter offgas treatment process system
HQ	hazard quotient
ILCR	incremental lifetime cancer risk
Lab	Analytical Laboratory
LADD	lifetime average daily dose

LAW	low-activity waste (Facility)
LMW	low molecular weight
LOP	LAW primary offgas process system
LVP	LAW secondary offgas/vessel vent process system
MTG/d	metric tons of glass per day
NOAEL	no-adverse-effect-levels
ORP	Office of River Protection
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyl
PCDD	polychlorinated dibenzo-p-dioxins
PCDF	polychlorinated dibenzofurans
PEM	process emissions model
PIC	products of incomplete combustion
PJM	pulse jet mixer
PJV	pulse jet ventilation system
PODC	principal organic dangerous constituents
PRA	preliminary risk assessment (*Pre-Demonstration Test Risk Assessment for the Hanford Tank Waste Treatment and Immobilization Plant*)
PT	Pretreatment (Facility)
PVP	pretreatment vessel vent process system
PVV	PT process vessel vent exhaust system
RAWP	24590-WTP-RPT-ENV-14-002, *Environmental Risk Assessment Work Plan for the Hanford Tank Waste Treatment and Immobilization Plant*
RDQO	regulatory data quality objectives
RFD	reverse flow diverter
RLD	radioactive liquid waste disposal system
SBS	submerged bed scrubbers
SCR	selective catalytic reduction
SLERA	screening level ecological risk assessment
SLERAP	Screening Level Ecological Risk Assessment Protocol (*Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA530-D-99-001A)
SST	single-shell tanks
T&E	threatened and endangered
TAP	toxic air pollutants
TCO	thermal catalytic oxidation
TEQ	toxic equivalents
TRV	toxicity reference value
TWINS	Tank Waste Information Network System
UHC	underlying hazardous constituents
VOC	volatile organic compounds
VSL	Vitreous State Laboratory

WESP	wet electrostatic precipitators
WTP	Hanford Tank Waste Treatment and Immobilization Plant

Executive Summary

ES.1 Conclusions

This pre-demonstration test risk assessment report (PRA) meets the requirements established by condition III.10.C.11.b of the Hanford Tank Waste Treatment and Immobilization Plant (WTP) Dangerous Waste Permit (DWP). It addresses two WTP operating configurations: Direct Feed Low-Activity Waste (DFLAW) for the near-term, and baseline WTP that follows. The PRA used the best available information with approved models, including US Environmental Protection Agency (EPA) combustion risk assessment guidance and the conservative exposure scenarios and assumptions therein, as well as other scenarios and methods in the approved risk assessment work plan (RAWP) for the WTP.

The human health risk assessment (HHRA) analyzed four adult, child, and infant scenarios involving exposure to multiple environmental media: worker, resident, resident subsistence farmer, and resident subsistence fisher. Two American Indian scenarios provided by local tribes were also assessed.

The cancer threshold for health concern in this HHRA for chemicals of potential concern (COPC) is a probability of 1 in 100,000 incremental lifetime cancer risk. A noncancer hazard index of 1 or less generally indicates that the exposure is likely to be without an appreciable risk of deleterious effect. For this HHRA, a hazard index threshold level of 0.25 was chosen to account for possible risks associated with other emissions sources. The primary conclusion of the HHRA is that the cancer and non-cancer risks were below their thresholds for all scenarios. Therefore, emissions from the operation of the WTP will not present adverse effects to the local workforce or surrounding populace.

The screening-level ecological risk assessment (SLERA) evaluated terrestrial and aquatic receptors inhabiting the Central Plateau area and the Columbia River. A total ecological screening quotient (ESQ) threshold of 0.25 was also chosen for evaluating ecological risk, and a value of 1 or less also indicates COPCs will not adversely affect the populations of wildlife at the site. The total ESQs and the additional evaluation of the conservative assumptions used to assess exposure and toxicity indicate that terrestrial and aquatic wildlife populations will not be adversely affected by operation of the WTP in DFLAW or full baseline modes.

ES.2 Risk Assessment

ES.2.1 Introduction

The PRA evaluated potential risks to human health and ecological resources from atmospheric emissions from WTP operations at the Hanford Site based on engineering estimates of emissions from WTP waste processing facilities. The emissions were estimated based on a conservative assessment of waste feed characteristics, including a comprehensive, forward-looking identification and assessment of COPCs, their concentrations in process offgases, and their destruction and removal by the air pollution control system. The PRA will be refined after completion of the performance demonstration test, scheduled to occur at the end of the DFLAW cold commissioning, and before dangerous or mixed waste treatment. The Final Risk Assessment (FRA) will be based on the emissions data from the test and refinement of the evaluation of risks to people and ecological resources.

For near-term operations, WTP will be operated in a DFLAW operating configuration for a minimum of 10 years, involving the Low-Activity Waste (LAW) Facility and the Effluent Management Facility

(EMF). Figure ES-1 shows the DFLAW facilities and the emissions sources (stacks) that are included in the PRA. Offgas emissions are treated before release to the atmosphere.

In the DFLAW operating configuration, the tank waste will be pretreated within the Hanford tank farms, and the pretreated LAW feed will be fed directly from the tank farms to the LAW Facility, bypassing the Pretreatment (PT) Facility which will not be needed. The LAW Facility is where the low-activity fraction of the waste is solidified by vitrification. Process waste liquid effluent from the LAW Facility will be transferred and treated at the EMF. The LAW Facility and EMF will generate atmospheric emissions. This results in the DFLAW feed having higher nitrates and nitrites than the Baseline feed because the waste will not be processed through PT.

The WTP will later be operated in the baseline WTP operating configuration for 40 years, when the PT Facility and the High-Level Waste (HLW) Facility become operational. Figure ES-2 shows the facilities associated with this configuration and the emissions sources that are included in the assessment. The PT Facility will separate and pretreat the LAW and HLW, as well as manage recycle waste streams produced from the LAW and HLW waste treatment operations, instead of the LAW recycles being treated at the EMF, as under the DFLAW configuration. Treated LAW and HLW will be transferred to the respective LAW and HLW Facilities for vitrification. Offgas emissions from the LAW, HLW, and PT Facilities will be treated before release to the atmosphere in this configuration.

ES.2.2 Air and Environmental Modeling

The identification and evaluation of the source terms for the two configurations were performed using procedures and models specified in the approved RAWP. The waste feed was characterized based on a list of 412 organic and inorganic COPCs from the Best-Basis Inventory, reported and suspected tank waste constituents, products of incomplete combustion (PIC) from waste treatment processes and other combustion devices, criteria pollutants, and offgas emission tests at the laboratory and pilot scales. A non-zero quantity was assigned to each waste feed COPC, even where data for a potential concentration did not exist.

Estimates of COPC emissions to the atmosphere were prepared using the process emission model (PEM) by modeling plant operations with a bounding feed vector. The PEM tracks waste constituent mass by performing a mass balance around each unit process as the waste material moves from process-to-process through the facilities.

The offgas treatment systems are composed of several units that remove, neutralize, and otherwise destroy substances and incompatible characteristics of the offgases. For the control systems, decontamination factors with appropriate degrees of conservatism were applied to the incoming quantity and phase of COPCs at each unit operation to predict destruction and removal efficiency by unit operations. Prior to modeling the dispersion of COPCs in the atmosphere, their concentrations in the emissions, as predicted by the PEM, were conservatively increased by the application of process upset (safety) factors. Furthermore, estimated emissions rates were compared to those based on projected analytical detection limits associated with stack testing. COPC emission rates based on concentrations below analytical detection limits were increased to rates corresponding to detection limits in accordance with the RAWP.

The CALPUFF (Version 5.8.5) air dispersion model was used to estimate how emitted COPCs are dispersed in the atmosphere. CALPUFF was identified as a preferred model for assessing long-range transport of air pollutants in EPA's *Guideline on Air Quality Models* (40 CFR 51, Appendix A) at the time the WTP risk assessment was initiated and is considered a screening technique to be used in consultation with the appropriate reviewing authority. CALPUFF was chosen as the appropriate air

dispersion model for the WTP in regulatory negotiations (CCN 057108, *Discuss and Resolve a Number of Outstanding Risk Assessment Issues in the WTP Risk Assessment Work Plan (RAWP)*).

Figure ES-1 DFLAW Operating Configuration

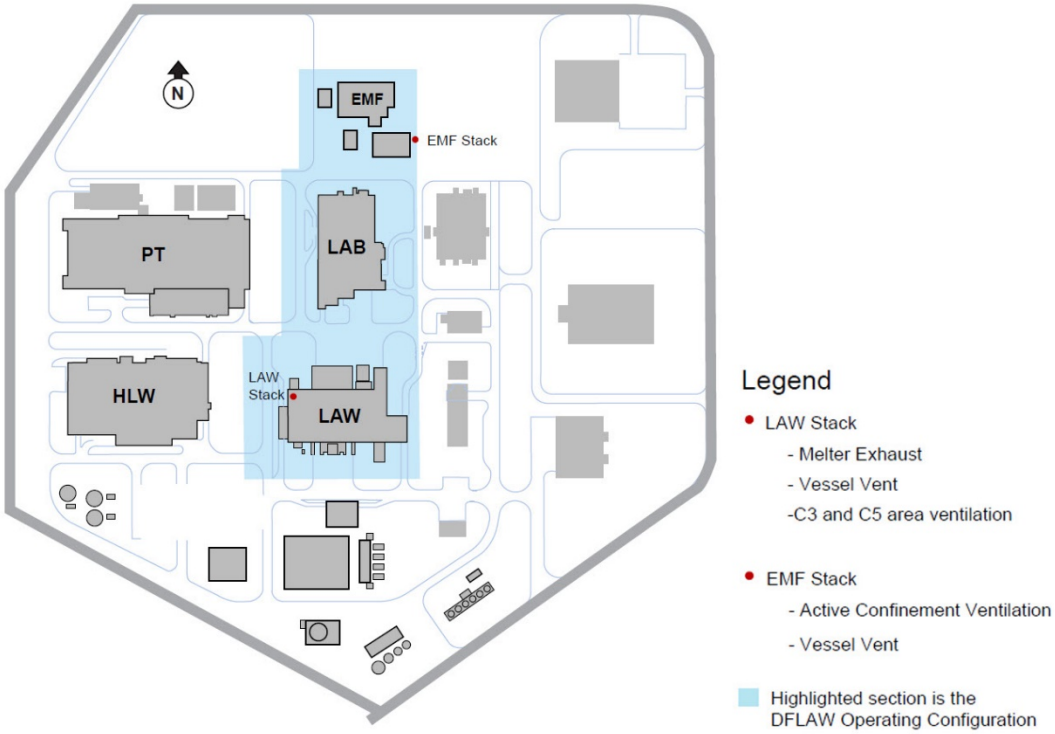
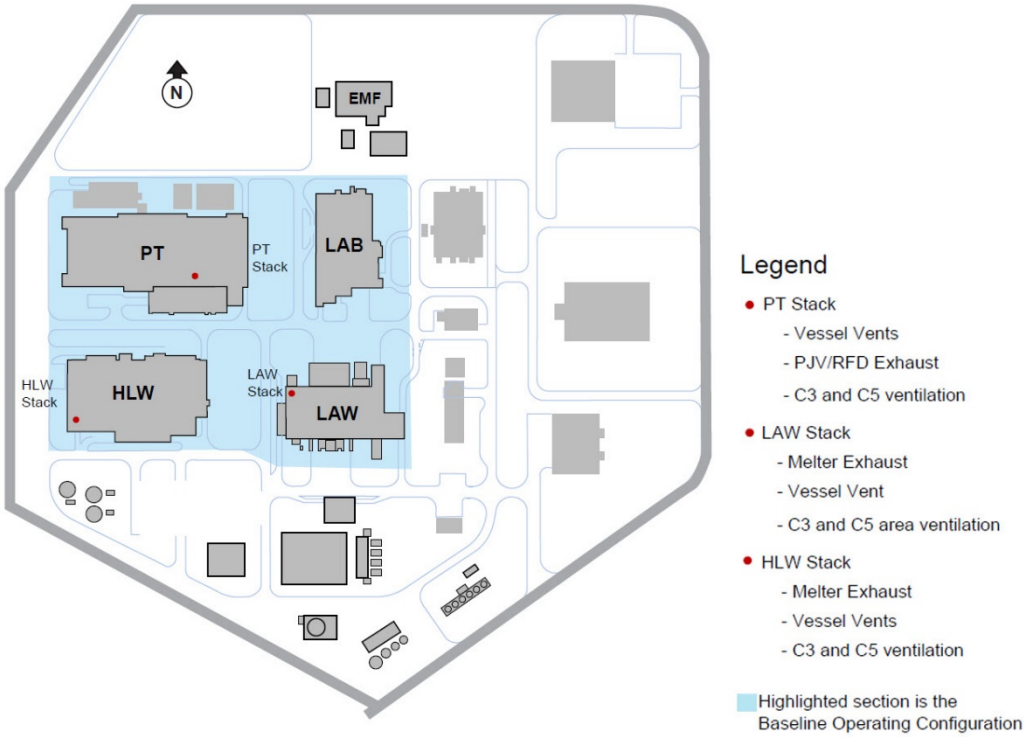


Figure ES-2 Baseline Operating Configuration



The model represented how emissions are dispersed in the atmosphere and deposited within 50 kilometers of the WTP, particularly on the soil and plants around the WTP and on the surface of the Columbia River. Additional approved environmental models were used to estimate the resulting COPC exposure point concentrations in soil, water, plants, and animals. Current (i.e., operational) and future (i.e., post-operational) exposures levels were estimated for all scenarios for each WTP configuration.

ES.2.3 Human Health Assessment

A range of human exposure scenarios with the COPCs were evaluated using approved methods. Plausible exposure scenarios (i.e., currently exist or may be reasonably expected to exist in the future) and parameter values were developed for:

- Adult Hanford Site industrial worker
- Adult and child resident

Worst-case exposure scenarios (i.e., hypothetical worst-case conditions involving scenarios not expected to occur) and parameter values were developed for:

- Acute (short-term) exposure
- Adult and child resident subsistence farmer
- Adult and child resident subsistence fisher

Infant scenarios were also prepared for exposure to co-planar polychlorinated biphenyls (PCB), polychlorinated dibenzo-p-dioxins, and polychlorinated dibenzofurans in breast milk in all scenarios except acute exposure. In addition, two adult and child subsistence American Indian scenarios with the COPCs were assessed based on exposure parameters provided by local tribes.

Cancer effects, represented by the calculated incremental lifetime cancer risk (ILCR), were estimated from the exposure levels using the available toxicity parameters of cancer slope factors. Noncancer effects, represented by the calculated hazard indices (HI), were estimated with reference doses. Acute air toxicity concentrations were used for the acute exposures.

Table ES-1 and Table ES-2 provide the summation of cancer risk and non-cancer risks, respectively, for the DFLAW operating configuration. The greatest cancer risk value is 1.6E-06 for the current adult subsistence farmer. The greatest non-cancer risk is an HI of 1.1E-03 for the current child resident subsistence farmer.

Table ES-1 Total Incremental Lifetime Cancer Risk for Exposure Scenarios for the DFLAW Operating Configuration

Time-frame	COPC Type	Hanford Site Industrial Worker	Resident		Resident Subsistence Farmer		Resident Subsistence Fisher	
			Adult	Child	Adult	Child	Adult	Child
Current	Chemicals	6.2E-09	4.7E-09	2.8E-09	1.6E-06	3.5E-07	1.2E-08	5.9E-09
Current	Radionuclides	3.1E-08	6.3E-09	1.9E-09	1.4E-07	7.9E-09	2.1E-08	3.3E-09
Future	Chemicals	7.5E-10	4.0E-10	3.2E-10	3.1E-09	9.4E-10	4.0E-10	3.2E-10
Future	Radionuclides	2.6E-08	1.4E-09	5.0E-10	7.1E-08	3.7E-09	1.4E-09	5.0E-10

Note: Incremental lifetime cancer risk health threshold value is 1.0E-5.

Table ES-2 Total Hazard Index for Exposure Scenarios for the DFLAW Operating Configuration

Time-frame	COPC Type	Hanford Site Industrial Worker	Resident		Resident Subsistence Farmer		Resident Subsistence Fisher	
			Adult	Child	Adult	Child	Adult	Child
Current	Chemicals	1.4E-03	4.9E-04	6.3E-04	8.5E-04	1.1E-03	6.9E-04	7.7E-04
Future	Chemicals	1.9E-04	9.4E-05	2.3E-04	1.2E-04	2.9E-04	9.4E-05	2.3E-04

Note: Hazard index health threshold is 2.5E-01.

Table ES-3 and Table ES-4 provide the summation of estimated cancer and non-cancer risks, respectively, for the baseline WTP operating configuration. The greatest cancer risk value is 2.6E-06 for the current adult subsistence farmer. The greatest non-cancer risk is an HI of 9.8E-03 for the current child resident subsistence farmer.

In no case for either configuration did the cumulative ILCR or HI for chemicals or radionuclides exceed the health threshold values of 1.0E-5 (ILCR) or 0.25 (HI), respectively.

Table ES-3 Total Incremental Lifetime Cancer Risk for Exposure Scenarios for the Baseline WTP Operating Configuration

Time-frame	COPC Type	Hanford Site Industrial Worker	Resident		Resident Subsistence Farmer		Resident Subsistence Fisher	
			Adult	Child	Adult	Child	Adult	Child
Current	Chemicals	4.5E-08	3.4E-08	1.3E-08	2.6E-06	5.5E-07	1.2E-07	2.5E-08

Table ES-3 Total Incremental Lifetime Cancer Risk for Exposure Scenarios for the Baseline WTP Operating Configuration

Time-frame	COPC Type	Hanford Site Industrial Worker	Resident		Resident Subsistence Farmer		Resident Subsistence Fisher	
			Adult	Child	Adult	Child	Adult	Child
Current	Radionuclides	6.3E-08	1.2E-08	2.2E-09	1.6E-07	1.3E-08	3.9E-08	3.0E-09
Future	Chemicals	6.6E-09	2.7E-09	2.8E-09	5.1E-08	1.1E-08	2.7E-09	2.8E-09
Future	Radionuclides	6.7E-08	4.5E-09	1.4E-09	2.0E-07	1.0E-08	4.6E-09	1.4E-09

Note: Incremental lifetime cancer risk health threshold value is 1.0E-5.

Table ES-4 Total Hazard Index for Exposure Scenarios for the Baseline WTP Operating Configuration

Time-frame	COPC Type	Hanford Site Industrial Worker	Resident		Resident Subsistence Farmer		Resident Subsistence Fisher	
			Adult	Child	Adult	Child	Adult	Child
Current	Chemicals	2.7E-03	8.2E-04	1.5E-03	7.2E-03	9.8E-03	4.2E-03	3.9E-03
Future	Chemicals	1.0E-03	4.8E-04	1.2E-03	8.9E-04	1.8E-03	4.8E-04	1.2E-03

Note: Hazard index health threshold is 2.5E-01

Risk drivers are those constituents with exposure estimates greater than 10% of the threshold values. No radionuclide presented a cancer risk or dose that would cause it to be considered a risk driver. No single COPC resulted in an acute exposure greater than 10% of the acute inhalation exposure criterion, nor did the sum of their indices exceed 10% of the acute hazard quotient threshold of 1.

Only one COPC was identified as a risk driver: dibenz[a,h]anthracene for the DFLAW operating configuration for the resident subsistence farmer, with an excess lifetime cancer risk value of 1.1E-06. Dibenz[a,h]anthracene is modeled as a feed COPC and a PIC. It was reported as a feed constituent in the feed vector, but its concentration was based on two samples whose results were the analytical detection limits for supernatant and tank sludge (i.e., undetected). A query of historical analytical data for dibenz[a,h]anthracene in tank waste shows analysis of 224 samples for dibenz[a,h]anthracene with nothing ever detected. In all likelihood, the dibenz[a,h]anthracene analytical detection limit (the basis for its feed concentration) is a conservative and bounding value, over-representing its actual concentration in the waste.

In the mutagen assessment, in no case did the cumulative cancer risk exceed the health criterion of 1.0E-05. For the nursing infant, exposure levels were below background and the chemical and radionuclide risks were below 1.0E-05 in all cases.

The two American Indian scenarios presented results that were below the health thresholds of both the cumulative cancer risk value of 1.0E-05, and the cumulative noncancer HI of 0.25.

The potential effects of uncertainty sources were qualitatively analyzed for each of the major components of the assessment: COPCs, waste characterization and feed vectors, emission estimates, environmental modeling, and the additional components of the risk assessment (exposure, toxicity, and risk characterization). This analysis supported the conservative design of the assessment, as those sources leading to overestimation of the risks dominated those leading to underestimating them.

ES.2.4 Ecological Resources Assessment

Terrestrial receptors inhabiting the Central Plateau and aquatic receptors inhabiting the Columbia River were evaluated. Ecological risks associated with operation in both the DFLAW and baseline WTP configurations were evaluated using conservative methods to determine exposure potential and toxicity. For each WTP configuration, exposure levels for each receptor were estimated based on contact with and uptake from media (soil, surface water, and sediment) and food. Potential impacts were estimated from the exposure levels using the available toxicity reference values (*TRV*). The *TRV*s, safe concentrations or doses of constituents that represent no-adverse-effect levels, were compiled according to the hierarchy specified in the RAWP. Dividing the receptor's exposure level by the *TRV* produces an ecological screening quotient (*ESQ*) that can be summed across multiple COPCs to provide an index quantifying potential impacts without regard to modes of action. *ESQ*s and indices less than 1 indicate with high confidence that COPCs do not adversely affect a receptor. *ESQ*s and indices exceeding 1 do not indicate that a COPC is hazardous but rather indicate that additional analysis is required to determine a more realistic estimate of risk.

Table ES-5 provides the sum of *ESQ*s for organic, inorganic, and radionuclide COPCs for each receptor for the DFLAW operating configuration. Organic COPCs may present a potential adverse effect to the red-tailed hawk and burrowing owl based on *ESQ* values of 1.4 and 0.58, respectively. These exceedances are probably not significant because the PRA assumed that the hawk resides and hunts at the upland location equal to the 90th percentile value and, therefore, does not account for the bird's expansive hunting range (refer to Table 4-1). In addition, known owl burrows are well outside of the terrestrial exposure assessment grid (DOE/RL-96-32). Otherwise, the results indicate that operation in the DFLAW configuration will not adversely affect ecological resources at the site.

Table ES-5 Ecological Screening Quotient Indices for the DFLAW Operating Configuration

COPC Type	Terrestrial Plant ESQ	Terrestrial Invertebrate ESQ	Mule Deer ESQ	Mourning Dove ESQ	Great Basin Pocket Mouse ESQ	Western Meadowlark ESQ	Coyote ESQ	Burrowing Owl ESQ	Red-Tailed Hawk ESQ
Inorganics	3.6E-01*	1.6E-05	4.6E-04	8.9E-06	3.4E-05	6.3E-07	6.0E-07	2.1E-06	4.4E-07
Organics	4.5E-04	7.6E-05	3.3E-04	1.1E-01	1.6E-02	3.9E-02	1.2E-02	5.8E-01*	1.4E+00*
Radionuclides	2.3E-07	3.4E-10	1.7E-09	3.4E-09	4.3E-09	3.4E-09	4.8E-09	4.1E-09	1.7E-10
COPC	**Aquatic Plant ESQ**	**Benthic Invertebrates ESQ**	**Aquatic Biota ESQ**	**Fish ESQ**	**Spotted Sandpiper ESQ**	**Canadian Goose ESQ**	**Great Blue Heron ESQ**	**Mink ESQ**	**Bald Eagle ESQ**
Inorganics	6.2E-09	1.1E-08	2.5E-09	8.6E-04	9.3E-09	2.6E-09	2.1E-09	2.5E-09	1.4E-09
Organics	6.4E-06	1.2E-02	8.5E-07	7.6E-06	5.0E-03	1.9E-04	8.6E-04	6.3E-05	6.0E-04
Radionuclides	2.7E-08	1.2E-14	4.1E-13	4.1E-13	1.7E-13	1.7E-13	4.0E-12	4.2E-12	4.2E-12

*** ESQ in excess of screening threshold.**

Note: ESQ threshold is 2.5E-01.

Table ES-6 provides the sum of *ESQ*s for organic, inorganic, and radionuclide COPCs for each receptor for the baseline WTP operating configuration. The results indicate that the *ESQ* for terrestrial plants is 1.5, and the ESQs for the Great Basin pocket mouse, coyote, burrowing owl, and red-tailed hawk are 4.0, 3.2, 0.73, and 1.8, respectively. As explained in Section 4.5.2.1, these slightly elevated *ESQ*s are probably not significant as they may be based on toxicity reference values for which there may be some concern and, in addition, the *ESQ*s are based on the assumption that the COPCs contributing significantly to the *ESQ* values are based on the same mode of toxicity. The other results indicate that operation of the baseline WTP generally will not adversely affect ecological resources at the site.

Table ES-6 Ecological Screening Quotients for the Baseline WTP Operating Configuration

COPC Type	Terrestrial Plant ESQ	Terrestrial Invertebrate ESQ	Mule Deer ESQ	Mourning Dove ESQ	Great Basin Pocket Mouse ESQ	Western Meadowlark ESQ	Coyote ESQ	Burrowing Owl ESQ	Red-Tailed Hawk ESQ
Inorganics	1.5E+00*	7.1E-04	2.5E-03	4.0E-04	2.0E-04	2.5E-05	3.7E-06	9.0E-05	8.7E-06
Organics	1.6E-03	1.4E-03	4.6E-04	1.0E-01	4.0E+00*	5.0E-02	3.2E+00*	7.3E-01*	1.8E+00*
Radionuclides	1.4E-07	2.1E-09	7.8E-09	1.5E-08	3.1E-08	1.5E-08	2.9E-08	2.6E-08	7.4E-10
COPC	**Aquatic Plant ESQ**	**Benthic Invertebrates ESQ**	**Aquatic Biota ESQ**	**Fish ESQ**	**Spotted Sandpiper ESQ**	**Canadian Goose ESQ**	**Great Blue Heron ESQ**	**Mink ESQ**	**Bald Eagle ESQ**
Inorganics	2.9E-08	5.3E-08	1.2E-08	7.0E-04	4.4E-08	1.3E-08	9.9E-09	5.7E-09	6.7E-09
Organics	7.7E-06	1.3E-02	2.2E-06	2.2E-05	4.4E-03	1.7E-04	2.2E-03	9.0E-03	1.6E-03
Radionuclides	1.6E-08	6.4E-14	1.6E-12	1.6E-12	1.6E-12	1.6E-12	1.7E-11	1.8E-11	1.8E-11

*** ESQ in excess of screening threshold.**
Note: ESQ threshold is 2.5E-01.

The slightly elevated total inorganics *ESQ* for terrestrial plants is explained by an *ESQ* of 1.5 for nitrogen oxides. The *TRV* used to calculate the *ESQ* is based on a poorly designed scientific experiment that did not approximate how nitrogen oxides behave in the environment; thus, this *ESQ* was concluded to be highly unreliable and unrealistic. The *ESQ* of 1.4 (DFLAW operating configuration) and 1.8 (baseline WTP operating configuration) for the hawk is explained by the sum of *ESQs* for polycyclic aromatic hydrocarbons (PAH), which the SLERA assumed follow a model of additivity even though PAHs can cause many different effects in laboratory test animals, but low levels are not particularly hazardous in the environment because animals quickly metabolize the substances. In addition, based on further information about PAHs presented below, the SLERA concluded that results for the hawk greatly overestimate possible risks associated with PAHs.

Examination of the organics *ESQs* indicated that PCBs were responsible for the elevated values for the mouse and coyote (Table ES-7) for the baseline WTP operating configuration.

Table ES-7 PCBs ESQs for the Baseline WTP Operating Configuration

Receptor	Organics ESQ	PCB ESQ
Coyote	3.2	3.2
Great Basin Pocket Mouse	4.0	3.9

Like the HHRA, the SLERA qualitatively evaluated uncertainty sources including the environmental modeling, the exposure and toxicity assessments, and the risk characterization. The uncertainty analysis supported the conservative design of the assessment, reflected in the federal combustion risk assessment guidance and RAWP, as those aspects of the SLERA leading to overestimation of the risks dominated those that might underestimate risks.

The finding of PCBs as a potential hazard to the coyote (*ESQ*=3.2) and mouse (*ESQ*=3.9)may be an anomaly reflecting conservative assumptions that the terrestrial receptors would feed and forage only on animals inhabiting the location in the upland environment where maximum contaminant concentrations are calculated to occur. In reality, wildlife are mobile and hunt and forage throughout their home range, the size of which varies based on many factors including population density and type and availability of food, among other things. This type of anomaly, which is common to screening level ecological risk assessments, was also noted as far back as 1996 in the *Final Environmental Impact Statement for the Tank Waste Remediation System.*

An additional line of evidence indicating PCBs may not pose a hazard to ecological receptors concerns the assumed toxicity of PCBs to mammals. The *ESQ*s for the coyote and mouse are based on an EPA (EPA530-D-99-001A) PCBs *TRV* of 0.206 µg/kg/day derived from a study with the mink exposed to 3,3',4,4',5,5'-hexachlorobiphenyl. EPA (EPA530-D-99-001A) indicates that the lowest, most conservative toxicity data were used to develop *TRV*s, regardless of test species, receptor, and other relevant toxicity data. Since 1999, other *TRV*s and ecological screening values for PCBs have been developed for mammals. For instance, the PCBs *TRV* of 68 ug/kg/day for Aroclor 1254 for an oldfield mouse was used to develop Tier 2 Preliminary Remediation Goals for the site (CHPRC-01311). Application of this *TRV* results in *ESQ*s of 0.01 and 0.012 for the coyote and mouse, respectively. The PCBs mammal *TRV* issue is discussed in greater detail in Section 4.5.2.1. The range of possible *ESQ*s for total PCBs from about 4 down to less than 0.01 for the coyote and mouse indicate that total PCBs may require further scrutiny.

Individual PAHs did not present *ESQ*s greater than 0.25, but four of the compounds were identified as possible risk drivers based on the technical approach outlined in the RAWP. The first PAH, 5-methylchrysene, is a presumed constituent in the waste feed and was retained as a COPC because of its historical detection as a PIC within the incinerator industry. The compound is produced by the incomplete combustion of organic matter and is primarily found in gasoline exhaust and tobacco smoke. There are no tank waste characterization data or vapor data for 5-methylchrysene, and its formation during treatment of LAW and HLW is unlikely. Its concentration in the feed is a presumed quantity and has not been sampled for in tank waste because it is not known to have been in use during Hanford operations. Its inclusion as a COPC is precautionary, and it is most likely not a component of Hanford tank waste.

Three other PAHs that presented as risk drivers, including benzo(b)fluoranthene, benzo(k)fluoranthene, and benzo(a)anthracene, have not been detected in tank waste samples and were presumed to be PICs for the PRA. Note that the WTP will not treat PAH precursors and will not operate under conditions necessary for their formation as PICs. In addition, no PAHs were detected in the testing of the pilot-scale prototypical offgas system.

That PAHs are risk drivers is also anomalous given the precautionary assumptions made regarding presumed concentrations in the waste feed and, like PCBs, the conservative exposure assumptions underpinning the analyses. In addition, PAHs are quickly metabolized by wildlife, so the exposure concentrations in prey are overestimated even more so.

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1 Introduction

1.1 Purpose

This *Pre-Demonstration Test Risk Assessment for the Hanford Tank Waste Treatment and Immobilization Plant* (PRA) presents the estimated potential risks to people and ecological receptors from operation of the Hanford Tank Waste Treatment and Immobilization Plant (WTP). These estimates are based on engineering calculations of emissions from WTP. This PRA is required to satisfy requirements established by condition III.10.C.11.b of the Dangerous Waste Permit (WA7890008967, *Dangerous Waste Portion of the Hanford Facility Resource Conservation and Recovery Act Permit for the Treatment, Storage, and Disposal of Dangerous Waste*, herein referred to as the DWP). This condition specifies that, prior to initial receipt of dangerous and (or) mixed waste in the WTP, the permittees must submit a PRA as DWP Appendix 6.3, which must address and include the following:

- Direct and indirect human health and ecological risk assessments performed pursuant to 24590-WTP-RPT-ENV-14-002, *Environmental Risk Assessment Work Plan for the Hanford Tank Waste Treatment and Immobilization Plant* (RAWP)
- Estimated stack emissions data (as reported in 24590-WTP-ES-PE-17-001, *Emissions Study for the Hanford Tank Waste Treatment and Immobilization Plant*)
- Basis and assumptions for these emissions, including but not limited to, projected operating conditions, feed-rates, and treatment effectiveness

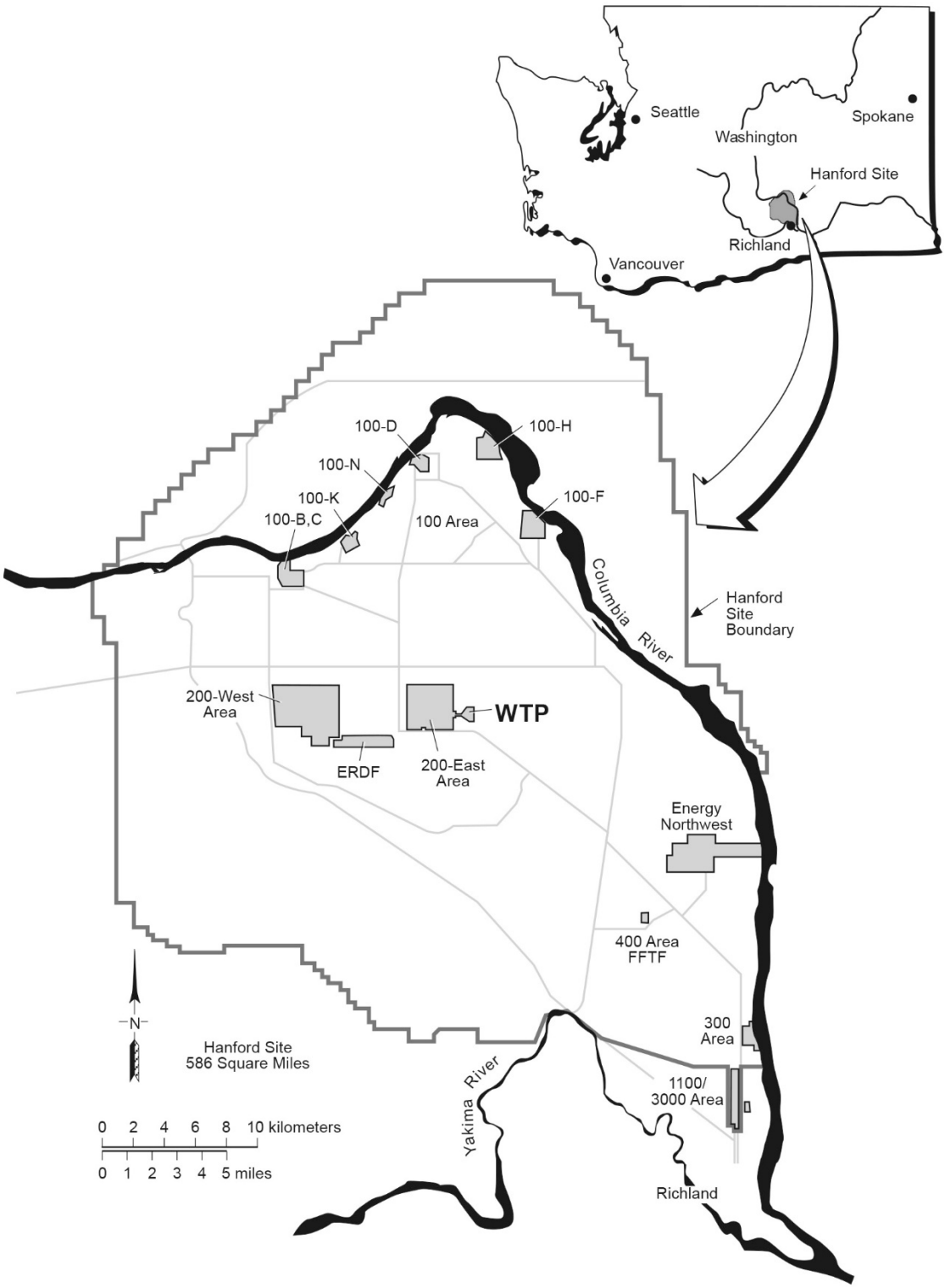
The purpose of this PRA is to present an evaluation of the potential worst-case impacts to people and ecological receptors from exposure to environmental media potentially impacted by WTP airborne emissions. The process involves data gathering, modeling, and conducting a risk assessment to evaluate the potential risks. The PRA is conducted using a variety of conservative assumptions throughout the entire process in order to bound estimated impacts and aid in the identification of risk drivers. This report provides the results of the PRA process. The PRA provides data that will benefit decision makers and assist in establishing initial operating conditions for the facilities that are protective of humans and ecological receptors. The results of this process are put into perspective by a discussion of risk characterization and an uncertainty analysis to facilitate informed risk management decisions.

This PRA will be refined after completion of a performance demonstration test, scheduled to be performed at the end of the cold commissioning for the direct feed to the Low-Activity Waste (LAW) Facility operating configuration (DFLAW), prior to mixed waste treatment. This PRA will then be superseded by a final human health and ecological receptor risk assessment report (FRA), in which the results of the performance demonstration test are substituted for the estimated emissions, and corresponding impacts to people re-evaluated, consistent with the RAWP. The RAWP contains further background descriptions, as noted in specific sections of this report.

1.2 Mission of the WTP and Its Operating Configurations

The Hanford Site is in southeastern Washington State; it is owned by the US government and is managed by the US Department of Energy (DOE), US Bureau of Land Management (BLM), US Fish and Wildlife Service (FWS), and Washington State Department of Fish and Wildlife. The WTP is located at the eastern end of the 200 East Area of the Hanford Site, northwest of Richland, Washington; on the 7.5-minute quadrangle topographic map of Gable Butte in Section 3, T12N, R26E, Willamette Meridian. Figure 1-1 shows the location of the WTP on the Hanford Site.

Figure 1-1 Location of the WTP on the Hanford Site



From 1944 through 1989, chemical processing facilities at the Hanford Site processed irradiated or spent nuclear fuel from defense reactors to separate and recover plutonium and other heavy elements for weapons production. The resultant waste is stored in 149 underground single-shell tanks (SST) and

28 underground double-shell tanks (DST) located in tank farms throughout the Central Plateau of the Hanford Site. The waste tanks received waste from all processing plants in the chemical separations areas, with smaller waste contributions from laboratories and other facilities.

The DOE evaluated several treatment alternatives for the Hanford tank waste (DOE/EIS-0391, *Final Tank Closure and Waste Management Environmental Impact Statement Hanford Site, Richland, Washington*, referred to as the TC&WM EIS). Ultimately, the chosen treatment alternative was separation of high-level (i.e., highly radioactive waste material resulting from the reprocessing of spent nuclear fuel) and low-activity (i.e., not high-level radioactive waste, waste incidental to reprocessing) tank waste components, followed by vitrification, in parallel with continued management of stored tank waste. The term "low-activity waste" generally refers to the supernatant and saltcake portion of Hanford's DST waste—although it can include suspended high-level waste (HLW) solids—while HLW generally refers to tank solids and sludges. The WTP will vitrify mixed radioactive waste from the Hanford tank system. The WTP includes five major facilities: Pretreatment (PT) Facility; LAW Facility; HLW Facility; Effluent Management Facility (EMF); Analytical Laboratory (Lab); and the Balance of Facilities (e.g., infrastructure and utilities) (BOF).

The WTP will be operated in two processing configurations.[1] Initially, WTP will be operated in the DFLAW operating configuration, involving the LAW Facility, the EMF, and the Lab, for 10 years. In the DFLAW operating configuration, the waste will be pretreated within the Hanford Tank Farms to remove cesium and solids. In this configuration, the pretreated LAW feed will bypass the PT Facility and be fed directly from the Tank Farms to the LAW Facility. The LAW Facility is where the low-activity fraction of the waste will be solidified by vitrification. The LAW Facility will generate liquid effluent. Liquid effluent generated in the LAW Facility and the Lab will be transferred and treated at the EMF. In the DFLAW operating configuration, the EMF will treat the bulk of the effluent from the LAW Facility by evaporation.

The WTP will then be operated for the next 40 years in the baseline WTP operating configuration, with the PT Facility and the HLW Facility both operational. The PT Facility will both separate and pretreat the LAW and HLW streams and manage recycle waste streams produced from the LAW and HLW waste treatment operation, instead of the EMF processing effluent streams, as in the DFLAW configuration. Treated LAW and HLW feed streams will be transferred to the respective LAW and HLW Facilities for vitrification. The three production process facilities (i.e., PT, LAW, and HLW Facilities) will also be supported by the BOF and Lab. The EMF will not support the baseline WTP operating configuration.

Human health and ecological receptor risks associated with both operating configurations are assessed using the same methodology as published in the RAWP. The differences are in the composition of the feed, the emission sources (e.g., the HLW and PT Facilities are not included in DFLAW), and the duration of operations (10 and 40 years). An advantage of this phased approach to operating the WTP is that DFLAW operations will generate data that can be used to assess the human health risks of operating in the baseline configuration, including emissions measurements and confirmation of some unit process efficiencies.

[1] For a detailed description of the WTP facilities and operations, consult Chapter 4 of the DWP.

1.3 Background

The major plans and reports associated with this risk assessment process include:

- **Risk assessment work plan** – The RAWP was submitted to comply with condition III.10.C.11.a of the DWP (approved by Washington State Department of Ecology [Ecology] on May 2, 2016). The RAWP establishes the methods for the implementation of the human health and ecological risk assessments. The pre-demonstration and final human health and ecological risk assessments are both described in the RAWP. The RAWP is supplemented with stand-alone support documents to specifically address conditions III.10.C.11.a.i through III.10.C.11.a.viii. These documents are also in Appendix 6.2 of the DWP and are listed in Table 1-1 below.

Table 1-1 Final Risk Assessment Work Plan and Supplements

Appendix	Document Number	Description
6.2	24590-WTP-RPT-ENV-14-002, Rev 0	Final RAWP – *Environmental Risk Assessment Work Plan for the Hanford Tank Waste Treatment and Immobilization Plant*
6.2.1	24590-WTP-RPT-ENV-10-001, Rev 0	Supplement 1 – *Constituents of Potential Concern for the WTP Air and Dangerous Waste Permits*
6.2.2	24590-WTP-ES-PE-17-001, Rev 0	Supplement 2 – *Emissions Study for the Hanford Tank Waste Treatment and Immobilization Plant*
6.2.3	24590-WTP-RPT-ENV-17-008, Rev 0	Supplement 3 – *Cell Emissions Estimate*
6.2.4	24590-WTP-RPT-ENV-14-003, Rev 2	Supplement 4 – *Chemical Parameters and Toxicological Inputs for the Environmental Risk Assessment for the Hanford Tank Waste Treatment and Immobilization Plant*
6.2.5	24590-WTP-RPT-ENV-08-001, Rev 4	Supplement 5 – *Hanford Tank Waste Treatment and Immobilization Plant Risk Assessment Air Quality Modeling Protocol*
6.2.6	24590-WTP-RPT-ENV-18-003, Rev 1	Supplement 6 – *Risk Assessment Work Plan for the Direct Feed Low Activity Waste Configuration*

- **Pre-demonstration test risk assessment report** – The pre-demonstration risk assessment is performed before performance-demonstration testing of the WTP. This assessment provides an estimate of human health and ecological receptor risk based on engineering estimates of emissions from WTP units.
- **Final risk assessment report** – The final risk assessment will be conducted following collection of data from performance demonstration testing of WTP units. The final risk assessment will be conducted using an approach like the preliminary assessment. However, estimated emission rates will be supplemented with the actual emissions results of the environmental performance demonstration tests. The performance demonstration test results cannot be used to validate air dispersion modeling (i.e, contaminant air concentrations and deposition rates) nor environmental modeling (e.g., contaminant soil concentrations), but will provide measured emissions rates. Note that all of these models contribute uncertainty, as described in Appendix D of this PRA.

This document presents the information that answers the question, “what do we know now?” based on computer-modelled estimates of emissions. These estimates are based on testing completed at Catholic University’s Vitreous State Laboratory (VSL), where one-tenth and one-third scale melter and off-gas systems were used as a “proof-of-concept” to confirm the effectiveness of the offgas components. During

this pilot testing, emissions sampling was done after each unit operation to arrive at decontamination factors (DF). A DF is equivalent to the removal efficiency that can be expected by each pollution abatement unit operation. The waste feed characteristics are also based on modelling using Tank Farm generator knowledge.

The use of these estimated emissions and feed characteristics is a starting point in the risk assessment process. Actual emissions and feed characteristics data will be gathered during the performance demonstration test that will be conducted in the DFLAW operating configuration. The performance demonstration test will use a simulant, or purchased product, that "mimics" general characteristics of Tank Farm waste (e.g., organics, chlorine, metals, nitrates and sulfates). The simulant will also be spiked with organics (principal organic dangerous constituents [PODC]), chlorine, and semi-volatile and nonvolatile metal compounds.

The RAWP provides a detailed description of the PRA methodology, including the basis and assumptions regarding selection of constituents of potential concern (COPC), air dispersion, environmental models, conceptual exposure model, exposure models and parameters, toxicity, and risk characterization. Figure 1-2 illustrates the overall risk assessment process. Supplement 2 of the RAWP (24590-WTP-ES-PE-17-001) provides estimated emissions, the basis and assumptions for those emissions, including waste feed composition, operational configuration, operating conditions, unit operations impacting emissions, diffusion and entrainment, emissions abatement, etc. For brevity, this PRA summarizes key bases and assumptions in the derivation of the potential human health and ecological impacts. The RAWP and its supplemental information should be consulted for additional detail.

1.4 Report Organization

The PRA analysis was prepared as a typical risk assessment, such as found in the *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (EPA530-R-05-006), hereinafter called Human Health Risk Assessment Protocol (HHRAP), and EPA's ecological risk assessment process. The report continues in the next section with a discussion of the emissions and environmental modeling that was performed to estimate the environmental concentrations of substances for air, soil, surface water, plants and animals. These concentrations were then used for exposure point concentrations (EPCs) for humans and ecological species. These EPCs were then combined with exposure parameters (e.g., frequency duration, intake rates) in the exposure assessment to estimate exposure levels. Finally, the exposure levels were combined with toxicity values to estimate the risks. The extensive assessment details contained in the RAWP are not duplicated in this report, which provides only summaries.

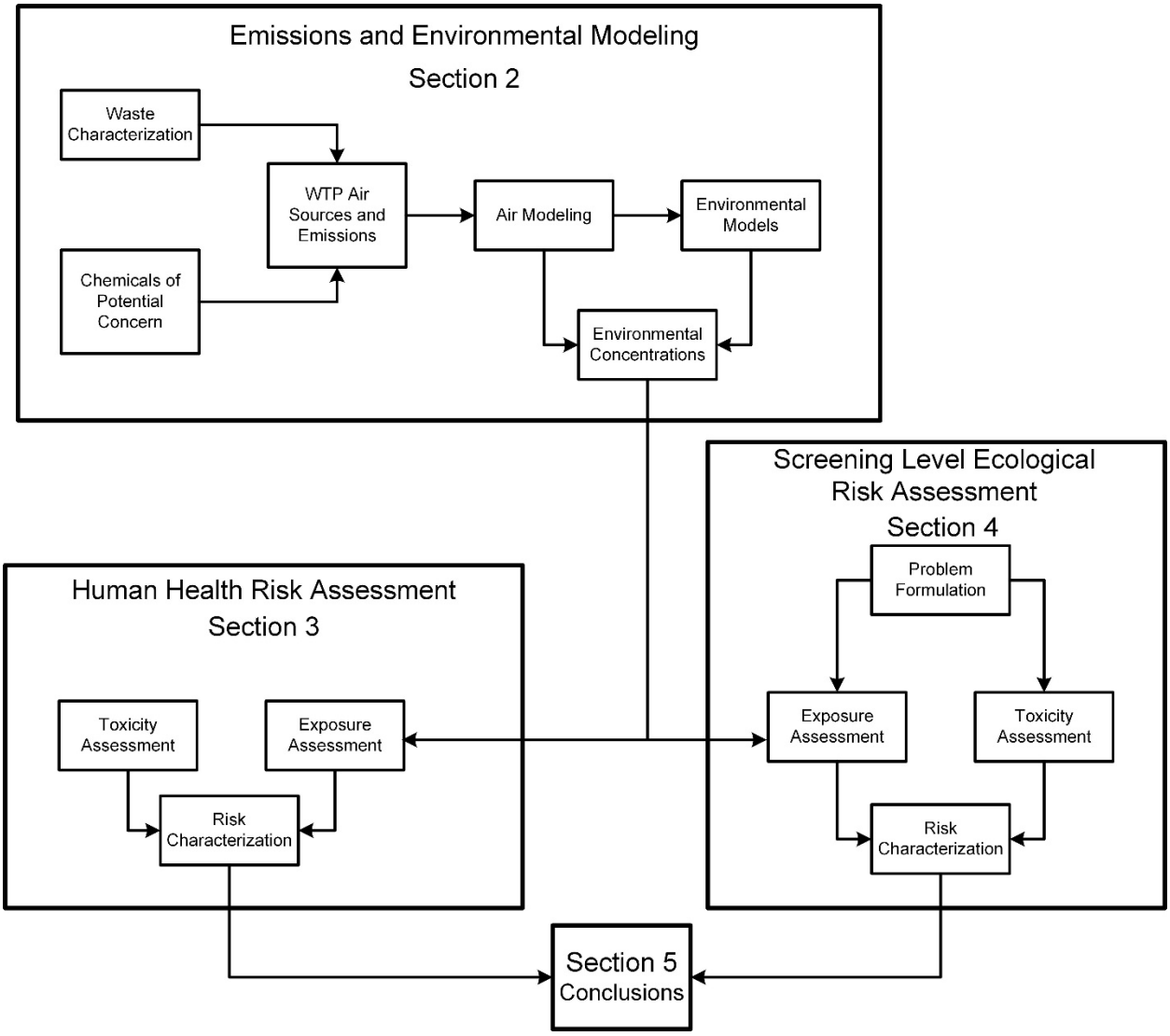
Figure 1-2 provides an overview of where these components can be found in this report. Section 2 describes the DFLAW and baseline WTP operating configurations and their emissions. Section 3 provides the human health risk assessment (HHRA), with subsections covering the exposure and toxicity assessments, and the risk characterization. Section 4 discusses the screening level ecological risk assessment (SLERA) with subsections covering problem formulation, exposure assessment, toxicity assessment, and risk characterization. Conclusions and recommendations are provided in Section 5. Each section describes the results for the DFLAW and baseline WTP operating configurations.

The use of COPCs and risk drivers in this report is different, however, from a typical risk assessment. A typical risk assessment for a site might include laboratory analysis for about 100 to 150 constituents. A procedure would then be applied to identify constituents potentially site-related and whose data are of sufficient quality for use in the quantitative risk assessment, called COPCs. The number of COPCs is typically less than the number initially identified. In contrast, the PRA consulted a number of different references to create a lengthy list of potential constituents that might be emitted at the site, with varying

levels of data quality (discussed in Section 2.2). This COPC list ultimately contained over 400 chemical and radiological constituents that were carried through the analysis. So the main difference between the PRA and a typical risk assessment is the absence of a step at the front of the PRA analysis to pare down the initial list of constituents and focus on those that are known or suspected to be associated with the facility. Results for individual COPCs with quantitative data were too extensive to include in this report but can be found in supplemental material. Total risks across all COPCs for individual pathways and across all pathways are included in this report.

"Risk driver" is described in the RAWP as a COPC that contributes 10 % or more of the threshold incremental lifetime cancer risk for human risk, or 10 % or more of the threshold hazard index for human or ecological risks. For humans, the thresholds are 1.0E-05 incremental lifetime cancer risk and a hazard quotient of 0.25 for noncancer risks. For ecological species, the threshold is an ecological screening quotient of 0.25. Instead of the typical application of COPCs, risk drivers have been described in this report to identify the major contributors, if any, to the exposures and risks.

Figure 1-2 PRA Report Organization



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2 WTP Emissions and Environmental Modeling

This section describes the major steps that were implemented to estimate the environmental concentrations used in both the human health and ecological risk assessments. The process began with the characterization of the mixed waste that leaves the DSTs and enters the WTP. This waste consists of a large number of chemical and radiological constituents, summarized by selecting a set of COPCs. The process characteristics of the DFLAW and baseline WTP operating configurations were used to estimate COPC emission rates, which were then used as input to an air quality dispersion model and other models to estimate the environmental concentrations for the ambient air, soil, Columbia River surface water and sediments, and animal species. Each of these steps is described in more detail in the remainder of this section.

2.1 Waste Characterization

Wastes derived from the SST system were generated primarily from three major chemical reprocessing operations: the bismuth phosphate process, the reduction oxidation process, and the plutonium uranium extraction process. The resultant wastes were blended and concentrated by evaporation to reduce the volume for storage in the large (up to 4,390,000 L) underground tanks. Acidic wastes were made alkaline through addition of sodium hydroxide or sodium carbonate to limit corrosion of the carbon steel tanks. The resulting waste consists primarily of precipitated metal hydroxides (sludge), alkaline salt solutions (supernatant), and crystallized salts (saltcake). Later, the tanks received spent nitric acid (from plutonium recovery operations), which was made alkaline by adding sodium hydroxide before transfer to the tanks. Sodium nitrite was also added as a corrosion inhibitor. These processing steps produced large volumes of sodium nitrate salts in the tanks.

Mixed wastes have accumulated in the DSTs since approximately 1971, depending on the age of the specific tank. The DSTs have and will continue to receive waste from the SSTs as part of SST waste retrieval operations.

Many waste components were added to the tanks or blended together as part of in-tank processes. In addition, some of the wastes were later reprocessed, resulting in significant blending of the wastes. Evaporators were used to reduce the waste volume. Waste was also left in waste tanks at high temperature, affecting which minerals formed from these wastes.

As a result of these waste processing activities, the tanks were filled with millions of gallons of waste as sludge, saltcake, and aqueous supernatant. The term “LAW feed” generally refers to the saltcake and supernatant portion of Hanford’s DST waste, although it can include HLW solids. The waste delivery processing in the Hanford Tank Farms is expected to dissolve most of the contents of the saltcakes when preparing the waste for sluicing to WTP.

Detailed information on tank waste characterization can be found in the Tank Waste Information Network System (TWINS). TWINS (PNNL 2018) is operated and maintained by the Pacific Northwest National Laboratory and serves as a living repository for tank inventory and characterization data.

2.2 Constituents of Potential Concern

The selection of COPCs for the WTP operating configurations focused on compounds that are: (1) likely to be emitted because of the presence of the compound or its precursors in the waste feed, utilizing waste

characterization information; (2) potential products of incomplete combustion (PIC); and (or) (3) those compounds potentially toxic to humans. Supplement 1 of the RAWP (24590-WTP-RPT-ENV-10-001, *Constituents of Potential Concern for the WTP Air and Dangerous Waste Permits*) should be consulted for further detail. Sources and adjustments for COPCs included:

1. The initial list of COPCs was taken from PNNL-12040, Rev. 0, *Regulatory Data Quality Objectives Supporting Tank Waste Remediation System Privatization Project*, also referred to as the "regulatory data quality objectives" (RDQO). The starting list includes both organic and inorganic constituents identified by DOE, Ecology, and the US Environmental Protection Agency (EPA) as COPCs.
2. Lower-toxicity organic chemicals that may be present in the tank waste but excluded from the RDQO list because they were "tentatively identified" were restored to the list (CCN 011395, *Resolution of RAWP Comments from May 7, 1999 Version of the Work Plan*).
3. The organic RDQO input list was updated as a result of changes to the underlying hazardous constituents (UHC), universal treatment standards (40 CFR 268.48, *Universal Treatment Standards*), and Double-Shell Tank DWP Application Part A Form (WA7890008967), and added tank waste compounds identified by the TWINS or Best-Basis Inventory not selected as RDQO or low-toxicity additions to the WTP feed COPC list. This step was necessary to align the COPCs with changes to the regulations and the Tank Farm Contractor's permit, and was consistent with the COPC selection process of the RDQO.
4. Chemicals from RPP-22491, Rev. 0, *Industrial Hygiene Chemical Vapor Technical Basis*, that were not already included in the COPC list as a result of the steps above, were added to the list of COPCs. This identified 17 compounds not otherwise included as COPCs by the preceding steps.
5. Radionuclides from Hanford Site tank waste inventory estimates (HNF-SD-WM-TI-740, *Standard Inventories of Chemicals and Radionuclides in Hanford Site Tank Wastes*) were included as COPCs. These radionuclides represent over 99% of the activity of the Hanford tank waste.
6. The list of feed COPCs was adjusted in accordance with the revision to WAC 173-460, *Controls for New Sources of Toxic Air Pollutants*, list of toxic air pollutants (TAP). This step was necessary to align the COPCs with changes to the regulations. This assessment was specific to the tank waste matrix and its potential to contain TAPs, and was consistent with the COPC selection process of the RDQO.
7. The list of COPCs was further adjusted in accordance with the agreements documented in 24590-WTP-RPT-MGT-04-001, *Regulatory Data Quality Objectives Optimization Report*. This adjustment to the COPC list optimized the list for tank characterization planning by specifying waste constituent COPCs (e.g., elimination or substitution of COPCs that are reactive with the waste or incompatible with waste analysis, or that lack regulatory drivers).
8. The list of feed COPCs was adjusted in accordance with the stack emission compounds from revised WAC 173-460 TAPs. This assessment was specific to the potential for the waste treatment process to generate TAPs, namely PICs.
9. Criteria pollutants (sulfur dioxide, particulate matter, carbon monoxide, ozone, nitrogen dioxide) from the national ambient air quality standards (40 CFR 60, *Standards of Performance for New Stationary Sources*) were added to the list of COPCs. Lead was already a COPC.
10. Chemicals that EPA had identified as potential PICs in combustion devices in EPA530-D-98-001A, *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, were compared to the list of COPCs. Although a number of these had already been identified as potential feed or PIC COPCs, the comparison added a number of PICs not previously considered COPCs, including dioxins, furans, and coplanar polychlorinated biphenyls (PCB).
11. Between 1998 and 2005, a series of offgas emission tests were conducted on various configurations of laboratory and pilot-scale vitrification melters by VSL. The results were used to identify

additional COPCs to be assessed in dangerous waste and air permitting activities, and identified 33 site-specific PICs.

Minor adjustments to the categorization of COPCs as waste feed constituents or PICs were made subsequently, as necessary, to ensure COPCs modeled within the WTP flowsheet were accurately estimated, as described in Supplement 2 of the RAWP (24590-WTP-ES-PE-17-001). The steps taken to identify COPCs resulted in over 400 COPCs in the waste, consisting of organics, inorganics, and radionuclides. Supplement 2 of the RAWP (24590-WTP-ES-PE-17-001) identifies these constituents by type (organic, inorganic, and radionuclide), category (feed, PIC, or both) and by Chemical Abstracts Service registry number (CASRN). The waste feed to the WTP for the COPCs used in this assessment is described in Appendix A.

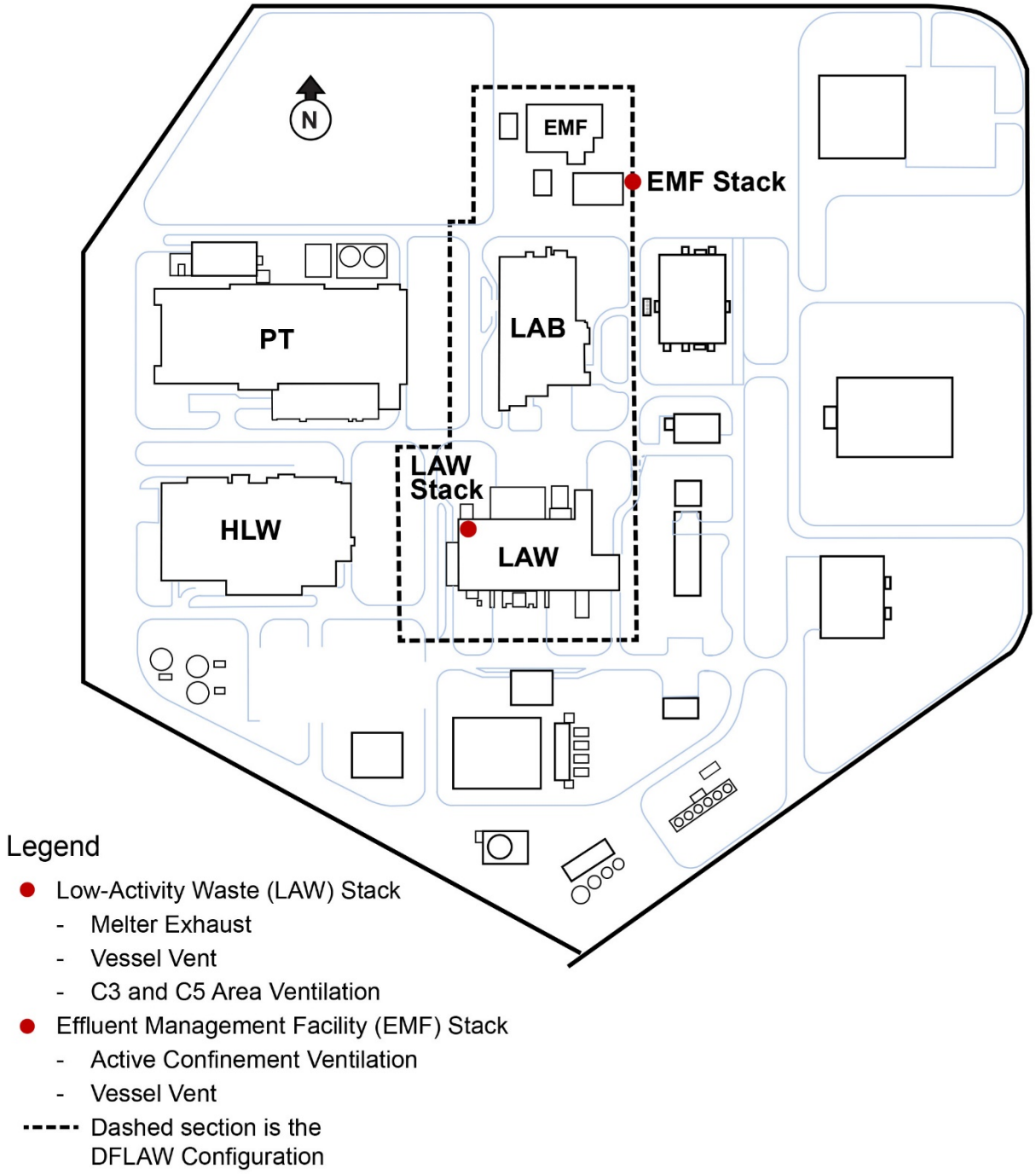
2.3 WTP Sources and Emissions

The following two sections describe the major emission sources and controls in each configuration. They are followed by a brief description of the facility emission estimates.

2.3.1 DFLAW Operating Configuration

Figure 2-1 shows the geographical distribution of the major DFLAW operating configuration facilities: the LAW Facility, EMF, and the Lab.

Figure 2-1 DFLAW Configuration



The LAW material will be fed directly from the Hanford Tank Farms to the LAW Facility, bypassing the PT Facility. The LAW Facility is designed to immobilize radioactive and hazardous/dangerous constituents in the treated LAW feed through vitrification. For the PRA, the Tank Farm waste is assumed to be delivered at a rate to support LAW Facility throughput at its maximum design capacity of 15 metric tons of glass per day (MTG/d) per melter, for two melters, with 100% availability.

The LAW melters generate offgas resulting from decomposition, oxidation, and vaporization of feed material. Constituents of the offgas will include nitrogen oxides (NO_x) from decomposition of metal nitrates in the melter feed; chloride, fluoride, and sulfur as oxides; acid gases; and particulates, including salts, cesium, and technetium as the radionuclides of significance; entrained feed material and glass. In addition, the LAW melters will generate small quantities of other volatile compounds, including iodine-129, carbon-14, tritium, and volatile organic compounds (VOC). Carbon-14 and tritium will be in the form of carbon dioxide and water, respectively.

The melters are ventilated by the LAW primary offgas process system (LOP) in series with the secondary offgas / vessel vent process system (LVP). The purpose of the LOP is to cool the offgas and remove aerosols generated by the melter. The primary components are film coolers, submerged bed scrubbers (SBS), and wet electrostatic precipitators (WESP). Vessel vent exhausts will combine with melter offgas at the interface of the LOP and LVP; thus, LOP and LVP controls will treat melter emissions, and LVP controls will treat vessel vent offgas. The LVP control equipment includes high-efficiency particulate air (HEPA) filters, carbon adsorbers, a thermal catalytic oxidation/ selective catalytic reduction (TCO/SCR) unit, and a caustic scrubber.

The EMF's purpose is to support processing of secondary liquid waste streams generated during LAW melter offgas control system operation. The EMF will also process small amounts of effluent from the Lab radioactive liquid waste disposal (RLD) vessels, as well as the waste transfer line flushing effluent. The EMF uses the vessels and evaporator design from the WTP pretreatment facility. It will collect and treat the liquid effluent in an evaporator. EMF evaporator condensate and Lab effluent will be sent from EMF to a disposal facility (liquid effluent retention facility/effluent treatment facility), while evaporator concentrates are recycled back to the LAW Facility for incorporation in the vitrification process. The EMF is assumed to operate at full capacity to support the LAW Facility. HEPA filters are used for control of air discharges.

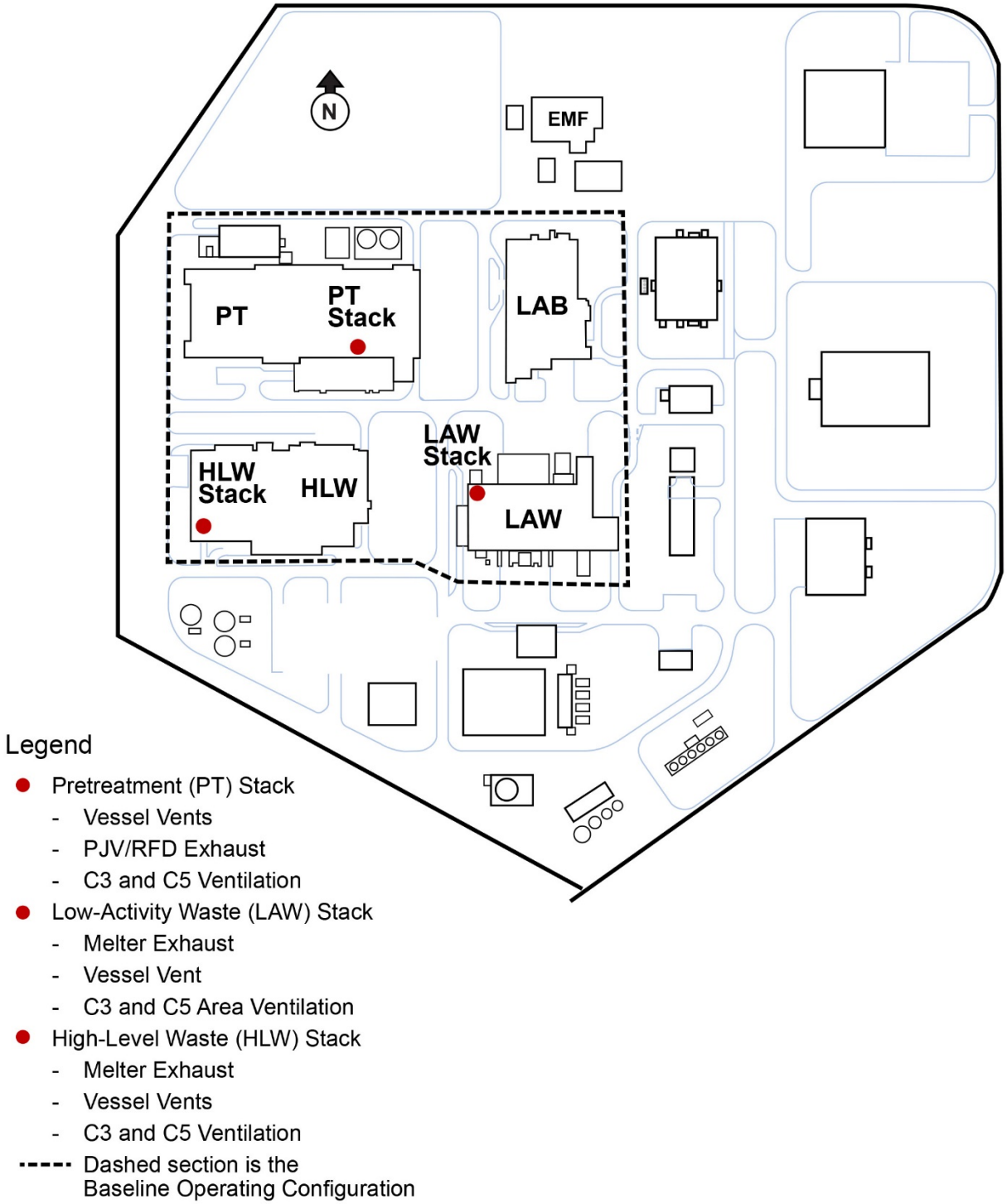
Working spaces are ventilated by separate cascades of ventilation that move air from areas of lower potential contamination to areas of higher potential contamination, passing through HEPA filters before discharging these sources to the atmosphere.

Detailed process and control technology descriptions for LAW waste processing systems and ventilation, and process offgas treatment systems are provided in Supplement 5 of the RAWP (24590-WTP-RPT-ENV-08-001), Section 5.2.2, while RAWP Supplement 6 (24590-WTP-RPT-ENV-18-003) contains this information for the EMF processing and offgas controls.

2.3.2 Baseline WTP Operating Configuration

Figure 2-2 shows the major baseline WTP operating configuration facilities: the PT, HLW, and LAW Facilities, and the Laboratory.

Figure 2-2 WTP Configuration



In this configuration, both LAW and HLW feed streams will be transferred from the Hanford Tank Farms and pretreated in the PT Facility via evaporation, ultrafiltration, cesium ion exchange, and offgas treatment. The PT Facility will separate the LAW and HLW fractions prior to treatment via vitrification.

Effluents from the LAW and HLW Facilities are recycled back to the PT Facility for reincorporation into the treatment process.

The PT Facility is assumed to operate at full capacity to support LAW Facility throughput at its maximum design capacity of 15 MTG/d per melter, for two melters, with 100% availability, and the HLW Facility at its maximum of 3.75 MTG/d per melter, for two melters, with 100% availability.

The PT vessel vent processing system (PVP) and PT process vessel vent exhaust system (PVV) will work in tandem to treat offgas from the vessel vent exhausts. Vessel vent exhaust will be treated by a caustic scrubber, high-efficiency mist eliminator (HEME), HEPA filters, TCO, and carbon adsorber. The PVP includes the bulk of emissions controls, while the PVV provides filtration (via HEPA filters) and maintains a negative pressure across the emissions treatment train by way of exhaust fans. The PVP will remove soluble nitrogen oxides (NO_x), acid gases, particulates, VOCs, and mists from vented vessel gases.

The PT pulse jet ventilation system (PJV) is used to treat pulse jet mixer (PJM) / reverse flow diverter (RFD) emissions to remove mists and particulates entrained in the vessel ventilation system. The PJV offgas is treated through a demister and HEPA filters.

The LAW Facility will operate the same way as described in the DFLAW operating configuration, with the exception that the PT Facility will perform the functions of EMF. Process emission sources and controls were described in Section 2.3.1.

The HLW Facility is designed to immobilize radioactive and hazardous constituents in the HLW feed through vitrification in much the same way as the LAW Facility. The melters generate offgas resulting from decomposition, oxidation, and vaporization of feed material. Constituents of the offgas include NO_x from decomposition of metal nitrates in the melter feed; chloride, fluoride, and sulfur as oxides; acid gases and particulates, including salts; dangerous radionuclides and metals (in the form of particles and aerosols); entrained feed material, and glass. In addition, the HLW melters generate small quantities of other volatile compounds including iodine-129, carbon-14, tritium, and VOCs. Carbon-14 and tritium are in the form of carbon dioxide and water, respectively. The melters are ventilated by the HLW melter offgas treatment process system (HOP), which consists of a film cooler, SBS, WESP, HEME, HEPA filters, carbon adsorber, silver mordenite iodine adsorption unit, and TCO/SCR. The HLW PJV exhausts are treated through HEPA filters.

Working spaces are ventilated by separate cascades of ventilation that move air from areas of lower potential contamination to areas of higher potential contamination. HEPA filters are used to control discharges to the atmosphere.

Detailed process and control technology descriptions can be found in Section 5.2.1 for PT and Section 5.2.3 for HLW of Supplement 5 of the RAWP (24590-WTP-RPT-ENV-08-001) for HLW waste processing systems and ventilation and process offgas treatment systems.

2.3.3 Emission Estimates

A bounding estimate of stack emissions for each of the two configurations was developed to quantify the human and ecological risks associated with airborne emissions. The emissions estimate individually considered 409 organic, inorganic, and radionuclide COPCs that could result from processing Hanford tank waste through WTP.

A detailed description of the emissions estimate is presented in Supplement 2 (24590-WTP-ES-PE-17-001) and Supplement 3 (24590-WTP-RPT-ENV-17-008) of the RAWP. The emissions were combined into a single stack for each major facility in each configuration for air modeling purposes: LAW Facility and EMF for DFLAW; and PT, LAW, and HLW Facilities for the baseline WTP. While the Lab will be operating in both configurations, its emissions and the associated risk are considered minor and are not included in the emissions estimates.

2.4 Air Modeling

The emission estimates were used as input to the air model in order to estimate air concentrations and deposition rates. The CALPUFF (Exponent 2015) air dispersion model (Version 5.8.5) was used to calculate how the emitted COPCs are dispersed in the atmosphere. CALPUFF was identified as a preferred model for assessing long-range transport of air pollutants in 40 CFR 51, *Requirements for Preparation, Adoption, and Submittal of Implementation Plans* (Appendix W, *Guideline on Air Quality Models*). CALPUFF was chosen as the appropriate air dispersion model for the WTP in regulatory negotiations.

CALPUFF is a multi-layer, multi-species, non-steady-state puff dispersion model that simulates the effects of time- and space-varying meteorological conditions on pollution transport, transformation, and removal. CALPUFF settings were verified by comparison to actual Hanford site weather data taken from onsite meteorological stations (24590-CM-HC4-HKYM-00001-01-00002, *Modeling Verification and Methods Report*). CALPUFF was run in accordance with the settings documented in the RAWP Supplement 5 (24590-WTP-RPT-ENV-08-001, *Hanford Tank Waste Treatment and Immobilization Plant Risk Assessment Air Quality Modeling Protocol*).

CALPUFF results, along with the estimated emissions, were then consolidated for use in the environmental models described in Section 2.5. Further details are provided in Appendix B. In summary, the following air modeling results serve as inputs to the HHRA:

- Onsite maximum, Columbia River, and Gable Mountain[2] receptor grids: maximum discrete air concentration and deposition values (as applicable to the exposure scenario, without regard to multiple locations) of all modeled species (all years/grid points)
- Offsite receptor grid: 90th percentile of the air concentration and deposition values of all modeled species (all years/grid points)
- Hunter/gatherer receptor grid: 95% upper confidence limit of the median (distribution-free) of air concentration and deposition values of all modeled species (all years/grid points)

For ecological assessment, the following serve as inputs to the SLERA:

- Onsite receptor grid (terrestrial receptors): 90th percentile of the air concentration and deposition values of all modeled species (all years/grid points)
- Columbia River receptor grid (aquatic receptors): maximum discrete air concentration and deposition values (as applicable to the exposure scenario, without regard to multiple locations) of all modeled species (all years/grid points)

[2] With the absence of the American Indian scenarios (see Section 3.1.2), the Gable Mountain and hunter/gatherer receptor grids are only applicable to the American Indian exposure scenarios discussed in Appendix D.

As detailed in Appendix B, CALPUFF modeling results can result in a high degree of non-normality in the data distribution. This is of concern in large receptor exposure grids where the probability of exposure at a single discrete location is less probable than at a smaller, localized receptor grid. As a result, and in accordance with the RAWP Section 6.1.4.3, exposure point concentration values from the CALPUFF modeling were established using the 90th percentile values for the offsite receptor grid for human health assessment. Similarly, the 90th upper percentile was chosen for the onsite grid for the screening level ecological risk assessment. This value represents a "high-end" ecological exposure, and was chosen to better represent the home range of the trophic level 4 receptors, whose exposure at a single discrete location is not probable. For smaller receptor grids (onsite maximum for worker exposures and the Columbia River) the maximum discrete values for air concentration and deposition (as applicable to the exposure scenario) were deemed appropriate as a means of bounding exposures at those locations while simplifying data selection. For the very large hunter/gatherer areas (where average exposures are of concern) the distribution-free 95% upper confidence limit of the median provides a sufficiently conservative estimate of air concentration and deposition. This approach ensures sufficient conservatism without misrepresenting potential exposures due to a highly improbable exposure to extreme deposition and air concentrations.

The emissions and air dispersion data were used to determine vapor and particle concentration and deposition at each receptor exposure location. Resultant EPCs were computed as described in the RAWP and are presented in Appendix C and the support files of this document.

2.5 Environmental Modeling

Risk assessment computations were performed using the Environmental Risk Assessment Model for the Hanford Tank Waste Treatment and Immobilization Plant (ERA Model), developed software that imports the CALPUFF results, and performs the sequential calculations specified in RAWP Sections 6, 7 and 8.

Concentrations of COPCs in soil were estimated from estimated deposition rates of COPCs in vapors and particles. The methodology described in the RAWP (as based on EPA guidance, EPA530-R-05-006) was used to calculate concentrations of constituents in aboveground (i.e., produce, forage, and silage) and belowground plants (i.e., produce), and was the same for humans and ecological receptor consumption. Plants, such as homegrown vegetables or wild produce, are consumed by humans and animals (e.g., as forage for browsing animals and as silage). Special consideration was given to modeling for total, divalent, and methyl mercury.

Uptake was modeled for several animal tissues for human consumption: beef, milk, pork, chicken, wild fowl, chicken eggs, wildfowl eggs, wild game (e.g., deer), and fish. EPCs were also estimated for ecological receptor exposures to plants, invertebrates, fish, mammals, and birds.

Concentrations of COPCs in surface water were estimated from EPCs derived from the Columbia River air modeling exposure grid. EPCs for surface water were used to estimate drinking water exposures, model concentrations in aquatic life for the SLERA, and model fish concentrations for human consumption.

River sediment concentrations were modeled using the modeled total water body concentrations. Sediment concentrations were used in the ecological risk assessment and to model fish concentrations (for PCBs and other strongly lipophilic COPCs) for human consumption.

Deposition is assumed to occur only during the operating lifespan of the facility for both soil and water media. The COPC concentrations were calculated for vapor, particle, and particle-bound phases. The

emissions report, included in Supplement 2 of the RAWP (24590-WTP-ES-PE-17-001), specifies the COPC phases along with the constituent-specific parameter values. Both wet and dry deposition were considered for particles, particle-bound, and vapor constituents. The EPCs were computed as described in the RAWP and are presented in Appendix C for those COPCs found to contribute at least 10% of the risk threshold (cancer or noncarcinogenic hazard) to at least one receptor. Further explanation is provided in Section 3.1.4.

The ERA Model was run for each operating configuration with the outputs of the emissions model and the results compared to risk thresholds specified in the RAWP. The initial risk characterization for PCBs indicated potential issues for ecological receptors, as discussed in Section 4.5.2. Consistent with EPA guidance (EPA/540/R/97/006, *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments*; EPA 540/F-01/014, *The Role of Screening-Level Risk Assessments and Refining Contaminants of Concern in Baseline Ecological Risk Assessments*), sources of uncertainty contributing to the elevated ecological screening quotients (*ESQ*) were evaluated, which identified the feed vector as the greatest source of uncertainty. A detailed examination of the feed vector indicated that estimated PCB concentrations in the feed were beyond what was historically detected in tank waste, and even potentially impossible within tank supernatant (e.g., the PCB concentration exceeded likely solubility limits). Tank waste characterization data were evaluated and a more plausible PCB concentration was determined and used to develop a refined feed vector (refer to Appendix A, Section A.2.4). This approach is consistent with previous agreements and avoids having to adjust exposure parameters (CCN 162025, *Meeting Minutes from Risk Assessment Workshop with BNFL Inc, DOE, Ecology and EPA on April 1-3, 1998*). The refinement of the feed vector was limited solely to PCBs.

The emissions and risk were remodeled for the SLERA based on the refined feed vector to produce results considered more representative of potential ecological impacts from PCBs. The HHRA, however, is based on the original feed vector, since such a refinement was not necessary. Emissions associated with the refined feed vector are presented in the notes accompanying the tables of Appendix A. SLERA results associated with the refined feed vector are presented with those of the original feed vector in Section 4.5.2.

2.6 Sources of Uncertainty

This PRA used the best available information, but data were often limited, resulting in sources of uncertainty (see Appendix D). These sources of uncertainty were addressed, however, by using conservative (i.e., health protective) assumptions, so that the estimated risks in this report are likely to overestimate the actual risks. The uncertainties associated with key steps in the risk assessment, and the protective assumptions and methods used, are discussed below:

- *Constituents of potential concern.* The sources for the COPCs in the emissions estimate included: estimated inventories from TWINS; reported and suspected tank waste constituents; PICs from waste treatment processes and other combustion devices; criteria pollutants; and offgas emission tests at the laboratory and pilot scales. A non-zero quantity was assigned to each waste feed COPC where data for a potential concentration did not exist. Refer to Appendix D, Section D.1.2 for additional details.
- *Emissions.* Upper bound estimates of the air emissions included use of a bounding feed vector, incorporating detection limits for those emissions estimated below detection, and process upset factors. Emissions were modeled at 100% capacity and for continuous operations. In the offgas control systems, decontamination factors (DF) were applied specific to the phase of COPCs at each unit operation to predict removal efficiency by unit operations. Conservative HEPA and PT Facility

carbon bed DFs were employed to compensate for unknowns; when no data were available, control equipment was not credited for COPC removal or destruction, specifically;

- The LAW and HLW facility melters were not credited for destruction or removal hazardous organics
- The LAW and HLW facility HEPA filters were not credited for vapor removal
- The LAW and HLW facility carbon beds were not credited for organics removal
- The LAW and HLW facility SCRs were not credited for organics removal
- The LAW facility caustic scrubber was not credited for organics removal
- The HLW facility silver mordenite adsorption unit was not credited for organics removal.

Refer to Appendix D, Section D.1.3 for additional details.

- *Environmental modeling.* The environmental modeling includes estimation of EPCs for soil, water, sediment, plants, and animals, and the use of those EPCs to estimate exposure levels for human and ecological receptors. The EPCs were conservatively estimated based on air dispersion results for upper bound concentration and deposition values at the onsite, Columbia River, and Gable Mountain receptor grids, as well as high-end values at the offsite and hunter/gatherer areas. Thus, very conservative EPCs cascaded forward in calculations of exposure levels for the receptors. Refer to Appendix D, Sections D.1.4 and D.1.5 for additional details.

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3 Human Health Risk Assessment

The purpose of this HHRA is to present an evaluation of the potential worst-case impacts to people from exposure to environmental media potentially impacted by WTP airborne emissions. The process involves data gathering, modeling, and conducting a risk assessment to evaluate the potential risks. The HHRA is conducted using a variety of conservative assumptions throughout the entire process in order to bound estimated impacts and aid in the identification of risk drivers. The results of this process are put into perspective by a discussion of risk characterization and an uncertainty analysis (see Appendix D) to facilitate informed risk-management decisions. The key steps of this assessment are the exposure and toxicity assessments; the risk characterization integrates the results of the two assessments. The exposure assessment uses the environmental concentrations described in Section 2.

3.1 Exposure Assessment

Exposure assessment is one of the major components of the risk assessment, as identified in Figure 1-2. This section introduces the exposure assessment components, with following subsections that discuss exposure scenarios, EPCs, and exposure parameters. It concludes with subsections on exposure levels for the risk driver, and nursing infants.

3.1.1 Introduction

Exposure assessment is the process of estimating the magnitude, frequency, duration, and type of potential exposures experienced by specific receptors to COPCs. This section presents the exposure scenarios and approach for conducting the quantitative exposure assessment.

A human health conceptual exposure model identifies exposure scenarios that are defined by potentially exposed populations and exposure pathways. The conceptual exposure model used for this PRA was developed from guidance and information obtained from the HHRAP (EPA530-R-05-006); DOE/RL-96-16, *Screening Assessment and Requirements for a Comprehensive Assessment: Columbia River Comprehensive Impact Assessment*; and discussions with DOE, Office of River Protection (ORP), Ecology, and the EPA.

The conceptual exposure model focused on identifying complete exposure pathways for potentially exposed populations. An exposure pathway is the means through which an individual may come in contact with a chemical in the environment. Exposure pathways are determined by:

- Environmental conditions (e.g., location of receptors, vegetative cover, wind speed and direction)
- The potential for chemical migration through environmental media (e.g., soil, vegetation, air)
- Lifestyles and work activities of potentially exposed populations

Although several potential pathways may exist, not all may be complete. For a pathway to be complete, all four of the following factors must exist:

- COPC release into the environment
- Release and transport mechanism (e.g., deposition to soil) that moves the COPC from the source to other locations

- Point of contact for chemicals, or proximity for external radiation for receptors to be exposed to the affected media
- Exposure pathway (e.g., breathing vapors or ingesting affected media)

These factors were considered in the development of the conceptual exposure model. The sources of COPC release are the WTP stacks. Transport processes, potential points of contact, and complete exposure pathways are identified to formulate exposure scenarios used in this quantitative risk assessment. The process of exposure assessment is detailed in the following subsections.

The EPCs used for estimating doses of COPCs depend on the location of the receptor exposure. The location of the various receptor populations identified for the quantitative risk assessment correspond to the receptor exposure grids defined during air dispersion modeling. These receptor grids represent key locations on and off the Hanford site where a receptor is exposed to constituents via a pathway specific to the receptor's exposure scenario. Emissions were modeled separately for each WTP facility (i.e., the PT, LAW, and HLW Facilities). The individual flues associated with each of the facility stacks (which are structural steel lattices that support the individual flues for that facility) were combined and modeled as one source for each facility.

For further detail on EPC for soil accumulation, surface water accumulation, sediment accumulation, special cases mercury modeling, and plant accumulation refer to RAWP Sections 6.2, 6.3, 6.4, 6.5, and 6.6.

3.1.2 Human Health Exposure Scenarios

The EPCs are a function of both receptor exposure location, and timing. This section briefly summarizes the exposure locations, pathways and timing to provide context to the EPCs presented. Consult RAWP Section 7 for additional details.

A human health conceptual exposure model identifies exposure scenarios that are defined by potentially exposed populations and exposure pathways. Table 3-1 summarizes the receptors, locations, exposure scenarios, and exposure pathways and Figure 3-1 shows the conceptual exposure model used for this assessment as was developed from guidance and information obtained from HHRAP (EPA530-R-05-006); DOE/RL-96-16; and discussions with DOE-ORP, Ecology, and EPA. The scenarios include the current (i.e., operational) and future (i.e., post-operational) periods of WTP operations.

Table 3-1 Human Receptor Populations and Exposure Pathways

		Exposure Pathways												
		Inhalation Routes		External Radiation		Ingestion								
Receptor	**Location**	Emissions [a]	Resuspended Soil	Radionuclides in air	Radionuclides in soil	Soil	Produce	Beef	Milk	Chicken & Eggs	Pork	Fish [b]	Drinking Water [b]	Breast milk [c]
Plausible Exposure Scenarios (evaluated in current and future timeframes)														
Hanford site industrial worker (adult)	Works at onsite ground maximum	X	X	X	X	X								X
	Resides at Hanford offsite location	X	X	X	X	X								
	Consumes homegrown produce (offsite)						X							
	Consumes water (Columbia River max)												X	
Resident (adult and child)	Resides at Hanford offsite location	X	X	X	X	X								X
	Consumes homegrown produce (offsite)						X							
	Consumes water (Columbia River max)												X	
Worst-Case Exposure Scenarios (evaluated in current and future timeframes)														
Acute exposure	Acute maximum	X		X										
Resident subsistence farmer (adult and child)	Resides at Hanford offsite location	X	X	X	X	X								X
	Consumes homegrown produce/livestock (offsite)						X	X	X	X	X			
	Consumes water (Columbia River max)												X	
Resident subsistence fisher (adult and child)	Resides at Hanford offsite location	X	X	X	X	X								X
	Consumes homegrown produce (offsite)						X							
	Consumes fish and water (Columbia River max)											X	X	

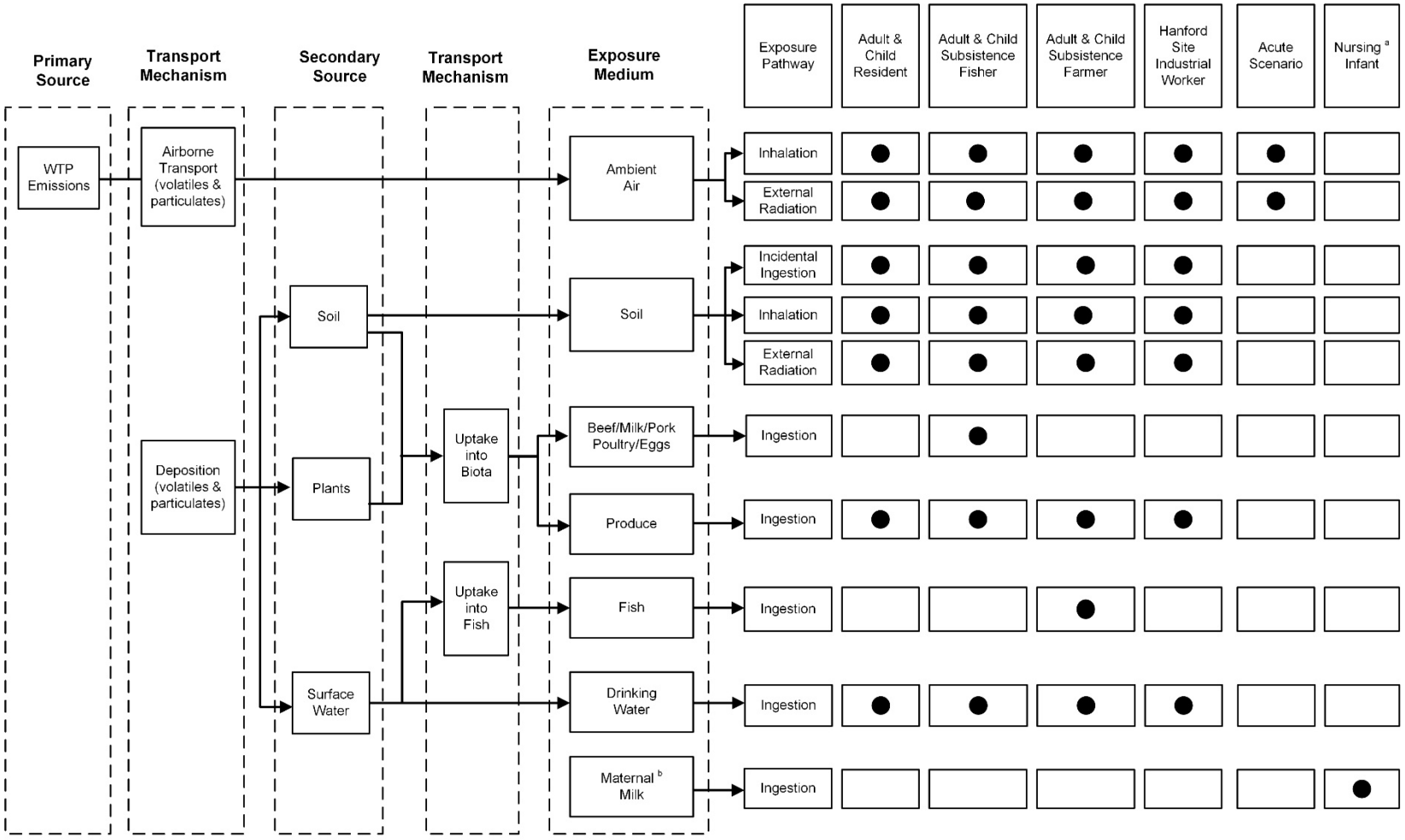
X = complete exposure pathway for receptor.

[a] Includes direct inhalation of vapor phase and particulate emissions. Applicable to current timeframe only (during WTP emissions).

[b] Pathway attributable to exposure to water/fish from the Columbia River maximum.

[c] Includes nursing infant assessment - maternal exposures indicated.

Figure 3-1 Human Health Conceptual Exposure Model



[a] Nursing infant is evaluated for Resident Subsistence Farmer, and Industrial Worker Scenarios.

[b] Maternal Milk Pathway assumes maternal exposure to all other media

Plausible exposure scenarios are those for receptors that currently exist, or may reasonably be expected to exist in the future, at a given location (e.g., a future resident at the Hanford offsite maximum location). The exposure scenarios reflect anticipated WTP operations and the continuation of current uses of the surrounding land and habitats, and make reasonable assumptions about future land uses while still using upper-bound estimates of exposure pathways and activity patterns. The worst-case exposure scenarios represent worst-case assumptions regarding the location of human receptors, exposure pathways, and activity patterns (e.g., subsistence fishing). The receptor locations used in the worst-case scenario are considered hypothetical, because assumed activities (e.g., residence, subsistence farming) do not currently occur in the worst-case Hanford Site locations, nor are they expected.

Table 3-1 does not include the resident subsistence American Indian hunter-gatherer exposure scenario that was developed for the TC&WM EIS (DOE/EIS-0391). For the EIS, DOE had negotiated a DOE American Indian scenario with the local tribes which modified some of the parameters in the Confederated Tribes of the Umatilla Indian Reservation and Yakama Indian Nation Native American scenarios to bring food consumption and inhalation rates more in line with other risk assessment inputs. DOE felt those changes were negotiated in good faith with the Tribal representatives. After publication of the EIS, DOE learned that Tribal scenarios could only be modified with approval from the Tribal Council, which had not been obtained. Based on the understanding of how the scenario was approved, the DOE American Indian scenario is not included in the PRA because of the concern that in doing so, the permittees would continue to propagate an error in presenting a scenario that the parties did not have the authority to modify.

DOE requested and invited the American Indian perspectives to ensure fair consideration of differing views and to inform the agency's decision-making process. DOE respects those views and considered them for the purposes of preparing this PRA. However, inclusion of these perspectives does not mean or imply that DOE is in agreement with them. Two American Indian resident subsistence scenarios were assessed to represent more closely the lifestyle described by guidance documents issued by local tribes. As per RAWP Section 10.2.3.2, the results are presented in an uncertainty section (Appendix D).

Figure 3-2, Figure 3-3, and Figure 3-4 show the exposure locations modeled for this assessment. As described below and in Appendix B, these represent the geographic areas where human receptors could come into contact with contaminated media and airborne COPCs. Figure 3-2 shows the onsite exposure location (current and future timeframe), while Figure 3-3 shows the offsite, Gable Mountain, Columbia River, and hunter/gatherer area in the current timeframe. Figure 3-4 depicts these same locations in the future timeframe, when the hunting/gathering area is expanded to include portions of the Hanford site interior.

Figure 3-2 Onsite Exposure Location

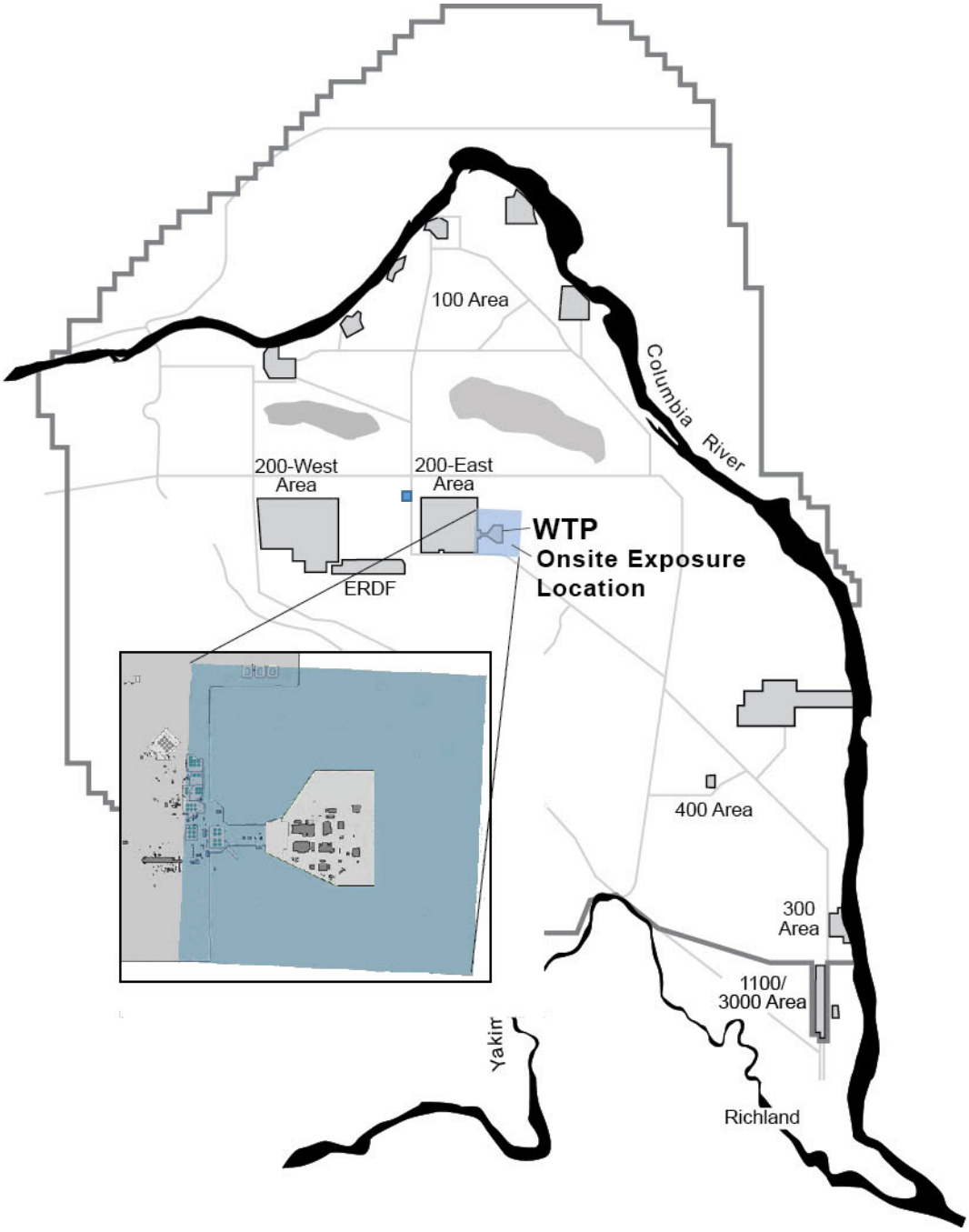


Figure 3-3 Offsite, Gable Mountain, Columbia River, and Hunter/Gatherer Area (current timeframe)

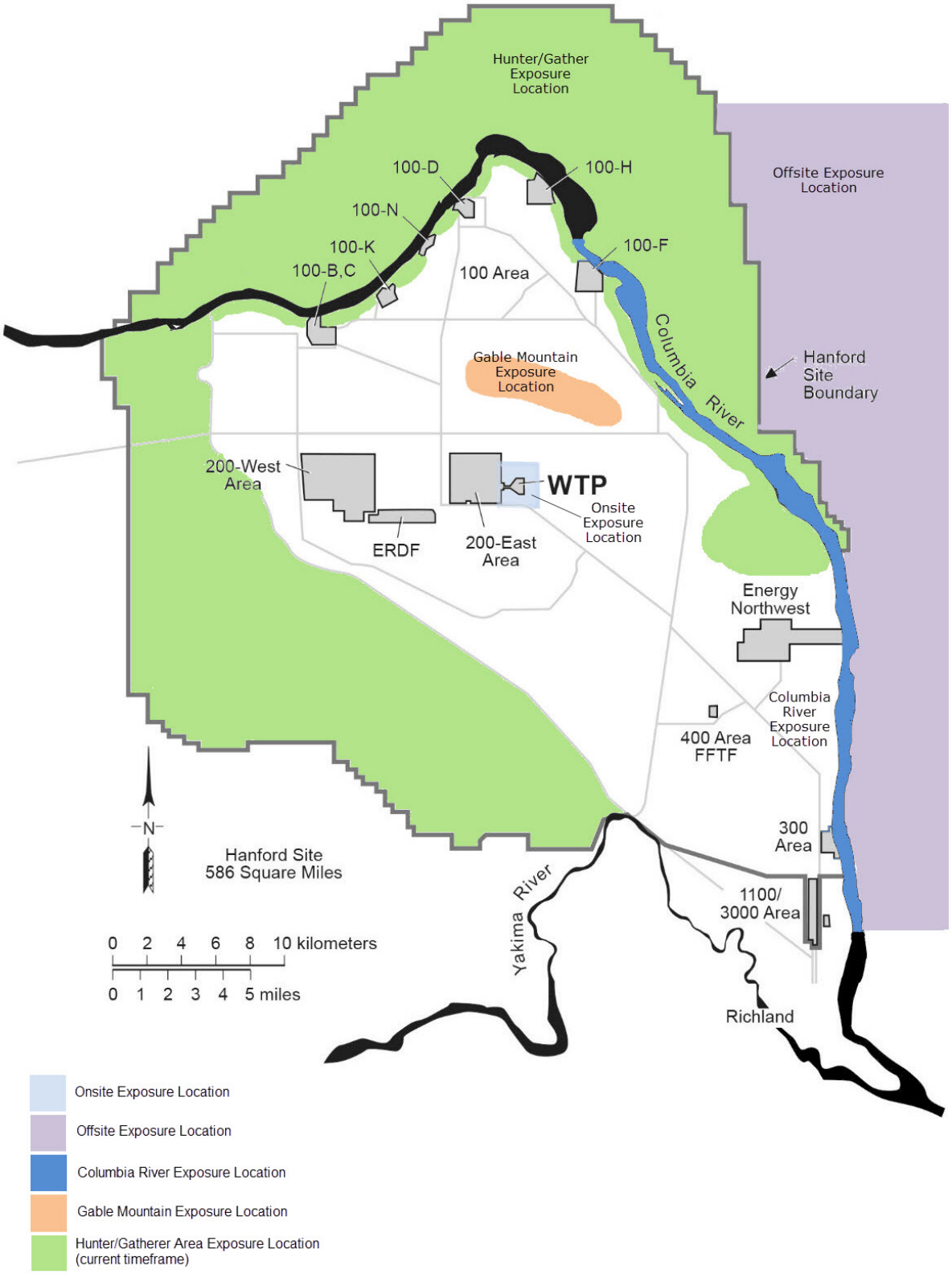
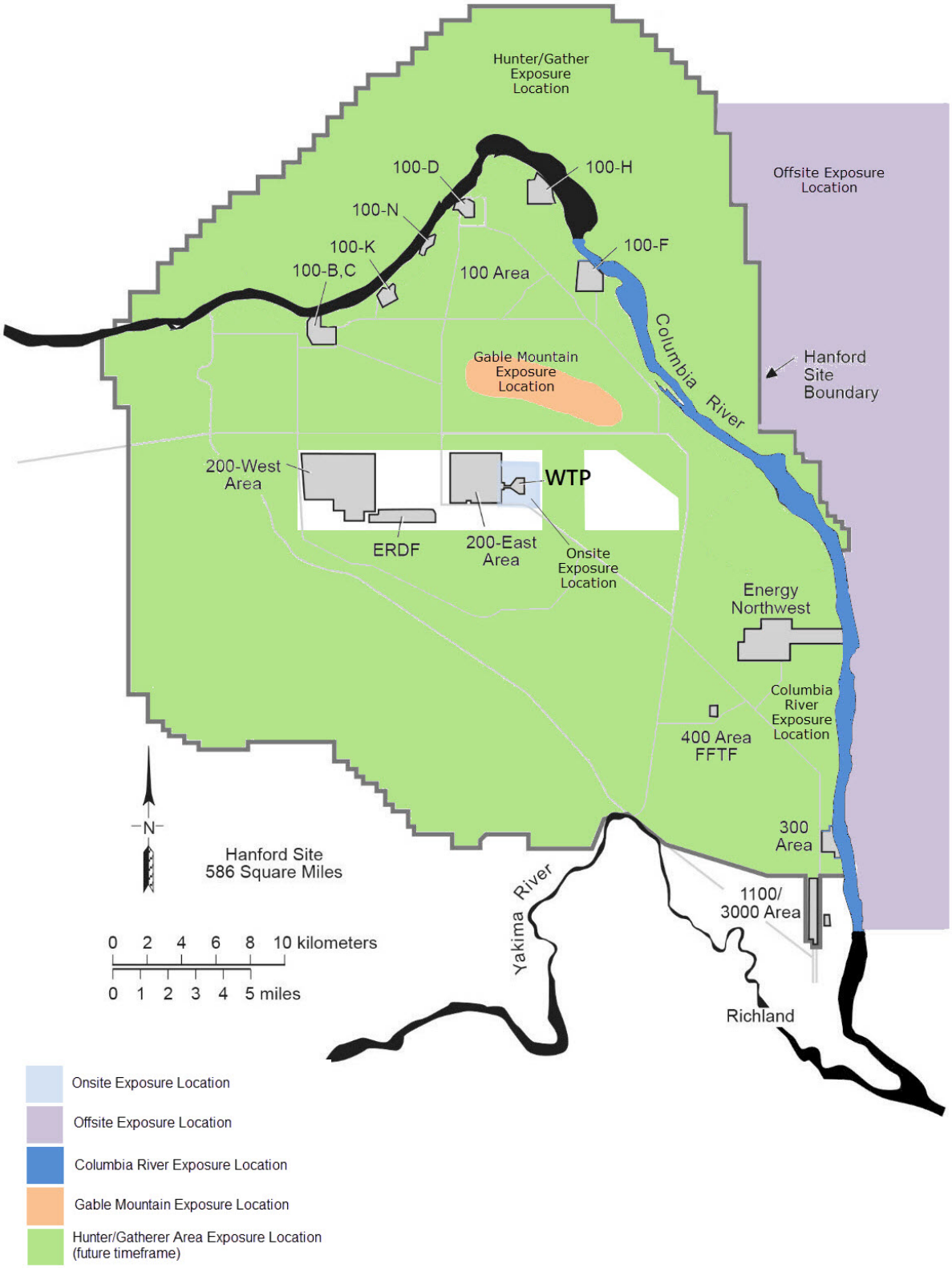


Figure 3-4 Offsite, Gable Mountain, Columbia River, and Hunter/Gatherer Area (future timeframe)



3.1.3 Receptor-Specific Exposure Scenarios

A set of exposure scenarios that describe the activities and exposure conditions was developed for the receptors in Table 3-1 and is provided below. The scenarios generally describe who is being exposed to what environmental media and over what time period.

3.1.3.1 Acute Exposure

According to HHRAP (EPA530-R-05-006), evaluating potential acute (short-term) inhalation exposure in addition to the chronic exposures evaluated by previously described exposure scenarios is recommended. The acute exposure scenario includes direct inhalation of airborne emissions and exposure to external radiation from airborne radionuclide emissions at the location of estimated maximum one-hour concentration. The Hanford site industrial worker for the acute exposure scenario is located at the point of maximum one-hour concentration and is independent of land use. Because the acute exposure scenario is based on the maximum-modeled concentration and assumes that a receptor will be present at the location of that maximum during the hour in which it occurs, this is considered a worst-case short-term scenario.

3.1.3.2 Hanford Site Industrial Worker

The Hanford Site Industrial Worker is an adult worker employed near the WTP and living offsite. The worker is exposed onsite (during work hours) through inhalation of emissions, ingestion of soil, inhalation of resuspended soil, ingestion of drinking water, and external exposure to radionuclides in air and soil. This worker is also assumed to be exposed while at home through these same pathways and through ingestion of homegrown produce (fruits and vegetables grown at the location of the residence) [3]. The worker is assumed to obtain drinking water supplied from the point of maximum concentration in the Columbia River.

The worker is assumed to be at work at the onsite maximum location for 8 hours each weekday (excluding holidays and yearly vacation), resulting in an exposure frequency of 250 days/year. The worker is assumed to be at home at the offsite location during the remaining 16 hours of the workday. Additionally, the worker is assumed to spend a cumulative 100 days at home (offsite) each year during weekends. It is assumed that the worker is neither at work nor home for 15 days/year, presumably on vacation outside of the area of assessment.

The Hanford site industrial worker is assumed to have a 20-year career. It is also assumed that a retired worker will live at the offsite location for 10 years after retirement. The retiree is assumed to be exposed through the same exposure pathways experienced by a worker while at home when not working. Unlike the worker, the retiree is assumed to spend 24 hours/day for 350 days/year at home and 15 days/year on vacation outside of the area of assessment.

The worker is assumed to have a nursing infant. The nursing infant of the Hanford site industrial worker is assumed to reside with the worker described above. It is assumed that the mother continues to work during the period of nursing and is exposed to the onsite maximum during the workday, and is exposed offsite while at home.

[3] The ingestion of soil and inhalation of resuspended soil is assumed for surface soil, and domestic produce (above and belowground) is grown in tilled soil at the offsite location.

3.1.3.3 Resident Adult and Child

The resident (adult and child) is assumed to live, work, and play at the offsite location and to be home 24 hours per day, 350 days per year, with 15 days per year on vacation or otherwise away from the home outside of the assessment area. The resident is assumed to be exposed through direct inhalation of airborne emissions, ingestion of soil, inhalation of resuspended soil, ingestion of drinking water, external exposure to radionuclides in air and soil, and ingestion of homegrown produce. The resident is assumed to obtain drinking water supplied from the point of maximum concentration in the Columbia River.

The nursing infant of the resident is assumed to reside with the resident described above.

3.1.3.4 Resident Subsistence Farmer Adult and Child

The resident subsistence farmer (adult and child) is assumed to live, work, and play at the offsite location (i.e., the resident farmer is assumed to be at home 24 hours per day, 350 days per year, with 15 days per year on vacation or otherwise away from the home). This receptor is assumed to maintain a farm that supplies his or her foodstuffs (i.e., produce, meat [beef, pork, and poultry], dairy products, and eggs)[4]. The resident subsistence farmer is assumed to be exposed through inhalation of emissions, ingestion of soil, inhalation of resuspended soil, ingestion of drinking water, external exposure to radionuclides in air and soil, and ingestion of homegrown foodstuffs. The livestock are raised at the offsite location and consume forage, silage, and grain grown at the offsite location. The farmer is assumed to obtain drinking water supplied from the point of maximum concentration in the Columbia River. The nursing infant of the resident subsistence farmer is assumed to reside with the resident subsistence farmer described above.

The difference between the resident and the resident subsistence farmer is the latter is assumed to be exposed through the ingestion of homegrown foodstuffs.

3.1.3.5 Resident Subsistence Fisher Adult and Child

The resident subsistence fisher scenario is the same as the resident scenario (Section 3.1.3.3) with the addition of fish ingestion. This receptor is assumed to live, work, and play at a single location (i.e., the resident fisher is assumed to be at home 24 hours per day, 350 days per year, with 15 days per year on vacation or otherwise away from the home). This fisher is assumed to obtain drinking water supplied from the point of maximum concentration in the Columbia River[5]. This receptor is assumed to have a garden that supplies produce and to obtain fish and drinking water from the Columbia River maximum. The resident subsistence fishers (adult and child) are assumed to be exposed through inhalation of emissions, ingestion of soil, inhalation of resuspended soil, ingestion of drinking water, external exposure to radionuclides in air and soil, ingestion of homegrown produce, and ingestion of locally caught fish.

The nursing infant of the resident subsistence fisher is assumed to reside with the resident subsistence fisher described above.

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[4] Domestic livestock is also presumed to consume grain and silage (grown in tilled soil), and forage (grown in untilled soil) from the offsite location.

[5] The concentration in the Columbia River is computed from the diffusion and deposition, which in turn are used for estimating a total water body concentration, dissolved-phase water concentration (used to assess drinking water exposure and fish consumption) and bed sediment concentration (also used to assess fish consumption).

3.1.4 Exposure Point Concentrations for the DFLAW Operating Configuration

The following sections discuss the risk drivers, and their respective EPCs as associated with the operation of WTP in the DFLAW configuration. A complete list of the EPCs can be found in the support files of this document.

The following sections present the EPCs for the risk drivers. As described in the RAWP (Section 7.4.1), the threshold for the total cancer risk for COPCs (both nonradioactive and radioactive), and the constituent-specific and pathway-specific incremental lifetime cancer risk is 1.0E-05, or 1 in 100,000 exposed individuals (EPA530-R-05-006) pathways. Thus, the level for a risk driver is 1.0E-06 incremental lifetime cancer risk or greater. Only one such COPC was identified. No inorganics and only one organic (dibenz[a,h]anthracene, 53-70-3) presented a corresponding cancer risk that would cause them to be considered risk drivers for human receptors (specifically, the resident subsistence farmer adults in the current exposure scenario).

An *HI* of 1 or less indicates that the chemical-specific dose is below the level associated with adverse effect. An *HI* threshold level of 0.25 has been selected as a risk management decision by Ecology and EPA Region 10 to provide a conservative evaluation of hazard and is consistent with EPA-R6-98-002, *Region 6 Risk Management Addendum - Draft Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*. Thus, the level for a risk driver is a hazard quotient of 0.025 or greater. No organics or inorganics presented a corresponding hazard that would cause them to be considered risk drivers for human receptors. No radionuclides presented a corresponding cancer risk that would cause them to be considered risk drivers for either human receptors. No single COPC approached an acute exposure greater than 10% of the acute hazard index threshold of 1, nor did the sum of their indices exceed 10% of the acute hazard quotient threshold of 1, so there were no acute exposure risk drivers.

It should be noted that dibenz[a,h]anthracene was reported as both a feed constituent and a PIC. Its feed concentration was based on two samples with results at the detection limit (24590-WTP-RPT-MGT-04-001), with an additional multiplier applied for the development of the bounding feed vector. TWINS[6] analytical data show 224 samples analyzed for dibenz[a,h]anthracene with nothing ever detected. Records indicating the disposal of this compound to the tank system or its likelihood of being a degradation product of heavier organics could not be found. The dibenz[a,h]anthracene analytical detection limit (the basis for its feed concentration) is most likely a conservative and bounding value, overestimating its actual waste concentration and its associated risk. And while dibenz[a,h]anthracene is also considered a PIC, it was never detected in the pilot-scale melter testing.

As applicable, italics are used in the following subsections to identify specific variables as cited in HHRAP (EPA530-R-05-006). Only applicable EPCs are shown (e.g., there are no soil EPCs for the Columbia River). Refer to RAWP Table 7-1 for additional details on applicable EPCs for each receptor. Appendix C provides all the EPC results for all receptors for dibenz[a,h]anthracene.

There were no risk drivers for the baseline WTP configuration, so there is no similar discussion for that configuration. The emissions of PICs associated with the DFLAW configuration were generally higher than the baseline WTP configuration. This is due to the DFLAW feed, which is higher in nitrates and nitrites than the baseline WTP feed and requires a greater amount of sugar to control its redox chemistry.

[6] Tank Waste Information Network System (TWINS), July 2018 update, available at https://twinsweb.labworks.org/twinsdata/Forms/About.aspx, Pacific Northwest National Laboratory, Richland, Washington.

This results in a higher total organic carbon concentration in the DFLAW melter feed relative to the baseline WTP LAW melter feed, which, in turn, contributes to PIC formation.

3.1.4.1 Air Concentration for Inhalation

Acute air concentration is the maximum one-hour concentration. Onsite air concentration is the maximum of the annual average air concentration. The maximum offsite annual average air concentration of dibenz[a,h]anthracene is 1.1E-11 $\mu g/m^3$ for the inhalation EPC.

3.1.4.2 Soil Exposure

Soil EPCs are from exposure to surface soil and soil concentration in untilled and tilled soil. Surface soil exposure is through the inhalation of resuspended soil and incidental ingestion of soil. Exposure to tilled soil is also indirect and comes from the consumption of domestic produce and livestock. Domestic produce may uptake COPCs through belowground transfer and livestock may be exposed through produce consumption and the incidental ingestion of soil. The current offsite exposure scenario soil EPCs for dibenz[a,h.]anthracene are:

- Surface soil: 8.2E-07 mg/kg
- Tilled soil: 8.2E-08 mg/kg

3.1.4.3 Surface Water Exposure

For the resident subsistence adult farmer, exposure occurs through consumption of water via the dissolved phase water concentration (C_{dw}). Likewise, fish consumed by humans accumulate COPCs by exposure to the dissolved phase water concentration, as well as the bed sediment concentration (C_{sed}) for COPCs such as PCBs. Columbia River EPCs specific to water are produced by the combination of deposition and diffusion, so they are only applicable to current exposure scenarios, as the river water is no longer affected with the cessation of emissions. Sediments may retain COPCs after plant shutdown. The Columbia River current exposure scenario EPCs for dibenz[a,h]anthracene are:

- Water column: 7.3E-12 mg/L
- Bed sediment: 5.2E-07 mg/kg

3.1.4.4 Plant Exposure

Domestic produce is consumed by human receptors. Plant uptake routes include deposition (*Pd*), air-to-plant transfer (*Pv*), root uptake to aboveground produce (Pr_{ag}), and root uptake to belowground produce (Pr_{bg}). The EPCs from deposition and air-to-plant vapor transfer are a function of deposition and air concentration, and vary solely by location. Since produce EPCs for root uptake are a function of soil concentration, aboveground and belowground EPCs vary by location. The current offsite exposure scenario soil EPCs for dibenz[a,h]anthracene for plant accumulation are:

- Aboveground: 5.6E-10 mg/kg
- Belowground: 3.3E-11 mg/kg

3.1.4.5 Livestock, Eggs, and Milk Exposure

The applicable livestock (beef, pork, and chicken), eggs, dairy products, game, and fish concentrations are identified below. Tissue concentration is generally a result of animal consumption of plant matter (forage, silage, and grains, as applicable) and the incidental ingestion of soil.

Tissue concentrations for livestock (beef, pork, and chicken), eggs, and milk are generally dependent upon the time period of exposure, as well as location. The current livestock EPCs for the resident subsistence adult farmer for dibenz[a,h]anthracene are:

- Beef: 4.7E-04 mg/kg
- Milk: 1.5E-04 mg/kg
- Pork: 3.9E-05 mg/kg
- Chicken: 4.2E-10 mg/kg
- Eggs: 2.4E-10 mg/kg

3.1.5 Exposure Parameters

Table 3-2 summarizes the exposure parameters used for the adult and child scenarios for both DFLAW and WTP configurations. Table 3-3 presents the nursing mother and infant exposure parameters used for both configurations. The exposure levels reported in Section 3.1.6 were calculated with these values and the EPCs in Section 3.1.4. Many parameters do not apply to all scenarios, and they can vary substantially between scenarios, depending on conditions, generally described in Section 3.1.3.

Table 3-2 Human Receptor Exposure Parameters

Description	Units	Onsite Worker	Resident		Subsistence Farmer		Subsistence Fisher	
		Adult	Adult	Child	Adult	Child	Adult	Child
Exposure frequency	days/yr	350	350	350	350	350	350	350
Exposure frequency at work	days/yr	250	-	-	-	-	-	-
Exposure frequency during retirement	days/yr	350	-	-	-	-	-	-
Exposure duration	yr	20	30	6	40	6	30	6
Exposure duration at work	yr	20	-	-	-	-	-	-
Exposure duration during retirement	yr	10	-	-	-	-	-	-
Exposure time	hr/day	24	24	24	24	24	24	24
Exposure time at work	hr/day	8	-	-	-	-	-	-
Body weight	kg	70	70	15	70	15	70	15
Averaging time for carcinogens	yr	70	70	70	70	70	70	70
Inhalation Averaging time for noncarcinogens	yr	20	30	6	40	6	30	6
Averaging time for noncarcinogens	yr	20	30	6	40	6	30	6
Averaging time for noncarcinogens during retirement	yr	10	-	-	-	-	-	-
Inhalation rate	m^3/hr	0.833	0.833	0.417	0.833	0.417	0.833	0.417
Inhalation rate at work	m^3/hr	1.5	-	-	-	-	-	-
Ingestion rate for soil	kg/day	0.0001	0.0001	0.0002	0.0001	0.0002	0.0001	0.0002
Ingestion rate for soil at work	kg/day	0.0002	-	-	-	-	-	-
Ingestion rate for drinking water	L/day	2	2	1	2	1	2	1
Ingestion rate for drinking water after work	L/day	1	-	-	-	-	-	-
Consumption rate: aboveground domestic produce	kg/kg·day FW	3.20E-4	3.20E-4	7.70E-4	4.70E-4	1.13E-3	3.2E-4	7.70E-4
Consumption rate: belowground produce	kg/kg·day FW	1.40E-4	1.40E-4	2.30E-4	1.70E-4	2.80E-4	1.40E-4	2.30E-4

Table 3-2 Human Receptor Exposure Parameters

Description	Units	Onsite Worker	Resident		Subsistence Farmer		Subsistence Fisher	
		Adult	Adult	Child	Adult	Child	Adult	Child
Consumption rate: protected produce	kg/kg·day FW	6.10E-4	6.10E-4	1.50E-3	6.40E-4	1.57E-3	6.10E-4	1.50E-3
Consumption rate domestic chicken	kg/kg·day FW	-	-	-	6.60E-4	4.50E-4	-	-
Consumption rate: beef	kg/kg·day FW	-	-	-	1.22E-3	7.50E-4	-	-
Consumption rate: pork	kg/kg·day FW	-	-	-	5.50E-4	4.20E-4	-	-
Consumption rate: eggs	kg/kg·day FW	-	-	-	7.50E-4	5.40E-4	-	-
Consumption rate: fish	kg/kg·day FW	-	-	-	-	-	1.25E-3	8.80E-4
Consumption rate: milk	kg/kg·day FW	-	-	-	1.37E-2	2.27E-2	-	-
Outdoor exposure time factor for radionuclides in soil	unitless	0.060	0.06	0.23	0.42	0.42	0.42	0.42
Indoor exposure time factor for radionuclides in soil	unitless	0.94	0.94	0.77	0.58	0.58	0.58	0.58
Indoor exposure time factor for radionuclides in soil after work	unitless	0.607	-	-	-	-	-	-
Outdoor exposure time factor for radionuclides in soil at work	unitless	0.167	-	-	-	-	-	-
Indoor exposure time factor for radionuclides in soil at work	unitless	0.167	-	-	-	-	-	-

"-" indicates parameter does not apply.

Table 3-3 Nursing Mother and Infant Exposure Parameters

Description	Units	Onsite Worker	Resident	Subsistence Farmer	Subsistence Fisher
Infant Exposure duration	yr	1	1	1	1
Maternal exposure duration	yr	20	30	40	30
Infant ingestion rate: breast milk	L/day	0.688	0.688	0.688	0.688
Infant body weight	kg	7.2	7.2	7.2	7.2
Averaging time for carcinogens	yr	1	1	1	1
Fraction of ingested COPC stored in maternal fat	unitless	0.9	0.9	0.9	0.9
Fraction of mother's weight that is fat	unitless	0.3	0.3	0.3	0.3
Fraction of mother's breast milk that is fat	unitless	0.04	0.04	0.04	0.04
Fraction of ingested COPC that is absorbed	unitless	0.9	0.9	0.9	0.9

3.1.6 Exposure Levels for Risk Drivers for the DFLAW Operating Configuration

A single compound, dibenz[a,h]anthracene (a carcinogen), was identified as a human health risk driver for the DFLAW operating configuration. This COPC was only a risk driver for the resident subsistence farmer adult in current exposure scenario. The intake by pathway is estimated for dibenz[a,h]anthracene for the resident subsistence farmer adult as described in Section 3.1.5. Estimates of COPC intake include the lifetime average daily dose (*LADD*) in units of mg/(kg·day), and for inhalation, the exposure concentration (*EC*) in µg/m^3. The *LADD*, which is the dose that is distributed (averaged) over an entire lifetime, is used to evaluate the cancer risk of a compound. The *EC* is weighted according to the ratio of the exposure time over the averaging time (i.e., it is limited to the 10-year period of the DFLAW operating configuration over the 70 year averaging time for carcinogens).

Note that for the future timeframe, there are no *LADD* and *EC* values for air inhalation and water ingestion because operations (i.e., emissions) have ceased. However, residual contamination remains in the soil; therefore, there are intakes for the ingestion pathways (e.g., soil, produce, meat, dairy) and there is an *EC* for the inhalation of suspended soil.

The levels and types of exposures for each human health scenario are presented for all receptors in Appendix C for the DFLAW operating configuration, even though dibenz[a,h]anthracene was not classified as a risk driver for any exposure scenarios other than the resident subsistence farmer adult. A complete list of exposure levels can be found in the support files of this document.

Table 3-4 summarizes the exposures for the resident subsistence farmer. The air inhalation exposure is the largest of the inhalation routes in the adult and child current timeframe for both the carcinogenic and noncarcinogenic effects. Milk ingestion is the largest adult and child ingestion route for both the current and future timeframes.

Table 3-4 Current Resident Subsistence Farmer Adult and Child Dibenz[a,h]anthracene *EC* and *LADD* for the DFLAW Operating Configuration

Receptor	Timeframe	Air Inhalation EC (µg/m^3)	Soil Ingestion LADD (mg/(kg·day))	Soil Inhalation EC (µg/m^3)	Produce Ingestion LADD (mg/(kg·day))	Beef Ingestion LADD (mg/(kg·day))
Adult	Current	1.5E-11	6.4E-14	5.9E-16	3.9E-10	3.1E-08
Child		9.2E-12	3.0E-13	3.0E-16	1.4E-10	2.9E-09
Adult	Future	n/a	2.2E-14	2.1E-16	1.2E-14	3.0E-13
Child		n/a	1.7E-13	1.6E-16	2.3E-14	1.5E-13

Table 3-4 Current Resident Subsistence Farmer Adult and Child Dibenz[a,h]anthracene *EC* and *LADD* for the DFLAW Operating Configuration

Receptor	Timeframe	Milk Ingestion LADD (mg/(kg·day))	Chicken Ingestion LADD (mg/(kg·day))	Egg Ingestion LADD (mg/(kg·day))	Pork Ingestion LADD (mg/(kg·day))	Drinking Water Ingestion LADD (mg/(kg·day))
Adult	Current	1.1E-07	1.5E-14	9.7E-15	1.2E-09	2.9E-15
Child		2.8E-08	5.1E-15	3.5E-15	1.4E-10	4.0E-15
Adult	Future	5.8E-13	5.2E-15	3.4E-15	1.2E-13	n/a
Child		7.7E-13	2.8E-15	1.9E-15	7.3E-14	n/a

n/a indicates not applicable.
EC: exposure concentration
LADD: lifetime average daily dose

A complete list of the exposure levels can be found in the support files folder of this document.

3.1.7 Infant Exposures

Section 7.1.2 of the RAWP required that nursing infant exposures to polychlorinated dibenzo-p-dioxins, polychlorinated dibenzofurans (PCDD/PCDF), and coplanar dioxin-like PCBs be estimated. The exposures to a limited set of radionuclides (strontium-90, iodine-129, cesium-134, and cesium-137) were also required because of their potential presence, accumulation in milk, and toxicity. The nursing infant was included in the scenario descriptions in Section 3.1.3.

Infant exposures of all receptors to PCDDs/PCDFs and coplanar PCBs in human breast milk were evaluated by comparing a site-specific estimated average daily dose to the infant (ADD_{inf}) to a background dose to the infant as discussed in RAWP Section 7.2.1.3. The individual ADD_{inf} of PCDD/PCDFs and coplanar PCBs was compared to a breast milk background dose of 60 pg/(kg·day) and 33 pg/(kg·day) respectively, and their total was compared to 93 pg/(kg·day). The next two subsections provide the estimated infant exposure levels and comparisons for the DFLAW and baseline WTP operating configurations.

3.1.7.1 DFLAW Operating Configuration

No single PCDD/PCDF or coplanar PCB approached the background concentration; the highest, for the farmer's infant, was 3,3',4,4',5-pentachlorobiphenyl (PCB 126), at just over 1/1000th of the background value (4.3E-02 pg toxic equivalents [TEQ]/(kg·day)). In addition, the 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) TEQ were computed and summed for the PCDD/PCDF and coplanar PCBs. The TEQ values (Table 3-5) were well below the background dose of dioxin-like compounds of 93 pg TEQ/(kg·day) for the current and future timeframes.

Table 3-5 Nursing Infant Average Daily Dose for Dioxins/Furans and Co-Planar PCBs TEQ for the DFLAW Operating Configuration

Timeframe	Onsite Worker (pg TEQ/kg·day)	Resident (pg TEQ/kg·day)	Subsistence Farmer (pg TEQ/kg·day)	Subsistence Fisher (pg TEQ/kg·day)
PCDD/PCDF TEQ				
Current	1.4E-05	1.8E-06	3.6E-04	3.3E-06
Future	4.7E-06	1.2E-07	2.9E-06	1.2E-07
Total Coplanar PCBs (as 2,3,7,8-TCDD TEQ)				
Current	5.9E-05	1.6E-05	4.8E-02	9.6E-04
Future	7.1E-06	2.1E-07	2.1E-05	2.1E-07
PCDD/PCDF/PCB TEQ				
Current	7.3E-05	1.8E-05	4.8E-02	9.7E-04
Future	1.2E-05	3.3E-07	2.4E-05	3.3E-07

The background dose for evaluation of dioxin-like compounds is 93 pg TEQ/ kg·day.

3.1.7.2 Baseline WTP Operating Configuration

No single PCDD/PCDF or coplanar PCB approached the background concentration, and the highest PCDD/PCDF or coplanar PCB, for the farmer's infant, was 3,3',4,4',5-pentachlorobiphenyl (PCB 126), at about 1/1000th of the background value (4.0E-02 pg TEQ/kg·day). In addition, the 2,3,7,8-TCDD TEQ values were computed and summed for the PCDD/PCDF and coplanar PCBs. The TEQ values (Table 3-6) were well below the background dose of dioxin-like compounds of 93 pg TEQ/ kg·day for the current and future timeframe scenarios.

Table 3-6 Nursing Infant Average Daily Dose for Dioxins/Furans and Co-Planar PCBs TEQ for the Baseline WTP Operating Configuration

Timeframe	Onsite Worker (pg TEQ/kg·day)	Resident (pg TEQ/kg·day)	Subsistence Farmer (pg TEQ/kg·day)	Subsistence Fisher (pg TEQ/kg·day)
PCDD/PCDF TEQ				
Current	3.1E-05	3.6E-06	4.8E-04	5.6E-06
Future	1.1E-05	2.9E-07	6.7E-06	2.9E-07
Total Coplanar PCBs (as 2,3,7,8-TCDD TEQ)				
Current	8.0E-05	1.8E-05	4.4E-02	8.7E-04
Future	8.3E-06	2.7E-07	2.4E-05	2.7E-07
PCDD/PCDF/PCB TEQ				
Current	1.1E-04	2.1E-05	4.5E-02	8.8E-04
Future	1.9E-05	5.6E-07	3.1E-05	5.6E-07

The background dose for evaluation of dioxin-like compounds is 93 pg TEQ/ kg·day.

3.2 Toxicity Assessment

The toxicity assessment approach is described in detail in RAWP Section 7.2. Chronic toxicity data were generally obtained from the EPA *Regional Screening Levels (RSLs) for Chemical Contaminants at*

Superfund Sites (EPA 2013, as amended). The regional screening level (RSL) table is a living document that reflects the current state of the science of toxicology and risk assessment.

Specific toxicity values used in this assessment can be found in Supplement 4 of the RAWP (24590-WTP-RPT-ENV-14-003) which provides the toxicity value, its source, and whether the value has been extrapolated from another exposure pathway (e.g., oral to dermal). Values were last updated on May 17, 2017. These toxicity values were used with the exposure levels, estimated with the methods discussed in Section 3.1, to estimate risks, which are provided in the risk characterization (Section 3.3). The remainder of this toxicity assessment discusses key concepts to assist in understanding the risk assessment approaches used for different types of effects.

3.2.1 Acute Inhalation Toxicity

Acute effects from direct inhalation of airborne COPCs (vapor and particulate) were evaluated by comparison of modeled one-hour maximum air concentrations to acute inhalation exposure criteria (AIEC). Acute effects from a one-hour exposure to radionuclides were estimated based on a total acute dose limit of 0.1 rem. One rem represents a 0.05% chance of eventually developing fatal cancer, so 0.1 rem represents a probability of five in 100,000.

3.2.2 Chronic Effects

The COPCs may have carcinogenic or noncarcinogenic effects, or both. The two effects are assessed differently. Radionuclides were evaluated only for carcinogenic effects but their stable form was evaluated for noncarcinogenic effects for cases where their stable form is toxic. Sections 3.2.2.1 and 3.2.2.2 summarize the toxicity assessment approach used for each.

3.2.2.1 Carcinogenic Effects

Cancer risks associated with ingestion were estimated using chemical-specific cancer slope factors (*CSF*). For chemicals, the *CSF* is defined as a plausible upper-bound estimate of the probability of a response (e.g., cancer) per unit intake of a chemical over a lifetime (EPA/540/1-89/002, *Risk Assessment Guidance for Superfund (RAGS), Vol. 1: Human Health Evaluation Manual (Part A)*).

In addition to the quantitative *CSF*, a qualitative weight-of-evidence classification is assigned by EPA to characterize the quality and quantity of data used to evaluate the potential carcinogenicity of chemicals. As defined by EPA/540/1-89/002, chemicals are assigned to one of six weight-of-evidence groups:

- Group A – Human carcinogen (sufficient evidence of carcinogenicity in humans)
- Group B1 – Probable human carcinogen (limited evidence of carcinogenicity in humans)
- Group B2 – Probable human carcinogen (sufficient evidence of carcinogenicity in animals, with inadequate or lack of evidence in humans)
- Group C – Possible human carcinogen (limited evidence of carcinogenicity in animals, or lack of human data)
- Group D – Not classifiable as to human carcinogenicity (inadequate or no evidence)
- Group E – Evidence of noncarcinogenicity for humans (no evidence of carcinogenicity in adequate studies)

Consistent with EPA/540/1-89/002, chemicals assigned a weight-of-evidence classification of A, B1, or B2 were quantitatively evaluated for carcinogenic dose-response. All Group C carcinogens were also quantitatively evaluated for carcinogenic effects per RAWP Section 7.2.1.1.

The interaction of the inhaled contaminant with the respiratory tract is affected by factors such as species-specific relationships of exposure concentrations (*EC*s) to deposited/delivered doses (e.g., human and a test species such as rat) and physiochemical characteristics of the inhaled contaminant. Therefore, EPA recommends using the concentration of the chemical in air as the exposure metric (e.g., mg/m^3), rather than inhalation intake of a contaminant in air based on inhalation rate and body weight (e.g., mg/kg·day) for estimating risk via inhalation (EPA-540-R-070-002 *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment)*).

Dermal *CSF*s were estimated for COPCs from oral toxicity values using chemical-specific gastrointestinal absorption factors to calculate total absorbed dose. This conversion is necessary because most oral *CSF*s are expressed as the amount of chemical *administered* per time and body weight; however, dermal exposure is expressed as an *absorbed* dose.

Potential infant exposures to PCDD/PCDFs and coplanar, dioxin-like PCBs in human breast milk were evaluated. The interpretation of infant exposure is limited by the lack of infant dose-response data. The EPA recommends evaluating infant exposures to dioxins in breast milk by comparing the calculated average daily dose to the infant (ADD_{inf}) to a background dose to the infant (EPA530-R-05-006). A background infant ADD_{inf} of 93 pg/kg · day of PCDD/PCDFs and co-planar, dioxin-like PCBs in breast milk as 2,3,7,8-TCDD TEQs, has been calculated by the EPA based on an average background 2,3,7,8-TCDD TEQ concentration of 25 parts per trillion (ppt) lipid measured in breast milk. Based on the national average background exposure level of 60 pg TEQ/(kg·day) of PCDD/PCDFs for nursing infants, reported by HHRAP (EPA530-R-05-006), 33 pg TEQ/(kg·day) was attributable to background exposure levels of co-planar, dioxin-like PCBs.

Ionizing radiation, and therefore all radionuclides, is considered a known human carcinogen (Group A). Cancer risk from exposure to radionuclides through ingestion, inhalation, and external exposure to radionuclides in soil was estimated using a *CSF*. Nursing infant scenarios were evaluated for exposure to strontium-90, iodine-129, cesium-134, and cesium-137. Since the background concentrations of strontium-90, iodine-129, cesium-134, and cesium-137 in human breast milk were not available, the potential toxicities of these radionuclides to an infant were evaluated using the ingestion *CSF* for each to calculate lifetime cancer risk.

For mutagenic chemicals, early life exposures have a larger impact than later exposures on lifetime risk. This impact was quantified using an age-dependent adjustment factor (*ADAF*) (EPA/630/R-03/003F, *Supplemental Guidance for Assessing Cancer Susceptibility from Early-Life Exposure to Carcinogens*).

3.2.2.2 Noncarcinogenic Effects

Ingestion-related noncarcinogenic effects of COPCs were evaluated by comparing a calculated intake or dose with an acceptable daily intake criterion (referred to as the *reference dose* [*RfD*]) established by EPA (EPA/540/R-95/036, *Health Effects Assessment Summary Tables (HEAST) FY-1995 Annual*; EPA/540/R/99/005, *Risk Assessment Guidance for Superfund: Volume I Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment)*). The *RfD* is an estimate (with uncertainty spanning perhaps an order of magnitude or greater) of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of

deleterious effects during a lifetime (EPA/540/1-89/002). The effects from inhalation of noncarcinogenic COPCs were evaluated by comparing a calculated exposure concentration with an inhalation reference value (referred to as the reference concentration [*RfC*]).

As with dermal *CSF*s, dermal *RfD*s were estimated for COPCs from oral toxicity values using chemical-specific gastrointestinal absorption factors to calculate total absorbed dose.

3.3 Risk Characterization

The purpose of the risk characterization is to evaluate the information obtained through the exposure and toxicity assessments to estimate the potential for receptors to experience adverse effects (i.e., cancer risks and noncancer hazards) as a result of exposure to media contaminated by emissions from the WTP. Potential health risks were characterized separately for carcinogenic and noncarcinogenic endpoints; chemical (i.e., nonradiological) and radiological cancer risks were also evaluated and are presented separately.

For carcinogenic effects, risk is expressed as the probability that an individual will develop cancer over a lifetime as a result of exposure to a carcinogen. Cancer risk from exposure to contamination is expressed as incremental lifetime cancer risk (*ILCR*), or the increased chance of cancer above the normal background rate of cancer. Cancer risk from external exposure to ionizing radiation is expressed in terms of morbidity.

The total cancer risk is the sum of all the constituent-specific cancer risks for COPCs of applicable pathways (inhalation, oral, and external) for each receptor. Total ILCR is 1E-5, summed over all constituents (chemicals and radionuclides) and all pathways (inhalation, oral, dermal, external).The radionuclides having potential health effects unassociated with radioactivity (i.e., noncancer effects) were evaluated as inorganic COPCs. These were antimony, barium, cadmium, cobalt, nickel, selenium, strontium, uranium, yttrium, and zirconium. For more detail on carcinogenic pathways refer to RAWP Section 7.4.1.1 for inhalation, Section 7.4.1.2 for oral, and Section 7.4.1.3 for external and absorption pathways.

Noncarcinogenic health hazards are characterized using an approach with a hazard quotient (*HQ*) and hazard index (*HI*), which is the sum of *HQ*s for a scenario. The *HQ*s were calculated for each COPC with noncarcinogenic effects. An *HI* of 1 or less indicates that the chemical-specific *ADD* is below the level associated with adverse effect. An *HI* threshold level of 0.25 has been selected. For more detail on noncarcinogenic pathways refer to the following in the RAWP: Section 7.4.2.1 for inhalation, 7.4.2.2 for oral, and 7.4.2.3 for absorption.

Additivity for all chemicals to produce a *HI* was assumed regardless of toxicological mechanism or endpoint. This approach is likely to overestimate the true human health risks associated with exposure to the COPCs, because chemicals may act on different target organs.

3.3.1 DFLAW Operating Configuration

This subsection presents the risk results for the DFLAW operating configuration, based on the exposure assessment and toxicity methods discussed in Sections 3.1 and 3.2, respectively.

3.3.1.1 Acute Total for the DFLAW Operating Configuration

No single COPC approached an acute exposure greater than 10% of the acute *HQ* threshold of 1; therefore, there are no acute risk drivers. Ammonia had the highest *HQ* of 5.1E-02 based on a maximum one-hour average *EC* of 0.16 mg/m^3. Its acute inhalation exposure criterion is 3.2 mg/m^3 (OEHHA 2016, *OEHHA Acute, 8-hour and Chronic Reference Exposure Level (REL) Summary*).

3.3.1.2 Chronic Total Risk Effects for the DFLAW Operating Configuration

Table 3-7 and Table 3-8 provide the summation of cancer risk and non-cancer risks, respectively, for the DFLAW operating configuration. The greatest cancer risk value is 1.6E-06 for the current resident subsistence farmer adult. The greatest non-cancer risk is a hazard index of 1.4E-03 for the current Hanford site industrial worker.

Table 3-7 Total Incremental Lifetime Cancer Risk for Exposure Scenarios for the DFLAW Operating Configuration

Time-frame	COPC Type	Hanford Site Industrial Worker	Resident		Resident Subsistence Farmer		Resident Subsistence Fisher	
			Adult	Child	Adult	Child	Adult	Child
Current	Chemicals	6.2E-09	4.7E-09	2.8E-09	1.6E-06	3.5E-07	1.2E-08	5.9E-09
Current	Radionuclides	3.1E-08	6.3E-09	1.9E-09	1.4E-07	7.9E-09	2.1E-08	3.3E-09
Future	Chemicals	7.5E-10	4.0E-10	3.2E-10	3.1E-09	9.4E-10	4.0E-10	3.2E-10
Future	Radionuclides	2.6E-08	1.4E-09	5.0E-10	7.1E-08	3.7E-09	1.4E-09	5.0E-10

Incremental lifetime cancer risk health threshold value is 1.0E-5.

Table 3-8 Total Hazard Index for Exposure Scenarios for the DFLAW Operating Configuration

Time-frame	COPC Type	Hanford Site Industrial Worker	Resident		Resident Subsistence Farmer		Resident Subsistence Fisher	
			Adult	Child	Adult	Child	Adult	Child
Current	Chemicals	1.4E-03	4.9E-04	6.3E-04	8.5E-04	1.1E-03	6.9E-04	7.7E-04
Future	Chemicals	1.9E-04	9.4E-05	2.3E-04	1.2E-04	2.9E-04	9.4E-05	2.3E-04

Hazard index health threshold is 2.5E-01.

In no case did the cumulative cancer risk or hazard index for chemicals or radionuclides exceed the health threshold values of 1.0E-5 (cancer risk) or 0.25 (hazard index). Pathway specific results are presented in Appendix C. A complete list of the cancer risks and hazard indices by receptor, timeframe, and COPC can be found in the support files of this document.

3.3.1.3 Summary of Risk Drivers for the DFLAW Operating Configuration

Risk assessment results for those COPCs whose contribution to risk exceeds 10% of the corresponding threshold for human health risk (refer to the RAWP Glossary) are presented in this section. Only dibenz[a,h]anthracene was identified as a risk driver (i.e., cancer risk exceeding 1E-06), associated with chronic exposure and cancer risk in the current timeframe for the resident subsistence adult farmer. The

incremental lifetime cancer risk for dibenz[a,h]anthracene for the current resident subsistence adult farmer is 1.1E-06, which is just above the criterion.

The cancer risk of dibenz[a,h]anthracene for all receptors is presented in Appendix C, along with its proportion of the cancer risk for total organics.

No inorganics presented a cancer risk or *HQ* (or *HI*) that would cause them to be considered risk drivers for human receptors. Likewise, no radionuclides presented a corresponding cancer risk that would cause them to be considered risk drivers for human receptors. No risk drivers were identified for exposures in the future timeframe.

3.3.1.4 Mutagen Assessment for the DFLAW Operating Configuration

Per RAWP Section 7.2.1.4, if the cancer risk associated with mutagenic COPCs exceeds 1.0E-07, then the risk from exposure to these COPCs is to be further assessed with consideration for age-dependent adjustment factors (*ADAF*), as described in EPA/630/R-03/003F. Mutagenic constituents that exceeded 1.0E-07 for a single or for multiple exposure pathways were carbon-14, benzo(a)pyrene, dibenz[a,h]anthracene, and 3-methylcholanthrene. The relevant receptor was the subsistence farmer.

These constituents were further assessed for mutagenicity (refer to RAWP Section 7.2.1.4). Table 3-9 shows the cancer risk value and associated exposure pathway of greatest risk contribution for the COPC indicated using an *ADAF*. The total cancer risk for all exposure pathways is also shown for the COPC with the *ADAF* applied. In no cases was the overall cancer threshold of 1E-05 exceeded.

Table 3-9 Mutagenic COPCs with Incremental Lifetime Cancer Risk in Excess of 1-in-10,000,000 for the DFLAW Operating Configuration

Receptor	Time-frame	CASRN	COPC	Dominant Exposure Pathway	ILCR for Dominant Pathway with ADAF	ILCR All Pathways with ADAF
Resident Subsistence Farmer Adult	Current	50-32-8	Benzo(a)pyrene	Milk Ingestion	5.4E-07	6.5E-07
		53-70-3	Dibenz[a,h]-anthracene	Milk Ingestion	2.2E-07	2.6E-07
		56-49-5	3-Methyl-cholanthrene	Milk Ingestion	1.3E-07	1.3E-07
		14762-75-5	Carbon-14	Milk Ingestion	9.5E-08	1.2E-07

Incremental lifetime cancer risk (ILCR) health threshold value is 1.0E-5.
ADAF: age-dependent adjustment factor

3.3.1.5 Nursing Infant Assessment for the DFLAW Operating Configuration

Section 3.1.7 presented potential infant exposures of all receptors to PCDD/PCDFs and coplanar PCBs in human breast milk. There is currently no consensus regarding the most appropriate single approach to quantitatively evaluate potential risks associated with exposure to dioxin-like compounds by nursing infants. Therefore, cancer risk was calculated in accordance with EPA/630/R-03/003F, as discussed in RAWP Section 7.2.1.4. Table 3-10 presents, for each scenario, the nursing infant cancer risks for PCDD/PCDFs and co-planar, dioxin-like PCBs. The TEQs were assessed for cancer impacts by multiplying the TEQ by the *CSF* for 2,3,7,8-TCDD.

For dioxins/furans, the largest cancer risk for the current and future exposure scenarios are 4.7E-08 for the farmer (current timeframe) and 6.1E-10 for the worker (future timeframe). For coplanar PCBs, the largest cancer risk for the current and future are 6.2E-06 and 2.7E-09, respectively, for the farmer. For the sum

of dioxins/furans and coplanar PCBs, the farmer has the largest current and future cancer risks of 6.3E-06 and 3.1E-09, respectively.

Table 3-10 Nursing Infant Dioxins/Furans and Coplanar PCB incremental Lifetime Cancer Risks for the DFLAW Operating Configuration

PCDD/PCDF TEQ				
Timeframe	**Hanford Site Industrial Worker**	**Resident**	**Resident Subsistence Farmer**	**Resident Subsistence Fisher**
Current	1.9E-09	2.3E-10	4.7E-08	4.3E-10
Future	6.1E-10	1.6E-11	3.7E-10	1.6E-11
Total Coplanar PCBs (as 2,3,7,8-TCDD TEQ)				
Timeframe	**Hanford Site Industrial Worker**	**Resident**	**Resident Subsistence Farmer**	**Resident Subsistence Fisher**
Current	7.7E-09	2.1E-09	6.2E-06	1.3E-07
Future	9.2E-10	2.8E-11	2.7E-09	2.8E-11
PCDD/PCDF/PCB TEQ				
Timeframe	**Hanford Site Industrial Worker**	**Resident**	**Resident Subsistence Farmer**	**Resident Subsistence Fisher**
Current	9.5E-09	2.3E-09	6.3E-06	1.3E-07
Future	1.5E-09	4.3E-11	3.1E-09	4.3E-11

Incremental lifetime cancer risk health threshold value is 1.0E-5.

Radionuclides (strontium-90, iodine-129, cesium-134, and cesium-137) are also included in the cancer assessment for breast milk consumption (Table 3-11). The largest current and future radionuclide total risks are 6.3E-07, and 7.1E-07, respectively, for the farmer.

Table 3-11 Nursing Infant Total Incremental Lifetime Cancer Risks for Radionuclides for the DFLAW Operating Configuration

Timeframe	Hanford Site Industrial Worker	Resident	Resident Subsistence Farmer	Resident Subsistence Fisher
Current	2.0E-07	3.5E-08	6.3E-07	3.5E-08
Future	9.8E-08	3.0E-08	7.1E-07	3.0E-08

Incremental lifetime cancer risk health threshold value is 1.0E-5.

3.3.2 Baseline WTP Operating Configuration

This subsection presents the risk results for the baseline WTP operating configuration.

3.3.2.1 Acute Total for the Baseline WTP Operating Configuration

No single COPC approached an acute exposure greater than 10% of the acute *HQ* threshold of 1; therefore, there are no acute risk drivers. Ammonia had the highest *HQ* of 4.1E-02 based on a maximum one-hour average *EC* of 0.13 mg/m^3. Its acute inhalation exposure criterion is 3.2 mg/m^3 (OEHHA 2016).

3.3.2.2 Chronic Total Risk Effects for the Baseline WTP Operating Configuration

Table 3-12 and Table 3-13 provide the summation of estimated cancer and non-cancer risks, respectively, for the baseline WTP operating configuration. The greatest cancer risk value is 2.6E-06 for the current adult subsistence farmer. The greatest non-cancer risk is a hazard index of 9.8E-03 for the current child resident subsistence farmer.

Table 3-12 Total Incremental Lifetime Cancer Risk for Exposure Scenarios for the Baseline WTP Operating Configuration

Time-frame	COPC Type	Hanford Site Industrial Worker	Resident		Resident Subsistence Farmer		Resident Subsistence Fisher	
			Adult	Child	Adult	Child	Adult	Child
Current	Chemicals	4.5E-08	3.4E-08	1.3E-08	2.6E-06	5.5E-07	1.2E-07	2.5E-08
Current	Radionuclides	6.3E-08	1.2E-08	2.2E-09	1.6E-07	1.3E-08	3.9E-08	3.0E-09
Future	Chemicals	6.6E-09	2.7E-09	2.8E-09	5.1E-08	1.1E-08	2.7E-09	2.8E-09
Future	Radionuclides	6.7E-08	4.5E-09	1.4E-09	2.0E-07	1.0E-08	4.6E-09	1.4E-09

Incremental lifetime cancer risk health threshold value is 1.0E-5.

Table 3-13 Total Hazard Index for Exposure Scenarios for the Baseline WTP Operating Configuration

Time-frame	COPC Type	Hanford Site Industrial Worker	Resident		Resident Subsistence Farmer		Resident Subsistence Fisher	
			Adult	Child	Adult	Child	Adult	Child
Current	Chemicals	2.7E-03	8.2E-04	1.5E-03	7.2E-03	9.8E-03	4.2E-03	3.9E-03
Future	Chemicals	1.0E-03	4.8E-04	1.2E-03	8.9E-04	1.8E-03	4.8E-04	1.2E-03

Hazard index health threshold is 2.5E-01.

Pathway-specific results are presented in Appendix C. A complete list of the cancer risks and hazard indices by receptor, timeframe, and COPC can be found in the support files folder of this document.

3.3.2.3 Mutagen Assessment for the Baseline WTP Operating Configuration

The constituents were further assessed for mutagenicity (see RAWP Section 7.2.1.4) as with the DFLAW configuration (Section 3.3.1.4). Table 3-14 shows the cancer risk value and associated exposure pathway of greatest risk contribution for the COPC indicated using an *ADAF*. The total cancer risk for all exposure pathways is also shown for the COPC with the *ADAF* applied. In no cases was the overall cancer risk threshold of 1.0E-05 exceeded.

Table 3-14 Mutagenic COPCs with Incremental Lifetime Cancer Risk in Excess of 1-in-10,000,000 for the Baseline WTP Operating Configuration

Receptor	Time-frame	CASRN	COPC	Dominant Exposure Pathway	ILCR for Dominant Pathway with ADAF	ILCR All Pathways with ADAF
Resident Subsistence Farmer Adult	Current	50-32-8	Benzo(a)pyrene	Milk Ingestion	5.1E-07	6.2E-07
		53-70-3	Dibenz[a,h]anthracene	Milk Ingestion	1.7E-07	2.0E-07
		56-49-5	3-Methyl-cholanthrene	Milk Ingestion	1.7E-06	1.7E-06
		14762-75-5	Carbon-14	Milk Ingestion	8.8E-08	1.2E-07
	Future	14762-75-5	Carbon-14	Milk Ingestion	1.0E-07	1.4E-07

Incremental lifetime cancer risk (ILCR) health threshold value is 1.0E-5.
ADAF: age-dependent adjustment factor

3.3.2.4 Nursing Infant Assessment for the Baseline WTP Operating Configuration

Section 3.1.7.2 presented potential infant exposure levels of all receptors to PCDD/PCDFs and coplanar PCBs in human breast milk. Section 3.3.1.5 described the approach to estimating cancer risks. For dioxins, the largest cancer risk for the current and future exposure scenarios are 6.3E-08 for the farmer and 1.4E-09 for the worker, respectively. For coplanar PCBs, the largest cancer risk for the current and future are 5.7E-06 and 3.1E-09, respectively, for the farmer. For the sum of dioxins/furans and coplanar PCBs, the farmer has the largest current and future cancer risk of 5.8E-06 and 4.0E-09, respectively.

Table 3-15 Nursing Infant Dioxins/Furans and Dioxin-Like PCB Cancer Risks for the Baseline WTP Operating Configuration (ILCR)

PCDD/PCDF TEQ				
Timeframe	**Hanford Site Industrial Worker**	**Resident**	**Resident Subsistence Farmer**	**Resident Subsistence Fisher**
Current	4.0E-09	4.7E-10	6.3E-08	7.3E-10
Future	1.4E-09	3.7E-11	8.8E-10	3.7E-11
Total Coplanar PCBs (as 2,3,7,8-TCDD TEQ)				
Timeframe	**Hanford Site Industrial Worker**	**Resident**	**Resident Subsistence Farmer**	**Resident Subsistence Fisher**
Current	1.0E-08	2.3E-09	5.7E-06	1.1E-07
Future	1.1E-09	3.6E-11	3.1E-09	3.6E-11
PCDD/PCDF/PCB TEQ				
Timeframe	**Hanford Site Industrial Worker**	**Resident**	**Resident Subsistence Farmer**	**Resident Subsistence Fisher**
Current	1.4E-08	2.8E-09	5.8E-06	1.1E-07
Future	2.5E-09	7.3E-11	4.0E-09	7.3E-11

Incremental lifetime cancer risk (ILCR) health threshold value is 1.0E-5.

Radionuclides (strontium-90, iodine-129, cesium-134, and cesium-137) are also included in the cancer assessment for breast milk consumption (Table 3-16). The largest current and future radionuclide total risks are 2.8E-06 and 5.4E-06, respectively, for the farmer.

Table 3-16 Nursing Infant Total Cancer Risks for Radionuclides for the Baseline WTP Operating Configuration (ILCR)

Timeframe	Worker	Resident	Farmer	Fisher
Current	8.5E-07	2.0E-07	2.8E-06	2.0E-07
Future	7.5E-07	2.3E-07	5.4E-06	2.3E-07

Incremental lifetime cancer risk (ILCR) health threshold value is 1.0E-5.

3.4 Sources of Uncertainty

This HHRA used the best available information, but data were often limited, resulting in sources of uncertainty (see Appendix D). These sources of uncertainty were addressed by using conservative (i.e., health protective) assumptions, so that the estimated risks in this report are likely to overestimate the actual risks. Key health protective assumptions include:

- *Human receptors.* Potential human receptors (infants, children, and adults) were addressed with a range of plausible and worst-case exposure scenarios that included conservative exposure parameter values. The scenarios included: Hanford site industrial worker, resident, resident subsistence farmer, and resident subsistence fisher. Conservative assumptions were assumed in each exposure scenario (i.e., assuming 100% of inhaled, ingested, and adsorbed media is contaminated), and bioavailability and metabolism factors[7] were set to 1. Appendix D, Section D.2.1.2 discusses additional uncertainties associated with human receptors.
- *Toxicity values.* The assessment used conservative toxicity parameters prepared by regulatory and health agencies. The EPA derives *RfD*s and *RfC*s by applying uncertainty factors to the no observed adverse effect level (NOAEL) or lowest observed adverse effect level to provide a margin of safety. Uncertainty factors can range from 1 to 10,000. For chemicals, the *CSF* is defined as a plausible upper-bound estimate of the probability of a response. Additional information regarding uncertainty in the toxicity assessment is provided in Appendix D, Section D.2.2.
- *Risk characterization.* Exposures were summed across pathways when they likely act on different target organs. Cancer risks, which are calculated using upper-bound *CSF*, were summed across pathways, producing overestimates of the risks. Refer to Appendix D, Section D.2.3 for additional information.

[7] The exception is the metabolism factor for bis(2-ethylhexyl)phthalate, which HHRAP (EPA530-R-05-006) recommends a value of 0.01.

4 Screening Level Ecological Risk Assessment

4.1 Introduction

The SLERA is built on four fundamental components of the EPA's ecological risk assessment process: (1) problem formulation, (2) exposure assessment, (3) effects assessment, and (4) risk characterization. The SLERA evaluated COPCs identified in the RAWP and is based on the emissions estimates, atmospheric dispersion modeling, and environmental modeling discussed in Section 2. The SLERA is conducted using a variety of conservative assumptions throughout the entire process in order to bound estimated impacts and focus risk management efforts on risk drivers, relevant exposure pathways, and those receptors for which the modeling results presented possible concerns.

4.2 Problem Formulation

Problem formulation is a planning process that establishes the goals, breadth, and focus of the risk assessment. Problem formulation defines the conceptual exposure model, ecological setting, ecological receptors, and assessment/measurement endpoints used to characterize risks. These four elements are thoroughly discussed in RAWP Sections 8.1.1, 8.1.2, 8.1.3, and 8.1.4, respectively. Overviews of each of these elements are presented below.

4.2.1 Conceptual Model

In ecological risk screening, the conceptual model focuses on identifying potentially complete exposure pathways for wildlife and other receptors at and around the Hanford Site. An exposure pathway is the means through which an organism comes in contact with a substance in the environment. The RAWP presents the conceptual exposure model developed to identify ecological receptors and relevant exposure pathways for the PRA. The end product of the conceptual exposure model is the identification of exposure scenarios that are defined by exposure pathways and potentially exposed populations. The conceptual model was developed from information obtained from EPA530-D-99-001A and DOE/RL-96-16. The conceptual exposure model is shown as Figure 4-1.

4.2.2 Ecological Setting and Description of Habitats

The ecological setting and habitats at Hanford and offsite locations determine what receptors will be potentially exposed and the important complete pathways for the receptors. The Hanford Site and offsite locations are located in the shrub-steppe region of the Columbia Basin (Daubenmire 1970, *Steppe Vegetation of Washington*). The Hanford Site, unlike adjacent areas, has not been farmed or grazed for over 50 years, so it has essentially returned to native status. It has become a refuge for a variety of plant and animal species (Gray and Rickard 1989, "The Protected Area of Hanford as a Refugium for Native Plants and Animals"), containing one of the largest remaining undisturbed shrub-steppe ecosystems in Washington State. About 665 km^2 (257 mi^2) of undeveloped lands are located on the site.

According to Western Regional Climate Center data from 2002, the average annual precipitation totals about seven inches at the Hanford Site, evenly distributed throughout the fall, winter, and spring months, with little precipitation during the summer. The Columbia River flows through the northern part of the Hanford Site and bends south to form part of the Hanford Site's eastern boundary. The Yakima River runs near the southern boundary. Rattlesnake Mountain, Yakima Ridge, and Umtanum Ridge form the

southwestern and western boundaries of the Hanford Site. The Saddle Mountains form the northern boundary (see Figure 4-2).

Biological diversity in the region is enhanced by the large, relatively undisturbed tract of native shrub-steppe habitat on the Hanford Site and by the Hanford Reach, a stretch of the Columbia River below Priest Rapids Dam (TC&WM EIS, DOE/EIS-0391). Additional factors influencing biological diversity include topographic features such as Rattlesnake Mountain, Gable Butte, Gable Mountain, and the presence of a variety of soils ranging from sand to silty and sandy loam. Unique topographic features include basalt outcrops, scarps (cliffs), scree slopes, and sand dunes. Offsite areas likely have similar features and habitats. Aquatic habitats relevant to the PRA are associated with the Columbia River (Figure 4-2).

Figure 4-1 Ecological Resources Conceptual Exposure Model

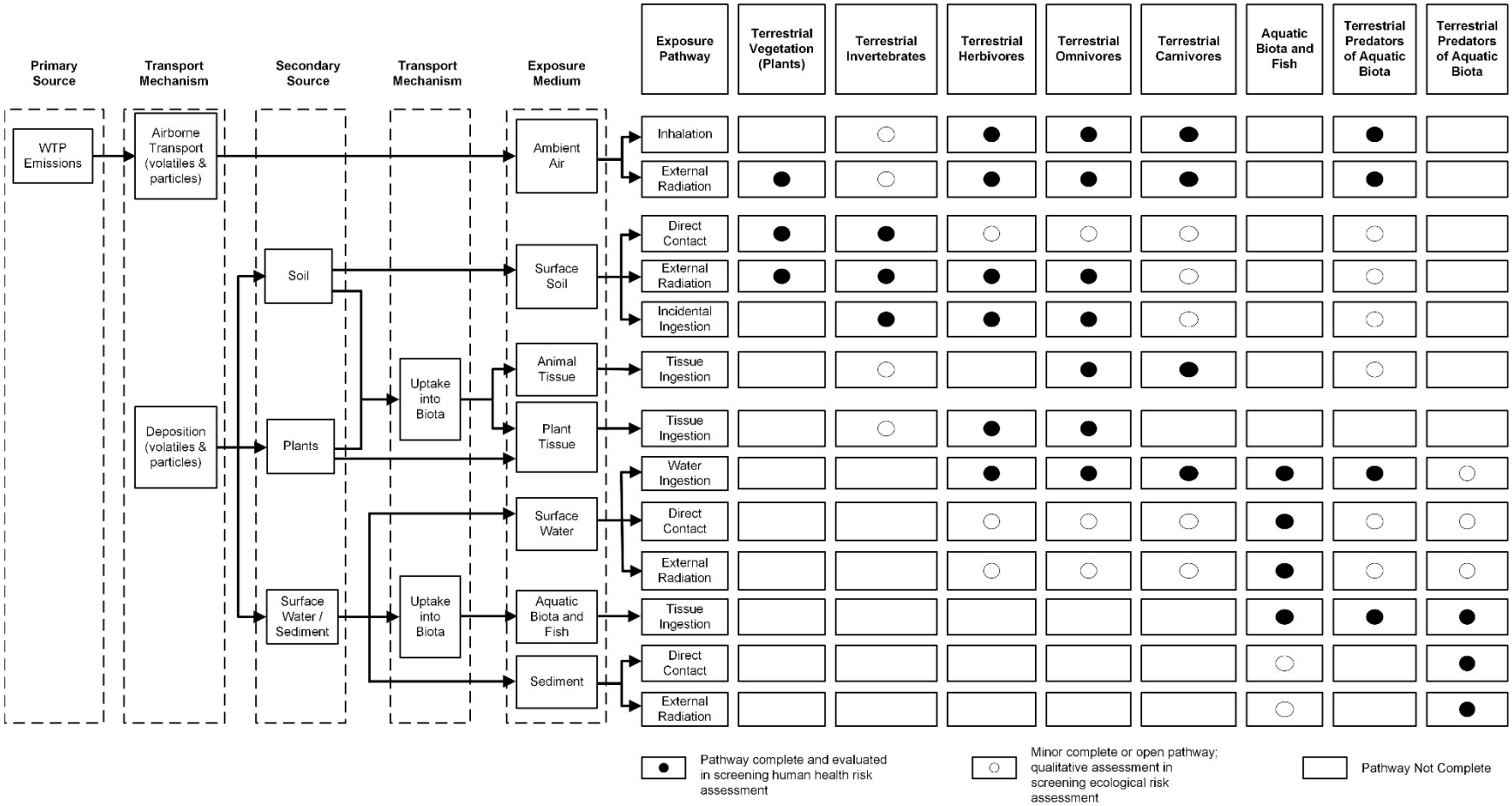
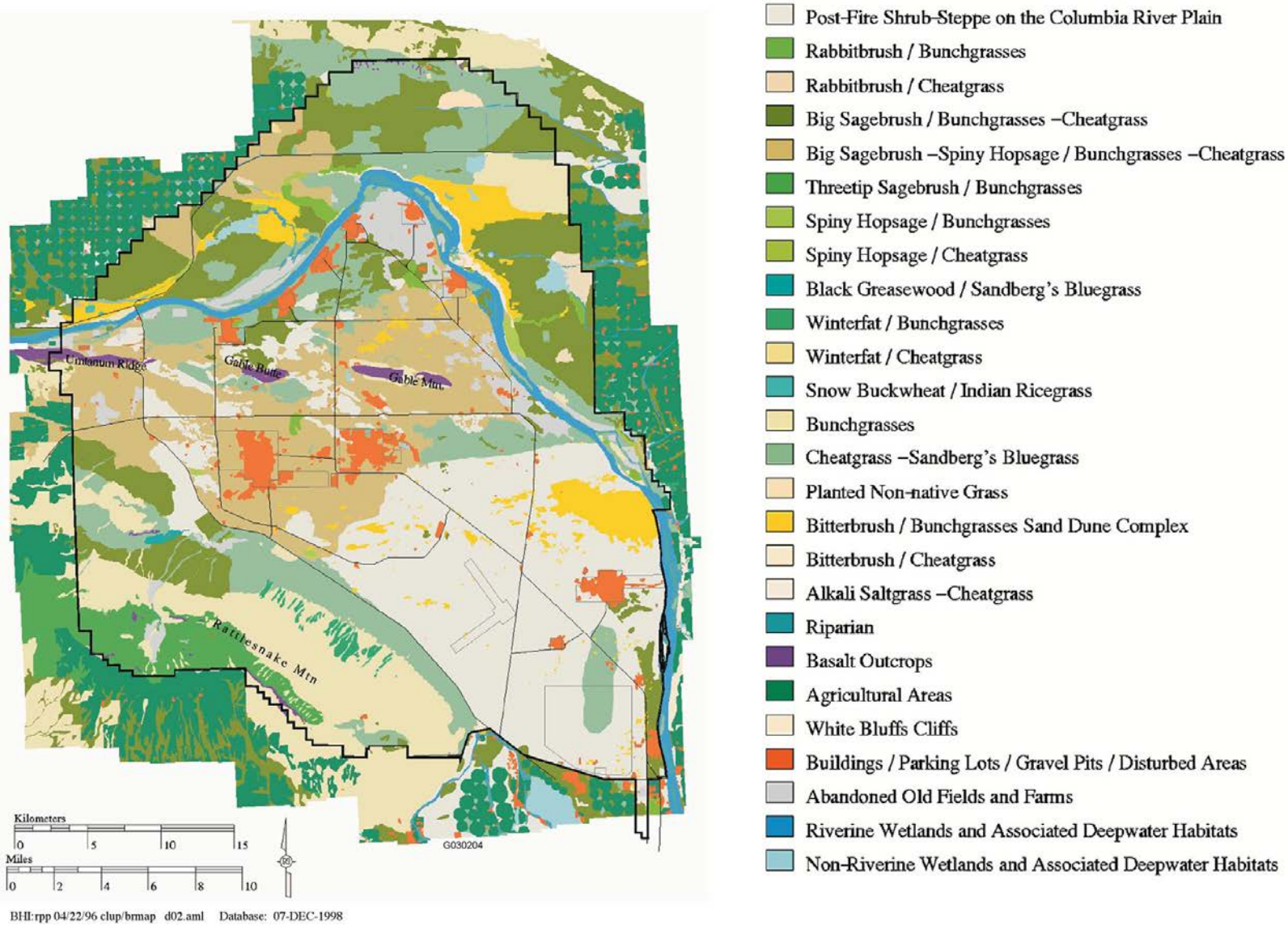


Figure 4-2 Vegetation Types of the Hanford Site



4.2.2.1 Central Plateau (Terrestrial Habitat)

The Central Plateau and surrounding areas in the Columbia Basin are predominantly shrub-steppe (BHI-00005, Rev. 0, Site Evaluation Report for Candidate Basalt Quarry Sites), characterized by bunchgrasses and sagebrushes. The WTP site in and immediately surrounding the 200 East Area is approximately 40% big sagebrush and rabbitbrush (Figure 4-2) and 20% Russian thistle, with the remainder disturbed vegetation or bare gravel (94-WHC-142, *Biological Review of the Tank Waste Remediation System (TWRS) Sites*). Introduced perennial grasses (e.g., Siberian wheatgrass [*Agropyron sibericum*]) have been used extensively in the Central Plateau to revegetate and stabilize disturbed areas against wind and water erosion. Additional details regarding the Central Plateau habitat and the Hanford Site are found in the TC&WM EIS (DOE/EIS-0391).

A characterization study of small mammals performed south of the 200 East Area identified the Great Basin pocket mouse, deer mouse, northern grasshopper mouse, sagebrush vole, and western harvest mouse (PNL-2253, *Ecology of the 200 Area Plateau Waste Management Environs: A Status Report*). The Great Basin pocket mouse represented more than 90% of the individuals caught. Medium and large mammals on site include rabbits, coyotes, badgers, and mule deer (PNL-2253). Many common bird species, such as the western meadowlark and sage sparrow, are likely to occur on the Central Plateau where suitable habitats exist.

Eleven raptors have been documented as nesting on the Hanford Site. These include the northern harrier, red-tailed hawk, Swainson's hawk, American kestrel, great horned owl, and burrowing owl (Fitzner and Gray 1991, "The Status, Distribution and Ecology of Wildlife on the U.S. DOE Hanford Site: A Historical Overview of Research Activities"; Rickard et al. 1988, *Shrub-steppe: Balance and Change in a Semi-arid Terrestrial Ecosystem*). Raptors use a variety of habitats for nesting and foraging on the Hanford Site, including outcrops, cliffs, trees, marshes, fields, and utility towers.

4.2.2.2 Columbia River (Aquatic Habitat)

The two major vegetation types occurring along the Hanford Reach are riparian and upland (NPS 1994, *Hanford Reach of the Columbia River, River Conservation Study and Environmental Impact Statement; Benton, Franklin, Grant, Walla Wala, and Yakima Counties, Washington*). Riparian habitats are found along the shoreline, in slack water and slough areas, and on islands in the river. Vegetation includes both woody and herbaceous species maintained by the high water table immediately adjacent to the river, and commonly includes reed canary grass, common witch grass, large barnyard grass, summer-blooming forbs, sandbar willow, poplar, white mulberry, and Russian olive (NPS 1994). Upland habitats along the Hanford Reach are composed of shrub-steppe vegetation similar to that found on the Central Plateau. Additional details regarding the Hanford Reach habitat and the Hanford Site are found in the TC&WM EIS (DOE/EIS-0391).

Wildlife in the Hanford Reach includes Canada geese, which use islands along the Hanford Reach extensively for nesting. Mule deer use the islands and other riparian areas for fawning habitat and nursery areas. Great blue herons and black-crowned night herons are associated with trees in riparian habitat along the Columbia River and use groves or individual trees for perching and nesting. The area supports over 40 species of fish, including salmon and steelhead, sturgeon, smallmouth bass, catfish, squawfish, and walleye.

4.2.2.3 Assumed Exposure Locations

Exposure locations are areas within the deposition grid at which ecological receptors are assumed to be continuously present and assumed to contact COPCs. They are exposed directly or indirectly through a food chain; in the air; and by those constituents deposited from the air onto soil and plants, or into water and sediment. Contamination at a given location is represented by COPC concentrations modeled for each of these media, as well as each item of food consumed by wildlife (see RAWP Section 8.2.1).

The COPC emissions estimates, air concentrations, and deposition fluxes were used to calculate media EPCs, represented by the onsite 90th percentile for terrestrial receptors, the Columbia River maximum for aquatic receptors and all water/sediment consumption for wildlife. These media concentrations were, in turn, used to calculate COPC concentrations in plant and animal matter ingested by wildlife. By assuming all terrestrial receptors forage and hunt at the onsite COPC 90th percentile location, and all aquatic receptors forage and hunt at the Columbia River COPC maximum location, the SLERA is purposely conservative to bound potential risks. It does not account for normal movement and distribution of COPC concentrations within the range of wildlife that would reduce exposures, nor does it reflect any other factors that would reduce exposures below the 90th percentile or maximum concentrations.

4.2.3 Receptor Identification and Food Webs

The terrestrial receptors were organized into a food web (Figure 4-3) based on trophic levels through which COPCs are transferred (i.e., from soil to producer, producer to consumer, and prey to predator). The communities and feeding guilds, trophic levels, and measurement receptors are:

- Plants (Trophic Level 1): cheatgrass, rabbitbrush
- Terrestrial invertebrates (Trophic Level 2): earthworms, darkling beetles
- Herbivorous mammals (Trophic Level 2): mule deer
- Herbivorous birds (Trophic Level 2): mourning dove
- Omnivorous mammals (Trophic Level 3): Great Basin pocket mouse
- Omnivorous birds (Trophic Level 3): western meadowlark
- Carnivorous mammals (Trophic Level 4): coyote
- Carnivorous birds (Trophic Level 4): burrowing owl, red-tailed hawk

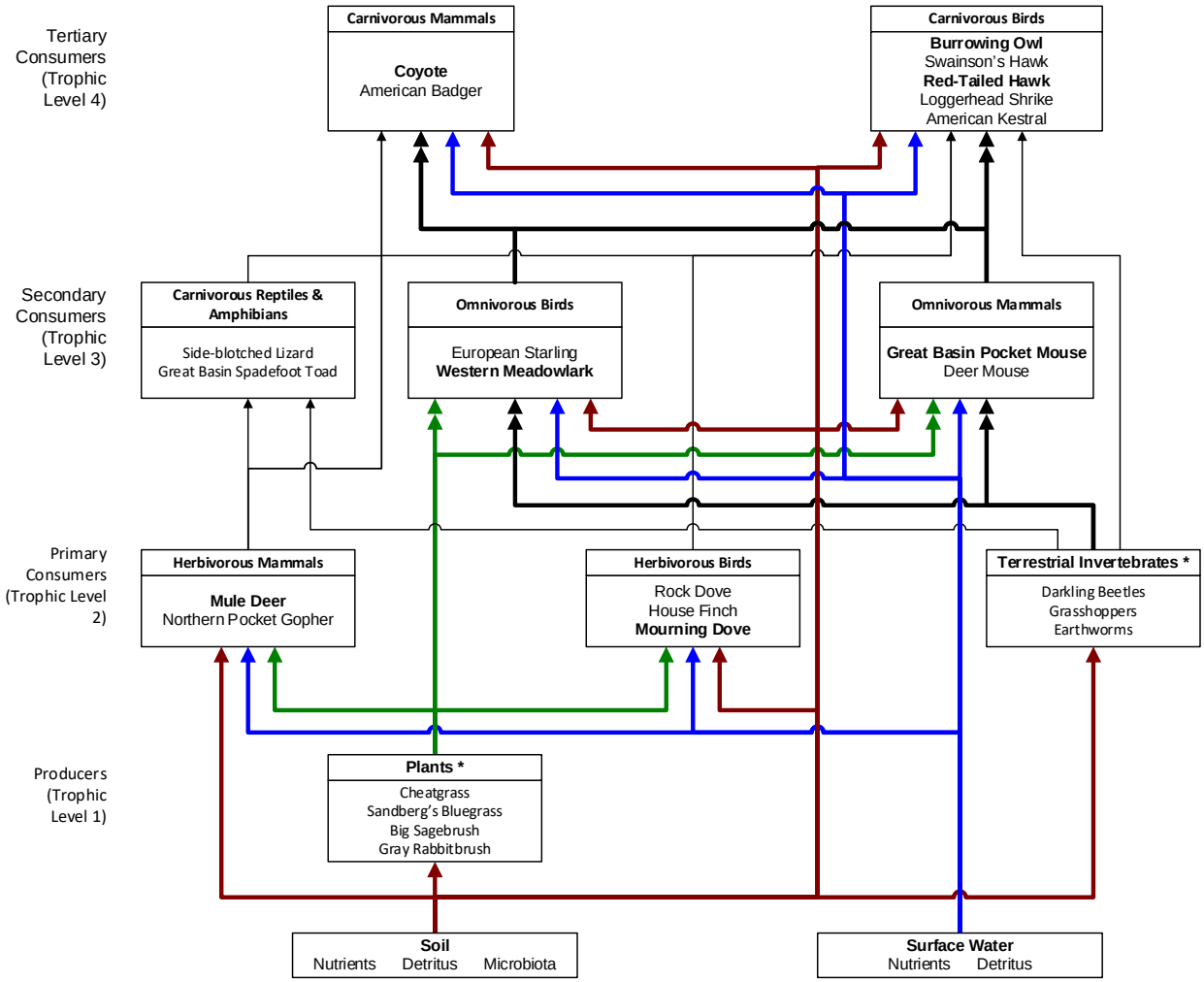
The aquatic receptors were organized similarly (Figure 4-4). The communities and feeding guilds, trophic levels, and measurement receptors are:

- Plants (Trophic Level 1): aquatic plants and plants rooted in sediment
- Benthic invertebrates (Trophic Level 2): sediment-dwelling clams and insects
- Aquatic organisms, fish, and other aquatic biota (Trophic Levels 2 through 4): bass, salmon, channel catfish, water fleas, other invertebrates
- Herbivorous waterfowl (Trophic Level 2): Canada goose
- Shorebirds (Trophic Level 3): spotted sandpiper
- Piscivorous birds (Trophic Level 4): great blue heron, bald eagle
- Piscivorous mammals (Trophic Level 4): mink

Applicable life history parameters for the measurement receptors are summarized in Table 4-1. The exposure parameters related to the fraction of plant and animal matter in the diet are in Table 4-2. Additional details are in RAWP Sections 8.1 and 8.2.

Figure 4-3 and Figure 4-4 provide the food webs for terrestrial and aquatic ecological receptors, respectively.

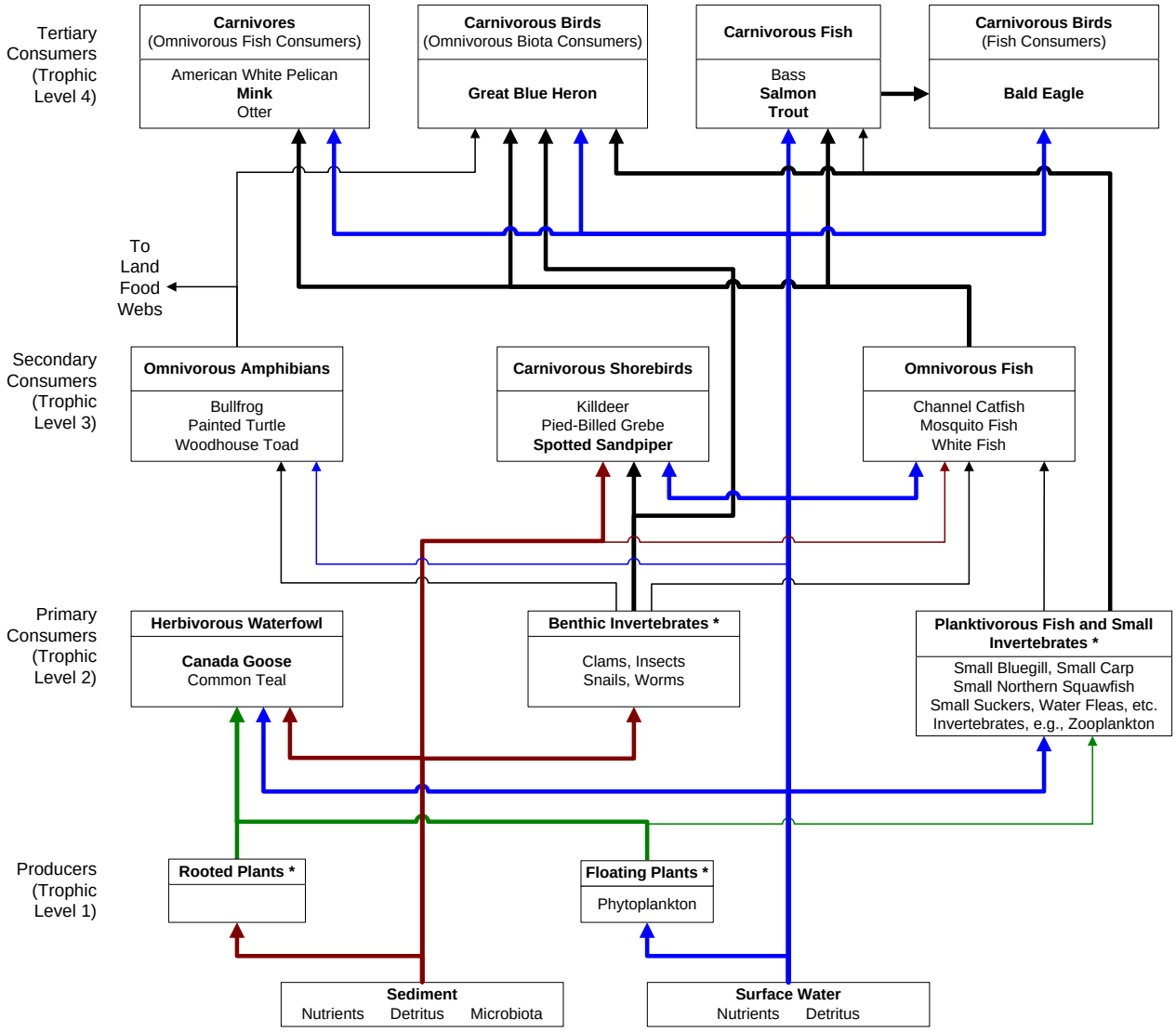
Figure 4-3 Upland Terrestrial Food Web and Receptors



Bold-faced type indicates measurement receptors for which exposure will be evaluated quantitatively.
Heavy lines indicate exposure pathways that will be evaluated quantitatively.
Thin lines indicate exposure pathways that will not be evaluated quantitatively.
Double arrow heads indicate food source is one of two potential exclusive food sources (see RAWP Section 8.2.1).
Line color indicates ingestion pathway (brown=soil, blue=water, green=plant, black=prey).

* Species specific measurement receptors not identified because the group is evaluated on a community level.

Figure 4-4 Columbia River Aquatic Food Web and Receptors



Bold-faced type indicates measurement receptors for which exposure will be evaluated quantitatively.
Heavy lines indicate exposure pathways that will be evaluated quantitatively.
Thin lines indicate exposure pathways that will not be evaluated quantitatively.
Line color indicates ingestion pathway (brown=soil, blue=water, green=plant, black=prey).

* Species specific measurement receptors not identified because the group is evaluated on a community level.

Table 4-1 Summary of Life History Parameters for Mammals and Birds

Receptor	Trophic Level	Body Weight (kg)	Home Range (ha)	Food Ing. Rate (kg/kg·BW/day)	Water Ing. Rate (kg/kg·BW/day)
Terrestrial Receptors					
Mule Deer	2	66.5	285	0.03476	0.044
Mourning Dove	2	0.128	1	0.21169	0.116
Great Basin Pocket Mouse	3	0.016	0.14	0.285	0
Western Meadowlark	3	0.094	3	0.028	0.13
Coyote	4	12.4	3010	0.018	0.077
Burrowing Owl	4	0.15	241	0.042	0.11
Red-Tailed Hawk	4	1.055	1770	0.105	0.057
Aquatic Receptors					
Canada Goose	2	3.72	983	0.031	0.038
Spotted Sandpiper	3	0.0425	0.25	0.875	0.165
Great Blue Heron	4	2.39	3.1	0.18	0.045
Bald Eagle	4	3.75	10	0.12	0.036
Mink	4	0.85	2.24	0.14	0.11

Table 4-2 Summary of Exposure Parameters for Receptors

Terrestrial Receptors	Plant Matter Diet Fraction	Animal Matter Diet Fraction	Soil Ingested Fraction	Fraction of Time Above Ground	Fraction of Time Spent Below Ground
Plants	n/a	n/a	n/a	0.5	0.5
Terrestrial Invertebrates	n/a	n/a	n/a	0.5	0.5
Mule Deer	1	0	0.02	1	0
Mourning Dove	1	0	0.09	1	0
Great Basin Pocket Mouse	0.62	0.38	0.01	0.3	0.7
Western Meadowlark	0.3	0.7	0.04	1	0
Coyote	0.02	0.98	0.0023	0.7	0.3
Burrowing Owl	0	1	0.1	0.5	0.5
Red-Tailed Hawk	0	1	0	0.05[a]	0

Aquatic Receptors	Plant Matter Diet Fraction	Animal Matter Diet Fraction	Sediment Ingested Fraction	Fraction of Time Near Water	Fraction of Time in Water	Fraction of Time in Sediment-Water Interface	Fraction of Time in Sediment
Plants	n/a	n/a	n/a	0	0.9	0.1	0
Benthic Invertebrates	n/a	n/a	n/a	0	0.1	0	0.9
Aquatic Biota	n/a	n/a	n/a	0	0.9	0.1	0
Planktivorous Fish	n/a	n/a	n/a	0	0.9	0.1	0
Omnivorous Fish	n/a	n/a	n/a	0	0.9	0.1	0
Carnivorous Fish	n/a	n/a	n/a	0	0.9	0.1	0
Canada Goose	1	0	0.07	0.5	0	0	0
Spotted Sandpiper	0	1	0.036	0.5	0	0	0
Great Blue Heron	0	1	0	0.5	0	0	0
Bald Eagle	0	1	0	0.05	0	0	0
Mink	0.09	0.91	0	0.2	0	0	0

"n/a" indicates the medium is not applicable to the receptor.

[a] It is assumed the red-tailed hawk spends 95% of the time in flight or perched such that there is negligible exposure due to radionuclides in the soil

4.2.4 Assessment Endpoints and Measures of Effect

Assessment endpoints and measures of effect were formulated following EPA530-D-99-001A guidance for communities and feeding guilds characteristic of the ecosystems in the study area. The assessment endpoints include:

- Protection of individual threatened and endangered (T&E) species
- Conservation of terrestrial plant and invertebrate communities, mammals, and birds
- Conservation of aquatic plant, invertebrate, and fish communities, mammals, and birds

Critical attributes of assessment receptors are survival for T&E species, and the abundance and productivity of communities and feeding guild populations. Protection of survival, abundance, and reproduction is assumed to protect the structure and function of the ecosystems.

Measures of effect, which are used in conjunction with measurement receptors to evaluate the assessment endpoints for the communities and feeding guilds, included comparing modeled COPC concentrations in media (soil, water, and sediment) and ingestion doses (for feeding guild receptors) to COPC concentrations and doses representing NOAEL toxicity. Where a modeled exposure level is less than the NOAEL, that COPC does not present an unacceptable hazard to a receptor, pending evaluation of the significance and magnitude of any uncertainties associated with the analysis.

4.3 Exposure Assessment

To estimate ecological risk to receptors from COPCs emitted from the WTP, terrestrial upland receptors and Columbia River receptors were evaluated. Air dispersion modeling determined the dispersal, concentrations, and deposition flux data for each habitat. The exposure levels for terrestrial receptors are based on the onsite air concentrations and deposition fluxes modeled for hundreds of upland locations and the 90th percentile values to carry forward into the exposure assessment. The exposure levels for receptors in the aquatic habitat, as well as the drinking water for wildlife, are based on the maximum air concentrations and depositions modeled for the Columbia River, regardless of location.

This section presents the modeled exposure levels for the terrestrial and aquatic receptors for both the DFLAW configuration and the baseline WTP configuration. The RAWP Section 8.2.3 details the methods for quantifying exposures for terrestrial receptors; RAWP Section 8.2.4 details the quantification of exposure at the Columbia River maximum (for aquatic receptors). Exposure levels include EPCs and estimated exposure levels in soil, water, and sediment, as well as doses to mammals and birds. The exposure levels for the DFLAW configuration and baseline WTP configuration are presented separately. While this report focuses on the risk drivers, the exposure levels for every substance evaluated in the PRA are presented in the support files of this document.

4.3.1 Key Assumptions

While basing the exposure assessment on very conservative data as outlined above is not realistic by any reasonable measure, the conservatism provides an upper bound to possible exposures. It is also an important counterbalance to uncertainties arising from the lack of information about populations of ecological receptors on- and off-site. For example, the conservative technical approach does not account for natural movement of receptors and the actual distribution of both direct and indirect exposures, which would be substantially lower. However, as an upper bounding estimate, it ensures that risks are not underestimated. The exposure assessment also assumes that all chemicals or radionuclides ingested reach the site of toxic action (i.e., an organ where toxicity is exerted). Thus, the analysis assumes substances

are completely bioavailable and are not metabolized, excreted, or sequestered, processes that are normal to all biota.

The exposure assessment assumes exposure from ingestion of food, soil, sediment, and water, as appropriate based on each receptor's life history and the best available information. The ingestion rates of food and environmental media (soil, sediment, and water) and the proportions of different types of food (plants and prey) that receptors ingest are summarized in Section 4.2. For more detail on receptor diets, refer to RAWP Section 8.2.1.

The proportions of different types of food that a receptor eats (i.e., its diet) are important factors in determining the exposure because different food types have different concentrations of COPCs. Two general diets to estimate ingestion exposure of omnivores and carnivores are discussed in this section. An *exclusive diet* is a diet consisting of a single type of prey or food, while a *realistic diet* is a diet where the fractions of different types of prey or food eaten are more or less the fractions reported to actually occur in one or more cases for the receptor or similar species. In the SLERA, the exposure assessment evaluated an exclusive diet in which the concentration of COPCs is calculated for each food item, and the food item with the highest concentration is used in the exposure evaluation. Thus, the exclusive diet scenario is a worst-case scenario that compounds the conservatism in the exposure assessment (i.e., it gives the most conservative risk estimate).

4.3.2 DFLAW Operating Configuration Risk Drivers

This section presents calculated exposures estimated for the DFLAW operating configuration; only the results for risk drivers (i.e., greater than 10% of threshold or *ESQ* > 0.025) are presented. The following exposure estimates are presented:

- EPCs for soil and plants for the upland terrestrial habitat and water, sediment, and plants for the Columbia River habitat.
- Estimated exposure levels (*EEL*) for terrestrial plant and soil invertebrate communities in the upland habitat, and aquatic life and benthic invertebrate communities in the Columbia River habitat
- Daily doses (*DD*) for mammals and birds in both the terrestrial and aquatic habitats

Appendix C provides the EPCs of all receptors for the risk driver COPCs.

4.3.2.1 Media Exposure Point Concentrations and Estimated Exposure Levels for the DFLAW Operating Configuration

The following sections present the EPCs for the risk drivers, which are those COPCs presenting risk that exceeds 10 percent of the risk threshold (*ESQ* > 0.025) for one or more receptor. While the EPCs are not directly comparable, they provide some relative context about the levels of risk drivers estimated for media and plants. The EPCs represent the starting concentrations in media and plants used to model direct and indirect ingestion exposures by mammals and birds. An EPC may also represent a media *EEL* for characterizing risks to plants, invertebrates, or fish, in which cases the risk driver may be relevant to those receptors. The text points out where an EPC also represents an *EEL*.

An *ESQ* of 1 or less indicates that the chemical-specific dose or media concentration is below the level associated with adverse effect. An *ESQ* threshold level of 0.25 has been selected as a risk management decision by Ecology and EPA Region 10 to provide a conservative evaluation of hazard to ecological receptors. Thus, the level for a risk driver is an *ESQ* of 0.025 or greater. No inorganics or radionuclides

presented a corresponding hazard that would cause them to be considered risk drivers for ecological receptors.

For the DFLAW operating configuration, three high molecular weight (HMW) polycyclic aromatic hydrocarbons (PAH) presented *ESQ*s greater than 0.025 based on the toxicity reference values in the RAWP; thus, these compounds were identified as risk drivers:

- benzo(b)fluoranthene[8] (205-99-2)
- benzo(k)fluoranthene (207-08-9)
- benzo(a)anthracene (56-55-3)

These were identified as organic compound risk drivers for the burrowing owl, mourning dove, and red-tailed hawk. No inorganic compounds or radionuclides presented as risk drivers for ecological receptors. The discussions which follow present the risk driver EPCs.

4.3.2.1.1 Central Plateau Terrestrial Receptors

The soil and terrestrial plant EPCs (Table 4-3) include the three ecological risk drivers identified for the DFLAW operating configuration. The EPCs for surface soil represent the concentrations of risk drivers in soil ingested by mammals and birds, and those for the top 15 cm of soil represent COPC concentrations for the root uptake pathway for terrestrial plants. The COPC concentrations in plants, which are also shown, stem from root uptake as well as direct deposition from the air and transfer of vapor from air. The total COPC concentrations in plants from combined root uptake, deposition, and vapor transfer are presented in the last column.

The concentrations in the top 2 cm of the soil also are *EEL*s for terrestrial plants and soil invertebrates, but in this case the values do not exceed 10% of the organics *ESQ*s for these communities, so the three PAHs are not risk drivers for plants and invertebrates.

Table 4-3 DFLAW Operating Configuration, Terrestrial Media EPCs

		Soil Concentration		Plant Tissue Concentration			
CASRN	Constituent	Surface (top 2 cm) (mg/kg)	Root Zone (top 15 cm) (mg/kg)	Root Uptake (mg/kg)	Deposition (mg/kg)	Air-to-plant Transfer (mg/kg)	Total (mg/kg)
205-99-2	Benzo(b)fluoranthene	3.6E-04	4.9E-05	5.9E-08	2.8E-08	6.9E-08	1.6E-07
207-08-9	Benzo(k)fluoranthene	2.4E-04	3.2E-05	3.9E-08	3.4E-07	1.1E-06	1.5E-06
56-55-3	Benzo(a)anthracene	4.0E-05	5.4E-06	1.3E-08	6.7E-08	7.0E-08	1.5E-07

4.3.2.1.2 Columbia River Aquatic Receptors

The water column, sediment, and aquatic plant EPCs (Table 4-4) are presented for the three risk drivers. The EPCs for total water column concentration are used to:

- Evaluate risks to aquatic invertebrates and fish; thus, the EPCs are also *EEL*s for aquatic life
- Estimate COPC concentrations in aquatic invertebrates and, for certain COPCs, fish
- Estimate uptake in drinking water ingested by mammals and birds

[8] Chemical Abstract Services registry number (CASRN) is shown in the parenthesis.

The dissolved water phase COPC concentrations are used to model the uptake of COPCs by aquatic invertebrates and fish (for most COPCs).

The COPC concentrations in sediment are used to:

- Evaluate risks to benthic invertebrates; thus, these values are *EEL*s for this community
- Estimate uptake of COPCs from sediment by benthic invertebrates and, for certain COPCs, fish
- Estimate uptake of COPCs from ingested sediment by mammals and birds that forage for food in the sediment

Table 4-4 also lists the EPCs for aquatic plants, estimated based on uptake from the water column, sediment, and air-to-plant vapor transfer. The sediment interstitial water concentrations are estimated for COPCs where it is necessary to predict uptake into sediment-based food chains based on a sediment-pore water equilibrium model.

Table 4-4 DFLAW Operating Configuration, Aquatic Media EPCs

CASRN	Constituent	Water Column Total (mg/L)	Dissolved Phase (mg/L)	Sediment (mg/kg)	Aquatic Plant Tissue (mg/kg)
205-99-2	Benzo(b)fluoranthene	1.2E-10	6.6E-11	2.8E-06	2.8E-08
207-08-9	Benzo(k)fluoranthene	3.9E-11	2.2E-11	8.8E-07	8.9E-09
56-55-3	Benzo(a)anthracene	1.3E-11	1.0E-11	1.5E-07	2.9E-09

4.3.2.2 Exposure Assessment for the DFLAW Operating Configuration

The risk driver *DD*s for terrestrial and aquatic receptors for the DFLAW operating configuration are the COPC dose used to evaluate exposures to mammals and birds. Appendix C provides the *EEL* and *DD* of all receptors for the risk driving COPCs.

4.3.2.2.1 Central Plateau Terrestrial Receptors

Table 4-5 summarizes the risk drivers for terrestrial receptors as determined in the SLERA. The *EEL*s for the upland ecosystem include *DD*s for mammals and birds. No inorganic or radionuclide COPCs, including their respective totals, were identified as risk drivers and/or contributors. Only affected receptors are listed.

Table 4-5 Terrestrial Receptor Risk Driver Daily Dose for the DFLAW Operating Configuration

Receptor	CASRN	Constituent	DD (mg/(kg·day))
Mourning Dove	205-99-2	Benzo(b)fluoranthene	7.0E-06
	207-08-9	Benzo(k)fluoranthene	4.9E-06
Burrowing Owl	205-99-2	Benzo(b)fluoranthene	2.6E-05
	207-08-9	Benzo(k)fluoranthene	5.0E-05
Red-Tailed Hawk	205-99-2	Benzo(b)fluoranthene	6.2E-05
	207-08-9	Benzo(k)fluoranthene	1.2E-04
	56-55-3	Benzo(a)anthracene	3.5E-05

4.3.2.2.2 Columbia River Aquatic Receptors

No risk drivers were identified for aquatic mammals and birds for the DFLAW operating configuration.

4.3.3 Baseline WTP Operating Configuration Risk Drivers

The calculated exposures estimated to occur for the baseline WTP operating configuration resulted in the following risk drivers (i.e., those greater than 10% of threshold or *ESQ* > 0.025) and exposure estimates:

- EPCs for soil and plants for the upland terrestrial habitat, and water, sediment, and plants for the Columbia River habitat.
- *EEL*s for terrestrial plant and soil invertebrate communities in the upland habitat, and aquatic life and benthic invertebrate communities in the Columbia River habitat
- *DD*s for mammals and birds in both the terrestrial and aquatic habitats

Appendix C provides the EPCs of all receptors for the risk driver COPCs.

4.3.3.1 Media Exposure Point Concentrations and Estimated Exposure Levels for the Baseline WTP Operating Configuration

For the baseline operating configuration, six organic COPCs were identified as risk drivers, with corresponding *ESQ*s in excess of 0.025. The compounds include PCBs, four PAHs, and a metabolite of the legacy pesticide DDT:

- Polychlorinated biphenyls (1336-36-3)
- Benzo(b)fluoranthene (205-99-2)
- Benzo(k)fluoranthene (207-08-9)
- 5-Methylchrysene (3679-24-3)
- Benzo(a)anthracene (56-55-3)
- 4,4’-DDE (72-55-3)

Organic risk drivers presented for the burrowing owl, coyote, great basin pocket mouse, mourning dove, red-tailed hawk, and western meadowlark. No inorganics or radionuclides presented a corresponding *ESQ* that would cause them to be considered risk drivers for ecological receptors. The risk driver EPCs are presented below.

4.3.3.1.1 Central Plateau Terrestrial Receptors

Table 4-6 presents the EPCs for the risk drivers identified for the baseline WTP operating configuration for the terrestrial receptors.

Table 4-6 Baseline WTP Operating Configuration, Terrestrial Media EPCs

CASRN	Constituent	Soil Concentration		Plant Tissue Concentration			
		Surface (top 2 cm) (mg/kg)	Root Zone (top 15 cm) (mg/kg)	Root Uptake (mg/kg)	Deposition (mg/kg)	Air-to-plant Transfer (mg/kg)	Total (mg/kg)
1336-36-3	Polychlorinated biphenyls	4.6E-05	1.8E-04	1.9E-07	0.0E+00	2.8E-08	2.2E-07
205-99-2	Benzo(b)fluoranthene	2.5E-04	3.3E-05	4.0E-08	2.0E-08	3.4E-08	9.5E-08

Table 4-6 Baseline WTP Operating Configuration, Terrestrial Media EPCs

CASRN	Constituent	Soil Concentration		Plant Tissue Concentration			
		Surface (top 2 cm) (mg/kg)	Root Zone (top 15 cm) (mg/kg)	Root Uptake (mg/kg)	Deposition (mg/kg)	Air-to-plant Transfer (mg/kg)	Total (mg/kg)
207-08-9	Benzo(k)fluoranthene	2.9E-04	3.9E-05	4.8E-08	2.9E-07	8.2E-07	1.2E-06
3697-24-3	5-Methylchrysene	3.0E-04	4.1E-05	5.8E-08	9.0E-08	1.1E-08	1.6E-07
56-55-3	Benzo(a)anthracene	4.4E-05	5.9E-06	1.4E-08	7.8E-08	5.1E-08	1.4E-07
72-55-9	4,4'-DDE	5.3E-03	7.0E-04	7.9E-07	2.8E-08	1.8E-07	1.0E-06

The concentrations in the top 2 cm of the soil are also *EEL*s for terrestrial plants and soil invertebrates, but in this case the values do not exceed 10% of the organics *ESQ*s for these communities, so the six COPCs are not risk drivers for plants and invertebrates.

4.3.3.1.2 Columbia River Aquatic Receptors

Terrestrial and aquatic receptors are presumed to be exposed to water from the Columbia River maximum (Section 4.3.2). Table 4-7 presents the risk driver concentrations for Columbia River aquatic habitat for the baseline WTP operating configuration.

Table 4-7 Baseline WTP Operating Configuration, Aquatic Media EPCs

CASRN	Constituent	Total Water Column (mg/L)	Dissolved Phase (mg/L)	Sediment (mg/kg)	Aquatic Plant Tissue (mg/kg)
1336-36-3	Polychlorinated biphenyls	6.6E-11	6.2E-11	1.9E-07	1.7E-09
205-99-2	Benzo(b)fluoranthene	8.4E-11	4.7E-11	2.0E-06	2.0E-08
207-08-9	Benzo(k)fluoranthene	3.3E-11	1.9E-11	7.6E-07	7.7E-09
3697-24-3	5-Methylchrysene	6.7E-11	5.1E-11	8.2E-07	9.9E-09
56-55-3	Benzo(a)anthracene	1.5E-11	1.2E-11	1.7E-07	3.4E-09
72-55-9	4,4'-DDE	2.4E-10	2.2E-10	7.7E-07	7.2E-09

Similar to the results for the terrestrial habitat, the concentrations for the total water column and the sediment are *EEL*s for aquatic life and benthic invertebrates, respectively; however, in these cases the values do not exceed 10% of the organics *ESQ*s for these communities, so the six COPCs are not risk drivers for these receptors.

4.3.3.2 Exposure Assessment for the Baseline WTP Operating Configuration

The baseline WTP operating configuration *DD*s for mammals and birds are summarized below. Appendix C provides the *EEL* and *DD* of all receptors for the risk-driving COPCs.

4.3.3.2.1 Central Plateau Terrestrial Receptors

Table 4-8 summarizes the risk drivers for terrestrial receptors as determined in the SLERA. The same three HMW PAHs presenting as risk drivers for the DFLAW operating configuration also presented for the baseline WTP operating configuration, along with PCBs, 5-methylchrysene, and 4',4-DDE. No inorganics or radionuclide COPCs, including their respective totals, were identified as risk drivers or contributors.

Table 4-8 Terrestrial Receptor Risk Driver Daily Doses for the Baseline WTP Operating Configuration

Receptor	CASRN	Constituent	DD (mg/(kg·day))
Mourning Dove	205-99-2	Benzo(b)fluoranthene	4.8E-06
	207-08-9	Benzo(k)fluoranthene	5.9E-06
Western Meadowlark	207-08-9	Benzo(k)fluoranthene	3.6E-06
Great Basin Pocket Mouse	1336-36-3	Polychlorinated biphenyls	8.1E-04
	72-55-9	4,4'-DDE	6.3E-03
Coyote	1336-36-3	Polychlorinated biphenyls	6.6E-04
Burrowing Owl	205-99-2	Benzo(b)fluoranthene	1.8E-05
	207-08-9	Benzo(k)fluoranthene	6.1E-05
	3697-24-3	5-Methylchrysene	9.7E-05
Red-Tailed Hawk	1336-36-3	Polychlorinated biphenyls	3.9E-03
	205-99-2	Benzo(b)fluoranthene	4.2E-05
	207-08-9	Benzo(k)fluoranthene	1.5E-04
	3697-24-3	5-Methylchrysene	2.4E-04
	56-55-3	Benzo(a)anthracene	3.8E-05
	72-55-9	4,4'-DDE	1.8E-02

4.3.3.2.2 Columbia River Aquatic Receptors

As with the DFLAW operating configuration, no risk drivers were identified for aquatic mammals and birds for the baseline WTP operating configuration.

4.4 Toxicity Assessment

Section 4.4 discusses key assumptions and relevant aspects of the toxicity reference values (*TRV*) used to evaluate the toxicity of risk driver COPCs for ecological receptors inhabiting the Central Plateau and the Columbia River.

The toxicity assessment was performed to evaluate relevant aspects of the *TRV*s and the magnitude and nature of the toxicity of COPCs to ecological receptors. The full list of *TRV*s for each receptor, including the values and sources, is presented in the RAWP and is not duplicated herein. Full details of the toxicity assessment are described in Supplement 4 of the RAWP (24590-WTP-RPT-ENV-14-003).

4.4.1 Key Assumptions

Where available, *TRV*s were taken from EPA530-D-99-001A, *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities*. The *TRV* represents a threshold value (concentrations in soil, water, and sediment for receptors that live in those media), below which a toxic effect is not expected to occur (i.e., NOAEL), or daily doses for mammals and birds. These values were taken from federal and state regulations and guidance, and the scientific literature and other sources as needed. Toxicity data from the literature were typically extrapolated using safety factors. Values were, however, not extrapolated from a test species (e.g., mouse) to a specific wildlife receptor (e.g., coyote).

4.4.2 Toxicity Reference Values

The RAWP Sections 8.3.1 and 8.3.2 present the hierarchy used in the selection of *TRV*s. Supplement 4 of the RAWP (24590-WTP-RPT-ENV-14-003) contains *TRV*s and identifies their source. The *TRV* for radionuclides is 1 rad/day for plants, invertebrates, benthic invertebrates, aquatic biota, and fish, and is 0.1 rad/day for mammals and avian receptors.

4.4.3 Toxicity Reference Values for Risk Drivers

Table 4-9 summarizes the *TRV*s for the risk drivers identified in Section 4.3, which are used in Section 4.5 for risk characterization. The units are microgram per kilogram of body weight per day (µg/kg BW/day).

Table 4-9 Toxicity Reference Values for Risk Drivers

CASRN	COPC	Receptor	TRV (µg/kg BW/day)	Reference
1336-36-3	PCBs	Coyote	0.206	EPA530-D-99-001A
1336-36-3	PCBs	Great Basin Pocket Mouse	0.206	EPA530-D-99-001A
1336-36-3	PCBs	Red-Tailed Hawk	72	EPA530-D-99-001A
205-99-2	Benzo(b)fluoranthene	Burrowing Owl	0.14	EPA530-D-99-001A
207-08-9	Benzo(k)fluoranthene	Mourning Dove	0.14	EPA530-D-99-001A
207-08-9	Benzo(k)fluoranthene	Red-Tailed Hawk	0.14	EPA530-D-99-001A
207-08-9	Benzo(k)fluoranthene	Western Meadowlark	0.14	EPA530-D-99-001A
3697-24-3	5-Methylchrysene	Burrowing Owl	1	EPA530-D-99-001A [(a)]
3697-24-3	5-Methylchrysene	Red-Tailed Hawk	1	EPA530-D-99-001A [(a)]
56-55-3	Benzo(a)anthracene	Red-Tailed Hawk	0.79	EPA530-D-99-001A
72-55-9	4,4'-DDE	Great Basin Pocket Mouse	147	OSWER Directive 9285.7-55 [(b)]
72-55-9	4,4'-DDE	Red-Tailed Hawk	227	OSWER Directive 9285.7-55 [(c)]

Table References:

EPA530-D-99-001A. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, Peer Review Draft. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC.

OSWER Directive 9285.7-55. 2005. *Guidance for Developing Ecological Soil Screening Levels*. US Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC.

Footnotes:
[(a)] Chrysene used as surrogate COPC for *TRV* value.
[(b)] Vole/Shrew used as surrogate for the receptor.
[(c)] Hawk (species not identified) used as surrogate for the receptor.

4.5 Risk Characterization

Risk characterization includes an estimate of the nature and magnitude of ecological risks, and a description of relevant uncertainties and their effect on the risk estimates. The risk characterization procedures are presented in detail in RAWP Section 8.4. This section presents the risk characterization for the DFLAW operating configuration and the baseline WTP operating configuration. The risk characterization discusses total risks and COPC risk drivers, but focuses on the latter. The RAWP required presentation of Total *ESQ*s; however, it is significant to note that, while they may ostensibly have some management value, they are screening values indexed across COPCs regardless of mechanism

of toxicity. (For example, it is not meaningful to add the risk of a compound that affects the nervous system to the risk of a compound that causes renal toxicity.)

Risk estimates for a receptor at an exposure location are calculated as the *ESQ*, the ratio of the COPC estimated exposure (the *EEL* or *DD*, depending on the receptor) to the COPC *TRV* (a benchmark for a medium or a NOAEL for a mammal or bird). Uncertainties particularly relevant to the risk estimates are discussed below, prepared in accordance with EPA530-D-99-001A guidance; details of uncertainties and the effect on the risk estimates are presented in Appendix D.

4.5.1 Risk Characterization for the DFLAW Operating Configuration

This section presents the summation of inorganic, organic, and radionuclide *ESQ*s for the DFLAW operating configuration, identifies risk drivers, and discusses lines of evidence for interpreting the significance of the *ESQ*s.

4.5.1.1 Central Plateau Terrestrial Receptors

Risk estimates for the terrestrial receptors for the DFLAW operating configuration are discussed in this section. Table 4-10 provides the Total *ESQ*s (summed across COPCs) for total organics, total inorganics, and total radionuclides exposures for each terrestrial receptor.

Table 4-10 Total ESQs for Terrestrial Receptors

Constituent Type	Terrestrial Plant ESQ	Soil Invertebrate ESQ	Mule Deer ESQ	Mourning Dove ESQ
Total Inorganics	3.6E-01*	1.6E-05	4.6E-04	8.9E-06
Total Organics	4.5E-04	7.6E-05	3.3E-04	1.1E-01
Total Radionuclides	2.3E-07	3.4E-10	1.7E-09	3.4E-09

Constituent Type	Western Meadowlark ESQ	Great Basin Pocket Mouse ESQ	Burrowing Owl ESQ	Red-Tailed Hawk ESQ	Coyote ESQ
Total Inorganics	6.3E-07	3.4E-05	2.1E-06	4.4E-07	6.0E-07
Total Organics	3.9E-02	1.6E-02	5.8E-01*	1.4E+00*	1.2E-02
Total Radionuclides	3.4E-09	4.3E-09	4.1E-09	1.7E-10	4.8E-09

*** ESQ in excess of screening threshold.**
The ecological screening quotient threshold value is 2.5E-01 (values less than 1.0 are not considered to have an adverse impact).

A Total *ESQ* value exceeding 1 was estimated for the red-tailed hawk (Total Organics *ESQ*=1.4). Total *ESQ* values exceeding 0.25 but less than 1 were estimated for terrestrial plants (Total Inorganics *ESQ*=0.36) and the burrowing owl (Total Organics *ESQ*=0.58). Other Total *ESQ*s were less than 0.25. Three PAH compounds—benzo(b)fluoranthene, benzo(k)fluoranthene, and benzo(k)anthracene—are COPC risk drivers (defined as a compound with an *ESQ* of 0.025, or 10 percent of the risk threshold of 0.25) that explain the slightly elevated Total Organics ESQ for the hawk. This information is summarized in Table 4-11, which also provides the *DD*s and *TRV*s used to calculate the *ESQ*s. Similarly, the two fluoranthene analogs also presented for the burrowing owl, which had a Total Organics *ESQ* of 0.58, and the mourning dove, which had a Total Organics *ESQ* of 0.11. The table also identifies the percent of the Total Organics *ESQ*s that are explained by each risk driver.

Table 4-11 ESQs for Specific COPCs

Receptor	CASRN	Constituent	Daily Dose (mg/(kg·day))	TRV (µg/(kg BW·day))	ESQ (unitless)	Percent Contribution
Mourning Dove	205-99-2	Benzo(b)fluoranthene	7.0E-06	0.14	0.050	47%
	207-08-9	Benzo(k)fluoranthene	4.9E-06	0.14	0.035	33%
Burrowing Owl	205-99-2	Benzo(b)fluoranthene	2.6E-05	0.14	0.19	32%
	207-08-9	Benzo(k)fluoranthene	5.0E-05	0.14	0.36	61%
Red-Tailed Hawk	205-99-2	Benzo(b)fluoranthene	6.2E-05	0.14	0.44	32%
	207-08-9	Benzo(k)fluoranthene	1.2E-04	0.14	0.87	62%
	56-55-3	Benzo(a)anthracene	3.5E-05	0.79	0.044	3%

There are insightful lines of evidence that can be evaluated to determine the significance of the PAH risk drivers. First, benzo(b)fluoranthene, benzo(k)fluoranthene, and benzo(a)anthracene are presumed to be PICs, which can be formed when certain biogenic substances are exposed to high temperatures under low oxygen or no oxygen conditions. Note that the WTP will not treat biogenic substances. For example, PAHs can be formed through the destructive distillation of coal into coke and coal tar, or the thermal cracking of petroleum residuals into lighter hydrocarbons, both of which are pyrolytic processes that occur intentionally. These PAHs can also be formed unintentionally by processes such as the incomplete combustion of motor fuels in cars and trucks, the incomplete combustion of wood in forest fires and fireplaces, and the incomplete combustion of fuel oils in heating systems.

Secondly, benzo(b)fluoranthene, benzo(k)fluoranthene, and benzo(a)anthracene were not detected in the testing of the pilot-scale prototypical offgas system. In the emissions estimate, formation of these PAHs was modeled at the TCO outlet. Since their PIC conversion factors were based on the method detection limit, their presence in the offgas is a presumption. The TCO operates at 700°F with a design flow of 6,000 acfm. These conditions are far different than those employed for distillation or true combustion.

Furthermore, these compounds have not been found in tank waste characterization studies.

Evaluation of the hazard of PAHs to mammals based on the EPA (2007) ecological soil screening level (SSL) for HMW PAHs is presented as an additional line of evidence. SSLs are concentrations in soil rather than daily doses. While no low molecular weight (LMW) PAHs were identified as risk drivers, the hazard of these substances is also presented for completeness. EPA (2007) lists mammalian NOAEL-based SSLs of 1.1 mg/kg and 100 mg/kg for HMW PAHs and LMW PAHs, respectively. Based on the SSLs, the *ESQ*s for HMW PAHs and LMW PAHs are each less than 1, indicating PAHs do not present a hazard to mammals in the upland habitat. Table 4-12 summarizes the results for the assessment of HMW PAHs and LMW PAHs relative to the SSLs.

Table 4-12 Assessment of PAHs Relative to SSLs for the DFLAW Operating Configuration

Receptors (mammals)	PAH Type	Soil Concentration (mg/kg)	SSL (mg/kg)	ESQ
Coyote Great Basin Pocket Mouse Mule Deer	HPAH	0.0046	1.1	0.0042
Coyote Great Basin Pocket Mouse Mule Deer	LPAH	0.0017	100	0.000017

This information indicates that the *ESQ*s overestimate risks to terrestrial receptors and represent an upper bounding condition. Coupled with the expansive home range of the hawk and the conservatism in the exposure assessment, it is concluded with high confidence that birds of prey represented by the red-tailed hawk will not be adversely affected by operation of the DFLAW configuration.

4.5.1.2 Columbia River Aquatic Receptors

Risk characterization results for the aquatic receptors for the DFLAW operating configuration are discussed in this section. Table 4-13 provides risk estimates for total organics, inorganics, and radionuclide exposures for aquatic receptors. All of the total *ESQ* values are less than the threshold of 0.25; therefore, *ESQ* values for specific substances are not discussed. The *ESQ* values associated with individual COPCs are in the support files of this document.

Table 4-13 Total Ecological Screening Quotients for Aquatic Receptors

Constituent	Aquatic Plant ESQ	Aquatic Biota ESQ	Benthic Invertebrate ESQ	Canada Goose ESQ	Spotted Sandpiper ESQ
Total Inorganics	6.2E-09	2.5E-09	1.1E-08	2.6E-09	9.3E-09
Total Organics	6.4E-06	8.5E-07	1.2E-02	1.9E-04	5.0E-03
Total Radionuclides	2.7E-08	4.1E-13	1.2E-14	1.7E-13	1.7E-13

Constituent	Great Blue Heron ESQ	Bald Eagle ESQ	Mink ESQ	Planktivorous Fish ESQ	Omnivorous Fish ESQ	Chinook Salmon ESQ
Total Inorganics	2.1E-09	1.4E-09	2.5E-09	8.6E-04	8.6E-04	8.6E-04
Total Organics	8.6E-04	6.0E-04	5.3E-05	7.7E-06	7.7E-06	7.6E-06
Total Radionuclides	4.0E-12	4.2E-12	4.2E-12	4.1E-13	4.1E-13	4.1E-13

The ecological screening quotient threshold value is 2.5E-01 (values less than 1.0 are not considered to have an adverse impact).

4.5.2 Risk Characterization for the Baseline WTP Operating Configuration

This section presents the summation of inorganic, organic, and radionuclide *ESQ*s for the baseline WTP operating configuration, identifies risk drivers, and discusses lines of evidence for interpreting the significance of the *ESQ*s.

4.5.2.1 Central Plateau Terrestrial Receptors

The risk estimates for the terrestrial receptors for the baseline WTP operating configuration are provided in Table 4-14. The Total *ESQ*s (summed across COPCs) for total organics, total inorganics, and total radionuclides exposures are listed for each terrestrial receptor. These results are based on evaluation of the refined feed vector (Section 2.5).

Table 4-14 Total Ecological Screening Quotient Values for Terrestrial Receptors

Constituent Type	Terrestrial Plant ESQ	Soil Invertebrate ESQ	Mule Deer ESQ	Mourning Dove ESQ
Total Inorganics	1.5E+00	7.1E-04	2.5E-03	4.0E-04
Total Organics	1.6E-03	1.4E-03	4.6E-04	1.0E-01

Total Radionuclides	1.4E-07	2.1E-09	7.8E-09	1.5E-08

Constituent Type	Western Meadowlark ESQ	Great Basin Pocket Mouse ESQ	Burrowing Owl ESQ	Red Tailed Hawk ESQ	Coyote ESQ
Total Inorganics	2.5E-05	2.0E-04	9.0E-05	8.7E-06	3.7E-06
Total Organics	5.0E-02	4.0E+00*	7.3E-01*	1.8E+00*	3.2E+00*
Total Radionuclides	1.5E-08	3.1E-08	2.6E-08	7.4E-10	2.9E-08

*** ESQ in excess of screening threshold.**
The ecological screening quotient threshold value is 2.5E-01 (values less than 1.0 are not considered to have an adverse impact).

Initially, a screening indicated that total *ESQ* values exceeding 1.0 for five receptors:

- Terrestrial plant community: Total Inorganics ESQ= 1.5
- Great Basin Pocket mouse: Total Organics ESQ= 91
- Burrowing owl: Total Organics ESQ= 1.4
- Red-tailed hawk: Total Organics ESQ= 3.5
- Coyote: Total Organics ESQ= 74

Examination of the COPC-specific *ESQ*s, particularly those for the mouse and coyote, indicated high concentrations of PCBs in the original feed vector explained virtually all of the elevated total organics *ESQ*s for these two receptors. Examination of the feed vector report indicated that PCBs, which were modeled as a single "total" compound rather than individual congeners or Aroclor mixtures, were assumed to be substantially higher than concentrations from available tank waste analytical data. The impact of the assumed PCB concentrations in the tank waste is not unexpected, because the feed vector input, which is an integral part of the source term, has a significant effect on risk estimates, and should be preferentially examined over exposure and toxicity parameters that may particularly influence the risk assessment.

The organics content of the original feed vector and the underpinning assumptions were critically reviewed. Based on this examination, a more realistic and reasonable feed vector was developed to provide a more appropriate and representative PCBs input into process emissions modeling, a change that cascaded through the SLERA. The rationale for developing these refinements is provided at the end of Section 2.5.

Corresponding risks were recomputed and the final results for total organic *ESQ* values for the mammals and birds identified above dropped considerably:

- Great Basin Pocket mouse: Total Organics ESQ= 4.0
- Burrowing owl: Total Organics ESQ= 0.73
- Red-tailed hawk: Total Organics ESQ= 1.8
- Coyote: Total Organics ESQ= 3.2

The risk estimates for all receptors, based on the refined feed vector, are presented in Table 4-13 and Table 4-14. Of particular note are the changes in potential impacts to the mouse, coyote, and hawk, with the resulting *ESQ*s only slightly above 1, verses 91, 74, and 3.5, respectively. For the refined feed vector analysis, several COPC risk drivers explain the elevated Total Organics *ESQ*s as shown in Table 4-15.

Note that slightly elevated Total Inorganics *ESQ* for terrestrial plants was computed for nitrogen dioxide, with a corresponding *ESQ* of 1.5. The *TRV* used to calculate this *ESQ* is based on a poorly designed

scientific experiment that did not approximate how nitrogen oxides behave in the environment; thus, this *ESQ* was determined to be highly unreliable and unrealistic (Anbazhagan 1992). For this reason, nitrogen oxide is not considered a true driver of risk.

Table 4-15 Risk Drivers for Terrestrial Receptors-Baseline WTP Operating Configuration

Receptor	CASRN	Constituent	Daily Dose (mg/(kg·day))	TRV (µg/(kg BW·day))	ESQ (unitless)	Contribu-tion
Mourning Dove	205-99-2	Benzo(b)fluoranthene	4.8E-06	0.14	0.034	33%
	207-08-9	Benzo(k)fluoranthene	5.9E-06	0.14	0.042	41%
Western Meadowlark	207-08-9	Benzo(k)fluoranthene	3.6E-06	0.14	0.026	52%
Great Basin Pocket Mouse	1336-36-3	Polychlorinated biphenyls	8.1E-04	0.206	3.9	99%
	72-55-9	4,4'-DDE	6.3E-03	147	0.043	1%
Coyote	1336-36-3	Polychlorinated biphenyls	6.6E-04	0.206	3.2	99%
Burrowing Owl	205-99-2	Benzo(b)fluoranthene	1.8E-05	0.14	0.13	18%
	207-08-9	Benzo(k)fluoranthene	6.1E-05	0.14	0.43	60%
	3697-24-3	5-Methylchrysene	9.7E-05	1	0.097	13%
Red-Tailed Hawk	1336-36-3	Polychlorinated biphenyls	3.9E-03	72	0.054	3%
	205-99-2	Benzo(b)fluoranthene	4.2E-05	0.14	0.3	17%
	207-08-9	Benzo(k)fluoranthene	1.5E-04	0.14	1.1	58%
	3697-24-3	5-Methylchrysene	2.4E-04	1	0.24	13%
	56-55-3	Benzo(a)anthracene	3.8E-05	0.79	0.049	3%
	72-55-9	4,4'-DDE	1.8E-02	227	0.081	4%

Similar to the results of the evaluation of the DFLAW operating configuration, PAHs presented as risk drivers for four receptors. The elevated total organics *ESQ*s for the mouse and coyote are explained by PCBs. In general, the results in Table 4-15 indicate modeling determined PCBs were the greatest contributor (and risk driver) to potential ecological impacts.

Besides the source term, exposure and toxicity parameters can have a major influence on the results presented by specific compounds. Review of the parameters indicated a commonality across toxicity modeling for the coyote and mouse. The evaluation of the WTP baseline configuration based on the more realistic, refined feed vector presented total PCBs *ESQ*s greater than 0.25 for the coyote (*ESQ*=3.2) and Great Basin Pocket mouse (*ESQ*=3.9). These *ESQ*s are based on an EPA530-D-99-001A PCBs *TRV* of 0.206 µg/(kg·day) derived using a safety factor of 100 from a lowest-observed-adverse-effect-level of 20.6 µg/(kg·day) calculated from a study with the mink exposed to 3,4,5-hexachlorobiphenyl. The decision to use an alternate mammalian TRV for PCBs (other than 0.206 ug/kg/d, based on a mink study, as listed in SLERAP [Aulerich et al, 1985]), is a departure from additional EPA guidance (e.g., EcoSSLs, Attachment 4-1, OSWER Directive 9285.7-55) which specifies use of a more sensitive species (e.g., mink for PCBs) to select a TRV. EPA530-D-99-001A indicates that the lowest, most conservative toxicity data were used to develop *TRV*s, regardless of test species, receptor, and other relevant toxicity data. Similar Hanford ecological risk assessments have used values for NOAELs, as obtained from a variety of appropriate reference sources (RPP-22777, Rev. 0, *PCB Risk Assessment for the Mobilization of Single-Shell Tank Solid Waste Using Double-Shell Tank Supernate*; RPP-22491).

Since 1999, other *TRV*s and ecological screening values for PCBs have been developed for mammals. Evaluation of these benchmarks are as follows:

- The Hanford Tier 2 soil PRG document (CHPRC-01311, Rev 2) evaluated the hazard of total PCBs to mammals and derived a different toxicity value . The document lists a mammalian *TRV* (NOAEL) of 68 ug/kg/d for PCBs (based on Aroclor 1254), for oldfield mice (McCoy et al 1995). Based on this *TRV*, total PCBs *ESQ*s for the mouse and coyote are equal to 0.01 and 0.01, respectively.
- The EPA (2002) *U.S. EPA Region 9 Biological Technical Assistance Group (BTAG) Recommended Toxicity Reference Values for Mammals*, derived a mammal PCBs NOAEL of 360 µg/kg-day. The group was composed of scientists from Region 9 EPA, the State of California, industry, and the Navy. Based on this *TRV*, alternate coyote and mouse *ESQ*s less than 0.01 are calculated, indicating PCBs do not pose unacceptable risks to the coyote and mouse and receptors in these feeding guilds.
- The ecological risk assessment guidance prepared by the EPA Scientific Support Section Superfund Division (EPA 2015, *Region 4 Ecological Risk Assessment Supplemental Guidance Interim Draft*) presents a total PCBs soil screening value of 330 µg/kg. The estimated total PCBs concentration for soil of the Central Plateau terrestrial habitat ranges from 0.000046 µg/kg for the top 2 cm of soil to 0.00018 µg/kg for the top 15 cm of soil. Coyote and mouse *ESQ*s based on the EPA Region 4 screening value are substantially less than 0.01. These *ESQ*s also indicate that PCBs do not pose unacceptable risks to large and small mammals inhabiting the Central Plateau.
- More recently, the Los Alamos National Laboratory (2017) ECORISK database presented preliminary soil remediation goals of 25 mg/kg for Aroclor 1254 and 54 mg/kg for Aroclor 1260. These values also indicate PCBs will not pose an unacceptable risk to mammals inhabiting the Central Plateau.

The total PCBs *ESQ*s for the mouse and coyote range from 3.9 and 3.2, respectively, based on the *TRV* in the SLERAP, to less than 0.01 based on four other lines of evidence. The evaluation of more recent information on the ecological toxicity of PCBs suggests that the emissions from the operation of the full WTP will not adversely affect ecological receptors inhabiting the Central Plateau.

In addition to PCBs, PAHs presented *ESQ*s requiring scrutiny, including 5-methylchrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, and benzo(a)anthracene, which are HMW PAHs.

5-Methylchrysene is a presumed feed constituent, and a TAP (WAC 173-460-150, *Table of ASIL, SQER and de Minimis Emission Values*). There are no tank waste characterization or vapor data for 5-methylchrysene. Its concentration in the feed is a presumed quantity (refer to Appendix A, Section A.2.3). 5-Methylchrysene is produced by the incomplete combustion of organic matter and is primarily found in gasoline exhaust and tobacco smoke. Its inclusion as a TAP is likely because of its historical detection as a PIC within industry. It was not sampled for during pilot-scale testing, and is not known to have been in use during Hanford operations. Its inclusion as a COPC is precautionary, and it is most likely not a component of Hanford tank waste.

Evaluation of the hazard of PAHs to mammals based on the EPA (2007) ecological soil screening level (SSL) for HMW PAHs is presented as an additional line of evidence. While no low molecular weight (LMW) PAHs were identified as risk drivers, the hazard of these substances is also presented for completeness. The *ESQ*s for HMW PAHs and LMW PAHs are each less than 1, indicating PAHs do not present a hazard to mammals in the upland habitat. Table 4-16 summarizes the results for the assessment of HMW PAHs and LMW PAHs relative to the SSLs.

Table 4-16 Assessment of PAHs Relative to SSLs for the Baseline WTP Operating Configuration

Receptors (mammals)	PAH Type	Soil Concentration (mg/kg)	SSL (mg/kg)	ESQ
Coyote Great Basin Pocket Mouse Mule Deer	HPAH	0.0012	1.1	0.0011
Coyote Great Basin Pocket Mouse Mule Deer	LPAH	0.0072	100	0.000072

Benzo(b)fluoranthene, benzo(k)fluoranthene, and benzo(a)anthracene also presented as risk drivers. Similarly, they have not been detected in tank waste samples and were included as COPCs because of their inclusion in EPA's PIC list (EPA530-D-98-001A; CCN 097844, *Discuss and Resolve the Outstanding Risk Assessment Issues in The Risk Assessment Work Plan (RAWP)*). None were detected in the testing of the pilot-scale prototypical offgas system, and they are not suspected to have been used during Hanford operations. Further, as explained in Section 4.5.1.1, operating conditions at the WTP are unlikely to generate PAHs, because there are no PAH precursors in the tank waste.

Furthermore, the *DD*s used to calculate bird *ESQ*s do not reflect the actual expected distribution of PAHs in food and forage for the receptors. In addition, PAHs are readily metabolized by vertebrates, which also indicates the analysis of the hazards of individual PAHs are likely overestimated the real hazard of the compounds.

4,4'-DDE, or p,p'-dichlorodiphenyldichloroethylene, is shown as a risk contributor for two terrestrial receptors (the mouse and hawk). 4,4'-DDE is an organochlorine pesticide byproduct and is retained as a COPC because of its listing as an underlying hazardous constituent in 40 CFR 268, *Land Disposal Restrictions*, and its inclusion in EPA's PIC list (EPA530-D-98-001A, CCN 097844). The compound is also identified as a probable COPC in RPP-22491, although the same report acknowledges that the compound has not been detected in the tank vapor space. 4,4'-DDE is a byproduct of DDT, use of which discontinued in 1972. There are no tank waste characterization or vapor data for 4,4'-DDE; its concentration in the feed is a presumed quantity (refer to Appendix A, Section A.2.3.).

As discussed below, no inorganic or radionuclide COPCs, including their respective totals, were identified as risk drivers and (or) contributors for terrestrial invertebrates or mammals.

4.5.2.2 Columbia River Aquatic Habitat

Table 4-17 provides the *ESQ* values for total organics, inorganics, and radionuclide exposures for aquatic receptors. All of the total *ESQ* values are less than the threshold of 0.25; therefore, *ESQ* values for specific substances are not discussed. The *ESQ* values associated with individual COPCs are in the support files of this document.

Table 4-17 Aquatic Receptor Ecological Screening Quotient Totals

Constituent	Aquatic Plant ESQ	Aquatic Biota ESQ	Benthic Invertebrates ESQ	Canada Goose ESQ	Spotted Sandpiper ESQ
Total Inorganics	2.9E-08	1.2E-08	5.3E-08	1.3E-08	4.4E-08
Total Organics	7.7E-06	2.2E-06	1.3E-02	1.7E-04	4.4E-03
Total Radionuclides	1.6E-08	1.6E-12	6.4E-14	1.6E-12	1.6E-12

Constituent	Great Blue Heron ESQ	Bald Eagle ESQ	Mink ESQ	Planktivorous Fish ESQ	Omnivorous Fish ESQ	Chinook Salmon ESQ
Total Inorganics	9.9E-09	6.7E-09	5.7E-09	7.0E-04	7.0E-04	7.0E-04
Total Organics	2.2E-03	1.6E-03	9.0E-03	2.2E-05	2.2E-05	2.2E-05
Total Radionuclides	1.7E-11	1.8E-11	1.8E-11	1.6E-12	1.6E-12	1.6E-12

The ecological screening quotient threshold value is 2.5E-01 (values less than 1.0 are not considered to have an adverse impact).

4.6 Sources of Uncertainty

The SLERA was a prospective analysis performed following the RAWP that took several years to prepare with input from federal and state regulatory agencies and many stakeholders. The analysis followed best available science, but the prospective and comprehensive nature (e.g., more than 400 COPCs) naturally resulted in uncertain aspects for which conservative assumptions were used to increase the likelihood that the SLERA did not underestimate actual risks that operation of the WTP might pose to ecological receptors. These sources of uncertainty were addressed by using safety factors, upper bounding protective conditions, and conservative assumptions throughout the analysis, frequently in a cascading and cumulative effect where conservatism is built upon conservatism many times over (refer to Appendix D). Sources of uncertainty for the exposure assessment, toxicity assessment, and risk characterization are as follows:

- *Exposure Assessment*. In a prospective risk assessment, actual concentrations receptors are exposed to are unknown, which represents a potentially expansive uncertainty. The exposure assessments for the upland Central Plateau and the Columbia River were based on modeled COPC concentrations for soil, air, water, and sediment from hundreds of locations distributed across the habitats, with many locations packed in a relatively dense cluster around the WTP, where metals and heavy, recalcitrant organic compounds quickly deposit from the emissions plumes. Furthermore, the exposure assessment used elevated emissions for many COPCs without history of detection in the tank waste, or PICs, such as PAHs, which were not detected in pilot-scale testing and for which there are no precursors in the waste. The exposure assessments were based on biased high (90th percentile and maximum) COPC concentrations in soil, air, water, and sediment, meaning the analysis assumed—at the onset—that modeled exposures were maximized, which in turn assumes that the ecological receptors foraged and hunted at these locations. In reality, receptor exposures are lower and quite variable as they depend on a host of factors, particularly the range of their forage and prey; diet mix; and population density. The exposure assessment also assumed, very conservatively, that each substance ingested was completely bioavailable—that is, all of a compound reaches a site of toxic action; none of the compound is metabolized, sequestered, or excreted. Appendix D, Sections D.1.2 and D.3.1 provide additional details and discussion of how these uncertainties impact the exposure assessment.

- *Toxicity values*. Because there are virtually no standardized, well-vetted ecological *TRV*s, the assessment used conservative *TRV*s, mostly prepared by regulatory agencies based on a variety of scientific studies. None of these studies followed a standard protocol, and the *TRV*s used were bridled by very conservative safety factors. To address these shortcomings, EPA530-D-99-001A used the most conservative toxicity value, regardless of receptor, to derive the *TRV*s in the federal guidance that was used in the PRA SLERA. Examination of the *TRV*s used for PCBs, for example, found that in this instance the values were extremely low, resulting in identification of PCBs as a possible risk driver. Examination of alternative PCBs *TRV*s indicated, conversely, that PCBs are not a risk driver. Additional detail is found in Appendix D, Section D.3.2.
- *Risk characterization*. To identify risk drivers, risks were summed across COPCs when the compounds likely act on different systems and target organs. This approach is likely to overestimate the true ecological risks associated with exposure to the COPCs, since many chemicals may act on different organs and systems, and is a major contributor to the uncertainty of risk characterization. This is compounded by assumptions regarding the magnitude and concentration of COPCs (see Section 2.6). Section D.3.3 of Appendix D provides additional detail on the impacts of this uncertainty on risk characterization.

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5 Conclusions

This PRA meets the requirements established by condition III.10.C.11.b of the WTP DWP. It addresses two WTP operating configurations: DFLAW for the near-term, and the baseline WTP that follows. The PRA used the best available information with approved models, including EPA combustion risk assessment guidance and the conservative exposure scenarios and assumptions therein, as well as other scenarios and methods in the approved RAWP. Air, soil, plant, and animal concentrations were estimated and used as inputs to the exposure assessments for human and animal receptors.

The HHRA analyzed four adult, child, and infant scenarios involving exposure to multiple environmental media: worker, resident, resident subsistence farmer, and resident subsistence fisher. Two American Indian scenarios provided by local tribes were also assessed, the results of which are included in Appendix D.

Human health risks were estimated for each COPC, added across the constituents for each pathway, and across all pathways in a scenario. The cancer threshold in the HHRA for COPCs is 1.0E-05 incremental lifetime cancer risk. A noncancer hazard index of 1 or less generally indicates that the exposure is likely to be without an appreciable risk of deleterious effect. For the HHRA, a hazard index threshold level of 0.25 was chosen. The primary conclusion of the HHRA is that the cancer and noncancer risks were below their thresholds in all scenarios and thus do not represent adverse effects to the local workforce or surrounding communities.

The SLERA evaluated terrestrial and aquatic receptors inhabiting the Central Plateau area and the Columbia River. A total *ESQ* threshold of 0.25 was also chosen for evaluating ecological risk, and a value of 1 or less also indicates COPCs will not adversely affect the populations of wildlife at the site. The total *ESQ*s and the additional evaluation of the conservative assumptions used to assess exposure and toxicity indicate that terrestrial and aquatic wildlife populations will not be adversely affected by operation of the WTP in the DFLAW or baseline WTP operating configurations.

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Appendix A

Emissions Estimate

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Acronyms

ACM	Aspen Custom Modeler
APPS	Aspen Process Performance Simulation
ASIL	acceptable source impact level
BBI	Best-Basis Inventory
CASRN	chemical abstracts service registry number
CH-TRU	contact-handled transuranic
COPC	constituents of potential concern
DF	decontamination factors
DFLAW	direct feed to the LAW Facility
DRE	destruction and removal efficiency
Ecology	Washington State Department of Ecology
EMF	effluent management facility
EPA	US Environmental Protection Agency
EPDT	environmental performance demonstration test
HEPA	high-efficiency particulate air
HLW	high-level waste (Facility)
HOP	HLW melter offgas treatment process system
HTWOS	Hanford Tank Waste Operations Simulator
LAW	low-activity waste (Facility)
MDL	method detection limit
MTG	metric tons of glass
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PEM	Process Emissions Model
PJM	pulse-jet mixer
PJV	pulse jet ventilation system
PRA	pre-demonstration risk assessment
PT	Pretreatment (Facility)
PVP	pretreatment vessel vent process system
RAWP	Risk Assessment Work Plan
RDQO	*Regulatory Data Quality Objectives*
RL	reporting limit
TAP	toxic air pollutants
TOC	total organic carbon
TWINS	Tank Waste Information Network System
WTP	Hanford Tank Waste Treatment and Immobilization Plant

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Appendix A
Emissions Estimate

A.1 Emissions Estimation

The Hanford Tank Waste Treatment and Immobilization Plant (WTP) will vitrify radioactive mixed waste. A bounding estimate of stack emissions from the WTP has been developed to allow for numerical quantification of the human and ecological risks associated with airborne emissions. The emissions estimate individually considers 409 organic, inorganic, and radionuclide constituents of potential concern (COPC) that could result from processing Hanford tank waste through the WTP.

The pre-demonstration risk assessment (PRA) relies upon an emissions estimate generated by modeling the impacts of various unit processes to a waste feed, as that feed is treated and eventually vitrified into a borosilicate glass. The modeling is steady state, and estimates glass production, liquid effluent production, and emissions. Emissions from the WTP form the basis for conducting the PRA. Model predictions are highly dependent upon feed compositions, particularly in the Pretreatment (PT) Facility feed receipt vessels, where raw waste is subject to agitation by filling and pulse jet mixers. Because of data uncertainties regarding the makeup of the WTP feed (particularly organics), a conservative feed vector is modelled, which is designed to provide reasonable assurance that estimated emissions and corresponding impacts are sufficiently bounded.

This section provides an overview of the assumptions and methodology used to arrive at the WTP stack emission estimates. Emissions are related to both the feed composition, and the impact of unit processes and emissions abatement as that feed is vitrified. The discussion below summarizes the derivation of the feed vector, how emissions are estimated for the unit processes, and the resulting emissions.

A detailed description of the emissions estimate is presented in Supplement 2 of the Risk Assessment Work Plan (RAWP) (24590-WTP-ES-PE-17-001, *Integrated Emissions Study for the Hanford Tank Waste Treatment and Immobilization Plant*), Supplement 3 of the RAWP (24590-WTP-RPT-ENV-17-008, *Cell Emissions Estimate*).

A.2 Feed Composition

The emissions estimate starts with the development of a feed vector (feed composition, in units of kg-moles). The development and application of the feed vector data are described in 24590-WTP-RPT-ENV-16-001, *Feed Vector Development in Support of WTP Environmental Risk Assessment Activities* (herein referred to as the feed vector report). This document provides the estimated quantities for inorganic, radionuclide, and some organic COPCs in a nominal and bounding feed vector. The feed vector chosen for emissions modeling was considered a “bounding” feed vector; that is, its concentrations were increased to bound the anticipated feed. A bounding feed vector is defined qualitatively as representing the maximum anticipated quantity of any given COPC, such that one would not realistically anticipate a sustained feed stream containing COPC quantities more than those reported. The bounding feed vector is based on a nominal vector, with additional COPC quantities to account for data uncertainties, and is the combination of model results (Section A.2.1) and estimates based on analytical data (Section A.2.2). In addition, quantities were assumed for COPCs not reported in the feed vector report (Section A.2.3). Thus, the bounding approach provides a reasonable, technically based worst-case estimate that addresses uncertainties about the magnitude of concentrations in the waste feed at any one time, and variability of the make-up of the waste over the duration the facility will operate.

Table A-1 and Table A-2 provide the feed vector concentrations used in the modeling of emissions for the direct feed to the Low-Activity Waste (LAW) Facility (DFLAW) operating configuration and the baseline WTP operating configuration, respectively. Table A-1 provides the Chemical Abstracts Service Registry Number (CASRN), COPC, and corresponding concentration in the treated LAW liquids and solids feed transferred from the tank farms to the LAW Facility. Table A-2 provides the CASRN, COPC, LAW liquids concentration, and high-level waste (HLW) liquids and solids concentrations. In the baseline WTP operating configuration, solids are assumed to be entrained in the HLW solids .

Table A-1 Modeled Feed Vector for the Pre-Demonstration Risk Assessment for the DFLAW Operating Configuration

CASRN	COPC	Concentration in LAW Liquids	Concentration in LAW Solids
Organics		**(mg/L)**	**(mg/kg)**
100-02-7	p-Nitrophenol	7.35E+00	7.86E+01
100-21-0	Phthalic acid	2.80E+00	3.00E+01
100-25-4	1,4-Dinitrobenzene	5.57E-03	5.95E-02
100-40-3	4-Ethenylcyclohexene	1.83E+00	1.95E+01
100-41-4	Ethyl benzene	4.98E-05	5.33E-04
100-42-5	Styrene	2.39E-05	2.55E-04
10061-01-5	cis-1,3-Dichloropropene	8.81E-05	9.42E-04
10061-02-6	trans-1,3-Dichloropropene	9.20E-05	9.84E-04
101-55-3	4-Bromophenylphenyl ether	2.80E+00	3.00E+01
104-76-7	2-Ethyl-1-hexanol	2.20E+00	2.35E+01
10595-95-6	n-Nitrosomethylethylamine	3.97E+00	4.24E+01
106-42-3	Xylene (m & p)	Included in 1330-20-7	
106-46-7	1,4-Dichlorobenzene	1.51E-02	1.62E-01
106-88-7	1,2-Epoxybutane	2.43E+00	2.60E+01
106-93-4	Ethylene dibromide	2.39E-05	2.55E-04
106-99-0	1,3-Butadiene	8.01E-04	8.57E-03
107-02-8	Acrolein	1.29E-03	1.38E-02
107-05-1	3-Chloropropene	8.81E-05	9.42E-04
107-06-2	1,2-Dichloroethane	2.79E-05	2.99E-04
107-12-0	Propionitrile	8.08E-03	8.64E-02
107-13-1	Acrylonitrile	8.81E-04	9.42E-03
108-05-4	Acetic acid vinyl ester	2.91E+00	3.11E+01
108-10-1	4-Methyl-2-pentanone	3.11E-04	3.33E-03
108-39-4	m-Cresol	6.41E+00	6.85E+01
108-87-2	Methylcyclohexane	1.01E-04	1.08E-03
108-88-3	Toluene	1.24E-04	1.33E-03
108-90-7	Chlorobenzene	2.87E-05	3.07E-04
108-94-1	Cyclohexanone	8.61E-02	9.21E-01
108-95-2	Phenol	2.00E-02	2.14E-01
109-74-0	n-Butanenitrile	2.33E+00	2.50E+01
109-99-9	Tetrahydrofuran	9.59E-04	1.03E-02
110-54-3	n-Hexane	4.65E-03	4.97E-02
110-59-8	Pentanenitrile	2.25E+00	2.40E+01
110-80-5	2-Ethoxyethanol	1.69E+01	1.80E+02
110-82-7	Cyclohexane	8.81E-05	9.42E-04
110-83-8	Cyclohexene	8.81E-05	9.42E-04
110-86-1	Pyridine	2.08E-02	2.22E-01
111-65-9	n-Octane	1.06E-03	1.14E-02
111-76-2	2-Butoxyethanol	2.66E+00	2.84E+01
111-84-2	n-Nonane	7.12E-04	7.62E-03
117-81-7	Bis(2-ethylhexyl) phthalate	2.20E+00	2.35E+01
117-84-0	Di-n-octylphthalate	9.62E+00	1.03E+02

Table A-1 Modeled Feed Vector for the Pre-Demonstration Risk Assessment for the DFLAW Operating Configuration

CASRN	COPC	Concentration in LAW Liquids	Concentration in LAW Solids
118-74-1	Hexachlorobenzene	5.00E-05	5.35E-04
120-12-7	Anthracene	1.72E+00	1.84E+01
120-82-1	1,2,4-Trichlorobenzene	1.77E-03	1.89E-02
120-83-2	2,4-Dichlorophenol	3.67E+00	3.92E+01
121-14-2	2,4-Dinitrotoluene	8.47E+00	9.06E+01
123-38-6	Propionaldehyde	2.94E-03	3.14E-02
122-39-4	N,N-Diphenylamine	2.67E-03	2.86E-02
123-72-8	Butanal	2.43E+00	2.60E+01
123-91-1	1,4-Dioxan	8.81E-04	9.42E-03
126-73-8	Tributyl phosphate	2.51E+00	2.69E+01
126-98-7	2-Methyl-2-propenenitrile	8.81E-04	9.42E-03
127-18-4	1,1,2,2-Tetrachloroethene	2.90E-05	3.11E-04
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	4.22E-02	4.51E-01
129-00-0	Pyrene	8.34E+00	8.92E+01
1330-20-7	Xylenes (total)	8.51E-03	9.11E-02
1336-36-3	Polychlorinated biphenyls – Note 1	3.87E+00	4.14E+01
134-32-7	alpha-Naphthylamine	1.93E+00	2.07E+01
141-78-6	Acetic acid ethyl ester	9.41E-05	1.01E-03
156-60-5	1,2-trans-Dichloroethene	6.55E+00	7.00E+01
1634-04-4	Methyl tert-butyl ether	2.38E+00	2.55E+01
189-55-9	Dibenzo[a,i]pyrene	1.70E+00	1.82E+01
189-64-0	Dibenzo[a,h]pyrene	1.70E+00	1.82E+01
191-24-2	Benzo(g,h,i)perylene	1.70E+00	1.81E+01
191-30-0	Dibenzo(a,l)pyrene	1.70E+00	1.82E+01
192-65-4	Dibenzo[a,e]pyrene	1.70E+00	1.82E+01
193-39-5	Indeno(1,2,3-cd)pyrene	1.70E+00	1.81E+01
206-44-0	Fluoranthene	8.37E+00	8.95E+01
208-96-8	Acenaphthylene	1.71E+00	1.83E+01
224-42-0	Dibenz[a,j]acridine	1.80E+00	1.92E+01
226-36-8	Dibenz[a,h]acridine	1.80E+00	1.92E+01
27154-33-2	Trichlorofluoroethane	1.02E+01	1.09E+02
319-84-6	alpha-BHC	9.86E-05	1.05E-03
319-85-7	beta-BHC	1.34E-04	1.43E-03
3697-24-3	5-Methylchrysene	1.72E+00	1.84E+01
4170-30-3	Crotonaldehyde (Propylene aldehyde)	1.20E-03	1.29E-02
50-00-0	Formaldehyde	4.05E+00	4.34E+01
50-32-8	Benzo(a)pyrene	3.49E-03	3.73E-02
53-70-3	Dibenz[a,h]anthracene	4.01E-03	4.29E-02
541-73-1	1,3-Dichlorobenzene	1.16E-03	1.24E-02
56-23-5	Carbon tetrachloride	4.56E-05	4.87E-04
56-49-5	3-Methylcholanthrene	1.73E+00	1.85E+01
58-89-9	gamma-BHC (Lindane)	1.33E-04	1.43E-03
58-90-2	2,3,4,6-Tetrachlorophenol	5.22E+00	5.58E+01
589-38-8	3-Hexanone	2.25E+00	2.41E+01
591-78-6	2-Hexanone	3.81E-03	4.07E-02
59-50-7	4-Chloro-3-methylphenol	7.74E+00	8.27E+01
59-89-2	N-Nitrosomorpholine	1.71E+01	1.83E+02
602-87-9	5-Nitroacenaphthene	2.24E+00	2.40E+01
60-29-7	Ethyl ether	3.31E-03	3.54E-02
60-35-5	Acetamide	3.99E+00	4.27E+01
621-64-7	N-Nitroso-di-n-propylamine	7.50E+00	8.02E+01
62-75-9	N-Nitroso-N,N-dimethylamine	3.97E-02	4.25E-01
628-73-9	Hexanenitrile	2.19E+00	2.34E+01

Table A-1 Modeled Feed Vector for the Pre-Demonstration Risk Assessment for the DFLAW Operating Configuration

CASRN	COPC	Concentration in LAW Liquids	Concentration in LAW Solids
630-20-6	1,1,1,2-Tetrachloroethane	1.13E+01	1.21E+02
67-56-1	Methyl alcohol	4.33E+00	4.63E+01
67-63-0	2-Propyl alcohol	2.46E-03	2.63E-02
67-64-1	2-Propanone (acetone)	4.18E-02	4.47E-01
67-66-3	Chloroform	2.98E-05	3.19E-04
67-72-1	Hexachloroethane	3.52E-01	3.77E+00
71-36-3	n-Butyl alcohol	7.12E-02	7.61E-01
71-43-2	Benzene	7.54E-05	8.06E-04
71-55-6	1,1,1-Trichloroethane	2.95E-05	3.16E-04
72-55-9	4,4-DDE	3.07E+00	3.28E+01
74-83-9	Bromomethane	5.96E-05	6.37E-04
74-87-3	Chloromethane	1.19E-04	1.27E-03
75-00-3	Chloroethane	5.96E-05	6.37E-04
75-01-4	1-Chloroethene	6.05E-05	6.47E-04
75-02-5	Fluoroethene (vinyl fluoride)	3.11E+00	3.33E+01
75-05-8	Acetonitrile	2.17E-02	2.32E-01
75-07-0	Acetaldehyde	2.97E+00	3.18E+01
75-09-2	Dichloromethane (methylene chloride)	1.77E-02	1.89E-01
75-21-8	Ethylene oxide (Oxirane)	5.13E-03	5.49E-02
75-27-4	Bromodichloromethane	2.21E+01	2.37E+02
75-34-3	1,1-Dichloroethane	2.39E-05	2.55E-04
75-35-4	1,1-Dichloroethene	3.75E-05	4.02E-04
75-45-6	Chlorodifluoromethane	8.81E-05	9.42E-04
75-50-3	Trimethylamine	2.66E+00	2.85E+01
75-69-4	Trichlorofluoromethane	7.25E-05	7.76E-04
75-71-8	Dichlorodifluoromethane	7.38E-05	7.90E-04
76-13-1	1,2,2-Trichlorotrifluoroethane	7.30E-05	7.81E-04
76-44-8	Heptachlor	6.86E-05	7.34E-04
78-83-1	2-Methylpropyl alcohol	4.14E+01	4.43E+02
78-87-5	1,2-Dichloropropane	2.39E-05	2.55E-04
78-93-3	2-Butanone	9.55E-03	1.02E-01
79-00-5	1,1,2-Trichloroethane	2.80E-05	2.99E-04
79-01-6	1,1,2-Trichloroethylene	3.18E-05	3.40E-04
79-10-7	2-Propenoic acid	6.22E+00	6.65E+01
79-34-5	1,1,2,2-Tetrachloroethane	2.80E-05	2.99E-04
79-46-9	2-Nitropropane	5.89E-03	6.30E-02
82-68-8	Pentachloronitrobenzene (PCNB)	5.57E-03	5.95E-02
83-32-9	Acenaphthene	8.44E+00	9.03E+01
84-66-2	Diethyl phthalate	2.50E+00	2.67E+01
84-74-2	Di-n-butylphthalate	5.11E+01	5.46E+02
85-01-8	Phenanthrene	1.72E+00	1.84E+01
85-68-7	Butylbenzylphthalate	1.64E+01	1.76E+02
86-73-7	Fluorene	1.73E+00	1.85E+01
87-68-3	Hexachlorobutadiene	1.51E-02	1.62E-01
87-86-5	Pentachlorophenol	1.46E-02	1.56E-01
88-06-2	2,4,6-Trichlorophenol	7.44E+00	7.95E+01
88-75-5	2-Nitrophenol	7.52E+00	8.05E+01
91-20-3	Naphthalene	7.90E+00	8.44E+01
91-58-7	2-Chloronaphthalene	2.20E+00	2.35E+01
92-52-4	1,1`-Biphenyl	5.57E-03	5.95E-02
95-47-6	Xylene (o)	Included in 1330-20-7	
95-48-7	o-Cresol	8.89E+00	9.51E+01
95-50-1	1,2-Dichlorobenzene	2.30E-02	2.46E-01

Table A-1 Modeled Feed Vector for the Pre-Demonstration Risk Assessment for the DFLAW Operating Configuration

CASRN	COPC	Concentration in LAW Liquids	Concentration in LAW Solids
95-57-8	2-Chlorophenol	8.00E+00	8.56E+01
95-95-4	2,4,5-Trichlorophenol	7.26E+00	7.77E+01
98-82-8	Cumene	1.80E+00	1.93E+01
98-86-2	Acetophenone	5.57E-03	5.95E-02
98-95-3	Nitrobenzene	1.95E-02	2.08E-01
Inorganics		**(mg/L)**	**(mg/kg)**
14265-44-2	Phosphate	5.62E+03	2.00E+05
14797-55-8	Nitrate	1.80E+05	0.00E+00
14797-65-0	Nitrite	8.50E+04	0.00E+00
14808-79-8	Sulfate	5.00E+03	0.00E+00
16887-00-6	Chloride	3.43E+03	0.00E+00
16984-48-8	Fluoride	5.00E+02	3.02E+04
57-12-5	Cyanide	2.29E+00	0.00E+00
593-74-8	Dimethylmercury	1.00E-06	0.00E+00
7429-90-5	Aluminum	5.51E+03	6.03E+00
7439-89-6	Iron (2+)	0.00E+00	0.00E+00
7439-89-6	Iron (3+)	4.37E+01	4.44E+01
7439-92-1	Lead	1.85E+02	0.00E+00
7439-93-2	Lithium	7.99E+00	0.00E+00
7439-95-4	Magnesium	0.00E+00	3.48E-01
7439-96-5	Manganese	0.00E+00	1.27E-01
7439-97-6	Mercury	2.38E+00	0.00E+00
7439-98-7	Molybdenum	2.50E+01	0.00E+00
7440-02-0	Nickel	1.58E+00	4.12E+02
7440-16-6	Rhodium	0.00E+00	0.00E+00
7440-22-4	Silver	7.88E-01	3.93E+01
7440-23-5	Sodium	1.29E+05	4.97E+03
7440-24-6	Strontium (total)	7.79E-02	1.59E+00
7440-25-7	Tantalum	1.25E-05	6.42E-05
7440-28-0	Thallium	0.00E+00	6.96E-01
7440-33-7	Tungsten	4.49E+01	0.00E+00
7440-36-0	Antimony	1.52E+01	0.00E+00
7440-38-2	Arsenic	2.03E+01	0.00E+00
7440-39-3	Barium	1.03E-02	5.25E+00
7440-41-7	Beryllium	1.12E+00	0.00E+00
7440-43-9	Cadmium	4.80E+00	1.06E+02
7440-47-3	Chromium (3+)	1.75E+02	6.76E-01
7440-47-3	Chromium (6+)	5.12E+02	0.00E+00
7440-48-4	Cobalt	0.00E+00	6.96E-02
7440-50-8	Copper	1.34E+00	0.00E+00
7440-61-1	Uranium	2.42E+01	4.56E-11
7440-62-2	Vanadium	1.00E-03	3.53E-02
7440-65-5	Yttrium	1.03E-01	0.00E+00
7440-66-6	Zinc	1.44E+01	0.00E+00
7440-67-7	Zirconium	0.00E+00	0.00E+00
7664-41-7	Ammonia/Ammonium	0.00E+00	0.00E+00
7782-49-2	Selenium	2.40E+01	0.00E+00
Radionuclides		**(pCi/L)**	**(pCi/g)**
10028-17-8	Tritium	1.92E+06	0.00E+00
10045-97-3	Cesium-137	1.43E+07	0.00E+00
10098-97-2	Strontium-90	4.56E+08	7.87E+06
10198-40-0	Cobalt-60	0.00E+00	2.70E+01
13966-29-5	Uranium-234	8.98E+03	1.72E-11

Table A-1 Modeled Feed Vector for the Pre-Demonstration Risk Assessment for the DFLAW Operating Configuration

CASRN	COPC	Concentration in LAW Liquids	Concentration in LAW Solids
13967-48-1	Ruthenium-106	1.15E+00	0.00E+00
13967-70-9	Cesium-134	2.05E+00	0.00E+00
13968-55-3	Uranium-233	3.06E+04	7.69E-11
13981-15-2	Curium-244	1.02E+06	0.00E+00
13981-16-3	Plutonium-238	1.21E+05	5.98E+05
13981-37-8	Nickel-63	3.45E+06	5.31E+05
13982-10-0	Plutonium-242	9.91E+01	2.86E+02
13982-63-3	Radium-226	4.41E+01	0.00E+00
13982-70-2	Uranium-236	2.98E+02	7.99E-13
13994-20-2	Neptunium-237	8.75E+04	1.56E-01
14119-32-5	Plutonium-241	1.69E+06	9.14E+06
14119-33-6	Plutonium-240	6.21E+05	3.83E+06
14133-76-7	Technetium-99	1.31E+08	0.00E+00
14158-29-3	Uranium-232	5.67E+02	1.81E-12
14234-35-6	Antimony-125	3.76E+05	0.00E+00
14331-85-2	Protactinium-231	0.00E+00	1.52E-01
14336-70-0	Nickel-59	4.58E+04	7.01E+03
14391-16-3	Europium-155	0.00E+00	1.28E+02
14596-10-2	Americium-241	1.59E+07	1.06E+02
14683-23-9	Europium-152	0.00E+00	5.77E+01
14762-75-5	Carbon-14	3.19E+06	0.00E+00
14952-40-0	Actinium-227	9.14E+03	4.76E-04
14993-75-0	Americium-243	9.21E+03	5.04E-05
15046-84-1	Iodine-129	1.24E+05	2.23E-02
15117-48-3	Plutonium-239	2.67E+06	1.66E+07
15117-96-1	Uranium-235	3.64E+02	7.54E-13
15262-20-1	Radium-228	2.70E+03	1.91E-03
15510-73-3	Curium-242	8.29E+05	0.00E+00
15585-10-1	Europium-154	0.00E+00	3.40E+02
15594-54-4	Thorium-229	0.00E+00	7.63E-02
15715-94-3	Samarium-151	0.00E+00	3.37E+05
15751-77-6	Zirconium-93	0.00E+00	1.36E+03
15757-87-6	Curium-243	5.90E+04	0.00E+00
15758-45-9	Selenium-79	3.08E+06	0.00E+00
15832-50-5	Tin-126	3.34E+06	0.00E+00
378253-44-2	Cadmium-113m	5.69E+06	9.03E+04
378782-82-2	Niobium-93m	0.00E+00	1.22E+03
7440-29-1	Thorium-232	0.00E+00	1.68E-01
7440-61-1R	Uranium-238	8.07E+03	1.52E-11

Note 1: Values shown are for the feed vector PCBs before refinement. The feed vector concentration for the refined feed vector was estimated to be 6.52E-02 mg/L for LAW liquids, with no LAW solids. Refer to Section A.2.4.
Ref: 24590-WTP-M4C-V20T-00001, *Air Emissions Estimate for DFLAW and Integrated WTP Configurations*.

Table A-2 Modeled Feed Vector for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

CASRN	COPC	Concentration in LAW Liquids[1]	Concentration in HLW Liquids	Concentration in HLW Solids
Organics		**(mg/L)**	**(mg/L)**	**(mg/kg)**
100-02-7	p-Nitrophenol	1.05E+01	5.47E+00	6.10E+01
100-21-0	Phthalic acid	3.99E+00	2.09E+00	2.33E+01
100-25-4	1,4-Dinitrobenzene	7.92E-03	4.15E-03	4.62E-02
100-40-3	4-Ethenylcyclohexene	2.60E+00	1.36E+00	1.52E+01
100-41-4	Ethyl benzene	7.09E-05	3.71E-05	4.14E-04
100-42-5	Styrene	3.40E-05	1.78E-05	1.98E-04
10061-01-5	cis-1,3-Dichloropropene	1.25E-04	6.57E-05	7.31E-04
10061-02-6	trans-1,3-Dichloropropene	1.31E-04	6.86E-05	7.64E-04
101-55-3	4-Bromophenylphenyl ether	3.99E+00	2.09E+00	2.33E+01
104-76-7	2-Ethyl-1-hexanol	3.13E+00	1.64E+00	1.82E+01
10595-95-6	n-Nitrosomethylethylamine	5.65E+00	2.96E+00	3.29E+01
106-42-3	Xylene (m & p)	Included in 1330-20-7		
106-46-7	1,4-Dichlorobenzene	2.15E-02	1.13E-02	1.25E-01
106-88-7	1,2-Epoxybutane	3.46E+00	1.81E+00	2.02E+01
106-93-4	Ethylene dibromide	3.40E-05	1.78E-05	1.98E-04
106-99-0	1,3-Butadiene	1.14E-03	5.97E-04	6.65E-03
107-02-8	Acrolein	1.84E-03	9.65E-04	1.07E-02
107-05-1	3-Chloropropene	1.25E-04	6.57E-05	7.31E-04
107-06-2	1,2-Dichloroethane	3.97E-05	2.08E-05	2.32E-04
107-12-0	Propionitrile	1.15E-02	6.02E-03	6.71E-02
107-13-1	Acrylonitrile	1.25E-03	6.57E-04	7.31E-03
108-05-4	Acetic acid vinyl ester	4.14E+00	2.17E+00	2.41E+01
108-10-1	4-Methyl-2-pentanone	4.43E-04	2.32E-04	2.58E-03
108-39-4	m-Cresol	9.12E+00	4.77E+00	5.32E+01
108-87-2	Methylcyclohexane	1.44E-04	7.56E-05	8.42E-04
108-88-3	Toluene	1.77E-04	9.27E-05	1.03E-03
108-90-7	Chlorobenzene	4.09E-05	2.14E-05	2.38E-04
108-94-1	Cyclohexanone	1.23E-01	6.42E-02	7.15E-01
108-95-2	Phenol	2.84E-02	1.49E-02	1.66E-01
109-74-0	n-Butanenitrile	3.32E+00	1.74E+00	1.94E+01
109-99-9	Tetrahydrofuran	1.37E-03	7.15E-04	7.96E-03
110-54-3	n-Hexane	6.62E-03	3.46E-03	3.86E-02
110-59-8	Pentanenitrile	3.20E+00	1.67E+00	1.86E+01
110-80-5	2-Ethoxyethanol	2.40E+01	1.26E+01	1.40E+02
110-82-7	Cyclohexane	1.25E-04	6.57E-05	7.31E-04
110-83-8	Cyclohexene	1.25E-04	6.57E-05	7.31E-04
110-86-1	Pyridine	2.96E-02	1.55E-02	1.72E-01
111-65-9	n-Octane	1.51E-03	7.92E-04	8.82E-03
111-76-2	2-Butoxyethanol	3.79E+00	1.98E+00	2.21E+01
111-84-2	n-Nonane	1.01E-03	5.31E-04	5.91E-03
117-81-7	Bis(2-ethylhexyl) phthalate	3.13E+00	1.64E+00	1.82E+01
117-84-0	Di-n-octylphthalate	1.37E+01	7.17E+00	7.98E+01
118-74-1	Hexachlorobenzene	7.12E-05	3.73E-05	4.15E-04
120-12-7	Anthracene	2.45E+00	1.28E+00	1.43E+01
120-82-1	1,2,4-Trichlorobenzene	2.51E-03	1.32E-03	1.47E-02
120-83-2	2,4-Dichlorophenol	5.22E+00	2.73E+00	3.04E+01
121-14-2	2,4-Dinitrotoluene	1.21E+01	6.31E+00	7.03E+01
123-38-6	Propionaldehyde	4.18E-03	2.19E-03	2.44E-02
122-39-4	N,N-Diphenylamine	3.80E-03	1.99E-03	2.22E-02
123-72-8	Butanal	3.46E+00	1.81E+00	2.02E+01
123-91-1	1,4-Dioxan	1.25E-03	6.57E-04	7.31E-03
126-73-8	Tributyl phosphate	3.58E+00	1.87E+00	2.09E+01

Table A-2 Modeled Feed Vector for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

CASRN	COPC	Concentration in LAW Liquids[1]	Concentration in HLW Liquids	Concentration in HLW Solids
126-98-7	2-Methyl-2-propenenitrile	1.25E-03	6.57E-04	7.31E-03
127-18-4	1,1,2,2-Tetrachloroethene	4.13E-05	2.16E-05	2.41E-04
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	6.00E-02	3.14E-02	3.50E-01
129-00-0	Pyrene	1.19E+01	6.22E+00	6.92E+01
1330-20-7	Xylenes (total)	1.21E-02	6.34E-03	7.07E-02
1336-36-3	Polychlorinated biphenyls – Note 1	5.51E+00	2.88E+00	3.63E+00
134-32-7	alpha-Naphthylamine	2.75E+00	1.44E+00	1.60E+01
141-78-6	Acetic acid ethyl ester	1.34E-04	7.01E-05	7.81E-04
156-60-5	1,2-trans-Dichloroethene	9.32E+00	4.88E+00	5.43E+01
1634-04-4	Methyl tert-butyl ether	3.39E+00	1.77E+00	1.98E+01
189-55-9	Dibenzo[a,i]pyrene	2.42E+00	1.27E+00	1.41E+01
189-64-0	Dibenzo[a,h]pyrene	2.42E+00	1.27E+00	1.41E+01
191-24-2	Benzo(g,h,i)perylene	2.41E+00	1.26E+00	1.41E+01
191-30-0	Dibenzo(a,l)pyrene	2.42E+00	1.27E+00	1.41E+01
192-65-4	Dibenzo[a,e]pyrene	2.42E+00	1.27E+00	1.41E+01
193-39-5	Indeno(1,2,3-cd)pyrene	2.41E+00	1.26E+00	1.41E+01
206-44-0	Fluoranthene	1.19E+01	6.24E+00	6.95E+01
208-96-8	Acenaphthylene	2.44E+00	1.28E+00	1.42E+01
224-42-0	Dibenz[a,j]acridine	2.56E+00	1.34E+00	1.49E+01
226-36-8	Dibenz[a,h]acridine	2.56E+00	1.34E+00	1.49E+01
27154-33-2	Trichlorofluoroethane	1.45E+01	7.62E+00	8.48E+01
319-84-6	alpha-BHC	1.40E-04	7.35E-05	8.18E-04
319-85-7	beta-BHC	1.91E-04	9.98E-05	1.11E-03
3697-24-3	5-Methylchrysene	2.45E+00	1.28E+00	1.43E+01
4170-30-3	Crotonaldehyde (Propylene aldehyde)	1.71E-03	8.97E-04	9.98E-03
50-00-0	Formaldehyde	5.77E+00	3.02E+00	3.37E+01
50-32-8	Benzo(a)pyrene	4.96E-03	2.60E-03	2.89E-02
53-70-3	Dibenz[a,h]anthracene	5.71E-03	2.99E-03	3.33E-02
541-73-1	1,3-Dichlorobenzene	1.65E-03	8.63E-04	9.61E-03
56-23-5	Carbon tetrachloride	6.48E-05	3.40E-05	3.78E-04
56-49-5	3-Methylcholanthrene	2.46E+00	1.29E+00	1.43E+01
58-89-9	gamma-BHC (Lindane)	1.90E-04	9.94E-05	1.11E-03
58-90-2	2,3,4,6-Tetrachlorophenol	7.43E+00	3.89E+00	4.33E+01
589-38-8	3-Hexanone	3.21E+00	1.68E+00	1.87E+01
591-78-6	2-Hexanone	5.42E-03	2.84E-03	3.16E-02
59-50-7	4-Chloro-3-methylphenol	1.10E+01	5.77E+00	6.42E+01
59-89-2	N-Nitrosomorpholine	2.43E+01	1.27E+01	1.42E+02
602-87-9	5-Nitroacenaphthene	3.19E+00	1.67E+00	1.86E+01
60-29-7	Ethyl ether	4.71E-03	2.47E-03	2.75E-02
60-35-5	Acetamide	5.68E+00	2.97E+00	3.31E+01
621-64-7	N-Nitroso-di-n-propylamine	1.07E+01	5.59E+00	6.22E+01
62-75-9	N-Nitroso-N,N-dimethylamine	5.66E-02	2.96E-02	3.30E-01
628-73-9	Hexanenitrile	3.11E+00	1.63E+00	1.81E+01
630-20-6	1,1,1,2-Tetrachloroethane	1.61E+01	8.45E+00	9.41E+01
67-56-1	Methyl alcohol	6.16E+00	3.22E+00	3.59E+01
67-63-0	2-Propyl alcohol	3.50E-03	1.83E-03	2.04E-02
67-64-1	2-Propanone (acetone)	5.95E-02	3.11E-02	3.47E-01
67-66-3	Chloroform	4.25E-05	2.22E-05	2.48E-04
67-72-1	Hexachloroethane	5.01E-01	2.63E-01	2.92E+00
71-36-3	n-Butyl alcohol	1.01E-01	5.30E-02	5.91E-01
71-43-2	Benzene	1.07E-04	5.62E-05	6.25E-04
71-55-6	1,1,1-Trichloroethane	4.20E-05	2.20E-05	2.45E-04
72-55-9	4,4-DDE	4.37E+00	2.29E+00	2.55E+01

Table A-2 Modeled Feed Vector for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

CASRN	COPC	Concentration in LAW Liquids[1]	Concentration in HLW Liquids	Concentration in HLW Solids
74-83-9	Bromomethane	8.48E-05	4.44E-05	4.94E-04
74-87-3	Chloromethane	1.69E-04	8.84E-05	9.85E-04
75-00-3	Chloroethane	8.48E-05	4.44E-05	4.94E-04
75-01-4	1-Chloroethene	8.60E-05	4.50E-05	5.02E-04
75-02-5	Fluoroethene (vinyl fluoride)	4.43E+00	2.32E+00	2.58E+01
75-05-8	Acetonitrile	3.09E-02	1.62E-02	1.80E-01
75-07-0	Acetaldehyde	4.23E+00	2.22E+00	2.47E+01
75-09-2	Dichloromethane (methylene chloride)	2.51E-02	1.32E-02	1.47E-01
75-21-8	Ethylene oxide (Oxirane)	7.31E-03	3.83E-03	4.26E-02
75-27-4	Bromodichloromethane	3.15E+01	1.65E+01	1.84E+02
75-34-3	1,1-Dichloroethane	3.40E-05	1.78E-05	1.98E-04
75-35-4	1,1-Dichloroethene	5.34E-05	2.80E-05	3.12E-04
75-45-6	Chlorodifluoromethane	1.25E-04	6.57E-05	7.31E-04
75-50-3	Trimethylamine	3.79E+00	1.98E+00	2.21E+01
75-69-4	Trichlorofluoromethane	1.03E-04	5.40E-05	6.02E-04
75-71-8	Dichlorodifluoromethane	1.05E-04	5.50E-05	6.13E-04
76-13-1	1,2,2-Trichlorotrifluoroethane	1.04E-04	5.44E-05	6.06E-04
76-44-8	Heptachlor	9.76E-05	5.11E-05	5.69E-04
78-83-1	2-Methylpropyl alcohol	5.89E+01	3.08E+01	3.44E+02
78-87-5	1,2-Dichloropropane	3.40E-05	1.78E-05	1.98E-04
78-93-3	2-Butanone	1.36E-02	7.11E-03	7.92E-02
79-00-5	1,1,2-Trichloroethane	3.98E-05	2.08E-05	2.32E-04
79-01-6	1,1,2-Trichloroethylene	4.52E-05	2.37E-05	2.64E-04
79-10-7	2-Propenoic acid	8.85E+00	4.63E+00	5.16E+01
79-34-5	1,1,2,2-Tetrachloroethane	3.98E-05	2.09E-05	2.32E-04
79-46-9	2-Nitropropane	8.39E-03	4.39E-03	4.89E-02
82-68-8	Pentachloronitrobenzene (PCNB)	7.92E-03	4.15E-03	4.62E-02
83-32-9	Acenaphthene	1.20E+01	6.29E+00	7.01E+01
84-66-2	Diethyl phthalate	3.56E+00	1.86E+00	2.08E+01
84-74-2	Di-n-butylphthalate	7.27E+01	3.81E+01	4.24E+02
85-01-8	Phenanthrene	2.45E+00	1.28E+00	1.43E+01
85-68-7	Butylbenzylphthalate	2.34E+01	1.22E+01	1.36E+02
86-73-7	Fluorene	2.46E+00	1.29E+00	1.43E+01
87-68-3	Hexachlorobutadiene	2.15E-02	1.13E-02	1.26E-01
87-86-5	Pentachlorophenol	2.07E-02	1.09E-02	1.21E-01
88-06-2	2,4,6-Trichlorophenol	1.06E+01	5.54E+00	6.17E+01
88-75-5	2-Nitrophenol	1.07E+01	5.61E+00	6.24E+01
91-20-3	Naphthalene	1.12E+01	5.88E+00	6.55E+01
91-58-7	2-Chloronaphthalene	3.13E+00	1.64E+00	1.82E+01
92-52-4	1,1`-Biphenyl	7.92E-03	4.15E-03	4.62E-02
95-47-6	Xylene (o)	Included in 1330-20-7		
95-48-7	o-Cresol	1.27E+01	6.63E+00	7.38E+01
95-50-1	1,2-Dichlorobenzene	3.28E-02	1.72E-02	1.91E-01
95-57-8	2-Chlorophenol	1.14E+01	5.96E+00	6.64E+01
95-95-4	2,4,5-Trichlorophenol	1.03E+01	5.41E+00	6.03E+01
98-82-8	Cumene	2.57E+00	1.34E+00	1.50E+01
98-86-2	Acetophenone	7.92E-03	4.15E-03	4.62E-02
98-95-3	Nitrobenzene	2.77E-02	1.45E-02	1.61E-01
Inorganics		**(mg/L)**	**(mg/L)**	**(mg/kg)**
14265-44-2	Phosphate	1.42E+04	1.18E+04	5.12E+04
14797-55-8	Nitrate	2.06E+05	1.58E+05	1.92E+04
14797-65-0	Nitrite	5.45E+04	4.25E+04	2.03E+03
14808-79-8	Sulfate	7.88E+03	7.06E+03	5.36E+03

Table A-2 Modeled Feed Vector for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

CASRN	COPC	Concentration in LAW Liquids[1]	Concentration in HLW Liquids	Concentration in HLW Solids
16887-00-6	Chloride	2.93E+03	2.34E+03	1.52E+00
16984-48-8	Fluoride	2.52E+03	4.47E+03	9.87E+03
57-12-5	Cyanide	4.30E-01	5.34E-01	3.76E+01
593-74-8	Dimethylmercury	1.00E-06	1.00E-06	0.00E+00
7429-90-5	Aluminum	9.72E+03	7.86E+03	1.97E+05
7439-89-6	Iron (2+)	0.00E+00	0.00E+00	0.00E+00
7439-89-6	Iron (3+)	5.68E+01	8.63E+01	4.91E+04
7439-92-1	Lead	3.21E+01	2.37E+01	3.06E+03
7439-93-2	Lithium	1.52E+00	4.00E-01	6.71E+01
7439-95-4	Magnesium	5.51E+00	3.36E+00	8.62E+02
7439-96-5	Manganese	7.28E+00	5.99E+00	7.30E+03
7439-97-6	Mercury	9.75E-01	2.12E+00	4.40E+01
7439-98-7	Molybdenum	1.87E+01	6.54E+00	1.39E+02
7440-02-0	Nickel	5.07E+01	3.86E+01	4.22E+03
7440-16-6	Rhodium	1.34E+00	7.94E-01	2.68E+01
7440-22-4	Silver	1.80E+00	8.06E-01	1.45E+02
7440-23-5	Sodium	1.51E+05	1.06E+05	7.35E+04
7440-24-6	Strontium (total)	2.63E+01	1.68E+01	1.81E+03
7440-25-7	Tantalum	1.03E+00	5.73E-01	2.30E+00
7440-28-0	Thallium	6.98E+00	5.04E+00	2.11E+02
7440-33-7	Tungsten	2.37E+00	3.73E+00	1.27E+02
7440-36-0	Antimony	5.48E+00	3.98E+00	9.35E+01
7440-38-2	Arsenic	6.44E+00	3.05E+00	1.43E+02
7440-39-3	Barium	1.40E+00	6.62E-01	3.58E+02
7440-41-7	Beryllium	3.18E-01	1.62E-01	1.70E+01
7440-43-9	Cadmium	6.66E+00	2.36E+00	3.13E+02
7440-47-3	Chromium (3+)	1.61E+01	5.92E+01	1.39E+04
7440-47-3	Chromium (6+)	6.33E+02	6.97E+02	0.00E+00
7440-48-4	Cobalt	1.61E+00	8.85E-01	4.95E+01
7440-50-8	Copper	2.75E+00	5.65E-01	9.99E+01
7440-61-1	Uranium	0.00E+00	6.26E+01	1.69E+04
7440-62-2	Vanadium	1.96E+00	8.07E-01	8.68E+01
7440-65-5	Yttrium	6.37E-01	4.07E-01	1.75E+01
7440-66-6	Zinc	2.84E+00	9.33E-01	2.19E+02
7440-67-7	Zirconium	4.39E+00	4.91E+01	1.73E+04
7664-41-7	Ammonia/Ammonium	0.00E+00	0.00E+00	0.00E+00
7782-49-2	Selenium	1.55E+01	1.67E+01	9.93E+00
Radionuclides		**(pCi/L)**	**(pCi/L)**	**(pCi/g)**
10028-17-8	Tritium	5.51E+05	1.03E+06	7.40E+00
10045-97-3	Cesium-137	4.94E+10	4.09E+10	4.77E+07
10098-97-2	Strontium-90	9.21E+08	1.08E+09	7.21E+08
10198-40-0	Cobalt-60	1.91E+04	2.06E+04	1.17E+03
13966-29-5	Uranium-234	8.61E+03	1.43E+04	5.23E+03
13967-48-1	Ruthenium-106	3.69E-05	7.71E-05	1.25E-06
13967-70-9	Cesium-134	8.50E+01	1.46E+02	1.88E-02
13968-55-3	Uranium-233	5.94E+07	5.88E+07	4.32E+07
13981-15-2	Curium-244	3.05E+04	1.53E+04	2.25E+03
13981-16-3	Plutonium-238	1.23E+05	1.10E+05	6.48E+04
13981-37-8	Nickel-63	4.73E+07	3.02E+07	2.01E+06
13982-10-0	Plutonium-242	1.79E+02	5.54E+01	1.65E+01
13982-63-3	Radium-226	2.26E+01	1.66E+01	1.46E-01
13982-70-2	Uranium-236	2.30E+02	4.77E+02	1.45E+02
13994-20-2	Neptunium-237	6.81E+04	6.26E+04	4.54E+03

Table A-2 Modeled Feed Vector for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

CASRN	COPC	Concentration in LAW Liquids[1]	Concentration in HLW Liquids	Concentration in HLW Solids
14119-32-5	Plutonium-241	2.95E+05	5.78E+05	2.55E+05
14119-33-6	Plutonium-240	3.79E+05	3.37E+05	2.19E+05
14133-76-7	Technetium-99	1.03E+08	8.47E+07	7.26E+04
14158-29-3	Uranium-232	5.07E+02	5.77E+02	2.22E+02
14234-35-6	Antimony-125	1.90E+03	2.98E+03	2.87E+01
14331-85-2	Protactinium-231	1.03E+04	4.57E+03	1.27E+02
14336-70-0	Nickel-59	8.47E+05	4.64E+05	3.14E+04
14391-16-3	Europium-155	1.92E+04	3.14E+04	7.49E+03
14596-10-2	Americium-241	9.47E+06	1.98E+07	6.35E+06
14683-23-9	Europium-152	1.37E+05	1.27E+05	1.06E+04
14762-75-5	Carbon-14	2.02E+06	2.36E+06	1.16E+03
14952-40-0	Actinium-227	7.78E+03	3.07E+03	1.47E+02
14993-75-0	Americium-243	4.70E+03	8.42E+03	2.73E+03
15046-84-1	Iodine-129	1.11E+05	8.59E+04	9.53E+01
15117-48-3	Plutonium-239	1.88E+06	1.58E+06	1.04E+06
15117-96-1	Uranium-235	3.31E+02	5.52E+02	1.96E+02
15262-20-1	Radium-228	5.87E+02	6.59E+02	2.28E+02
15510-73-3	Curium-242	2.86E+04	1.90E+04	1.99E+03
15585-10-1	Europium-154	3.18E+05	5.15E+05	1.11E+05
15594-54-4	Thorium-229	3.71E+02	2.96E+02	5.45E+01
15715-94-3	Samarium-151	7.68E+08	5.37E+08	5.42E+07
15751-77-6	Zirconium-93	4.95E+06	2.90E+06	4.59E+04
15757-87-6	Curium-243	2.55E+03	1.18E+03	1.75E+02
15758-45-9	Selenium-79	2.72E+06	2.25E+06	8.95E+02
15832-50-5	Tin-126	3.87E+06	1.32E+06	1.76E+04
378253-44-2	Cadmium-113m	1.40E+06	1.13E+06	8.38E+03
378782-82-2	Niobium-93m	5.25E+06	3.15E+06	4.90E+04
7440-29-1	Thorium-232	5.17E+02	5.59E+02	2.27E+02
7440-61-1R	Uranium-238	9.86E+03	1.72E+04	5.65E+03

[1.] No LAW solids data was reported and are assumed to be entrained with HLW solids. Their concentration is presumed inconsequential for this estimate and bound by HLW solids.

Note 1: The refined feed vector concentrations were estimated to be 6.52E-02 and 1.34E+00 mg/L for LAW and HLW liquids, respectively. The feed vector concentration for the refined feed vector was estimated to be 8.00E+00 mg/kg for HLW solids. Refer to Section A.2.4.

Ref: 24590-WTP-M4C-V20T-00001, *Air Emissions Estimate for DFLAW and Integrated WTP Configurations*.

A.2.1 Model Derived Feed Constituents

For the bounding feed vector, the concentrations of inorganics, radionuclides, and total organic carbon (TOC) (used as a scalar) were developed using the Hanford Tank Waste Operations Simulator (HTWOS) and inputs from the Best-Basis Inventory (BBI) (PNNL 2015). The BBI is the official database for Hanford Site tank waste inventory estimates and contains data on the current state of constituent inventories (as they are determined to currently exist within Tank Farms). The BBI inventories are developed using a data source hierarchy of sample-based values, calculated values (based on correlations with other analytes), engineering-based values (primarily process knowledge, results for similar tanks, and pre-1989 sample data), and model-based template values (based on history and records, and model results).

The BBI data were then utilized by HTWOS to predict a feed vector. By utilizing HTWOS, a time- and pathway-dependent feed vector was produced from the static inventory information found within the

BBI[1]. HTWOS is a dynamic event-simulator, governed by prescribed initial conditions, constraints, and operating logic. It is used to simulate tank waste storage, processing, and immobilization. HTWOS simulates the movement of waste material through the tank farm system in support of tank retrieval operations to facilitate long-term management of the waste. The feed vector represents "as-delivered" feed; that is, the feed composition allows for the impact of retrieval by the Tank Operations Contractor prior to delivery to the WTP as predicted by HTWOS. The HTWOS feed vector consisted of 48 LAW and 960 HLW batches, which contained the liquid and solid constituent quantities (in kmol) for TOC (less than the contribution of oxalate), oxalate, inorganics, and radionuclides in each batch. The average batch inventory of each reported organic, in kg, was computed based on its corresponding TOC ratio and the average batch quantity of TOC (corrected for oxalate)[2], in kmol, and the molecular weight of carbon. The average batch inventory of each reported inorganic and radionuclide COPC, in kg, was computed based on its average batch quantity, in kmol, and its corresponding molecular weight. As appropriate, compounds were tracked by their corresponding inorganics (e.g., Al^{3+} from the Al portion of $Al(OH)_3$, $Al(OH)^{4-}$, Al^{3+}, and AlO(OH)).

To develop a DFLAW bounding feed vector, HTWOS was run in a modified configuration. These modifications are as follows:

- During actual WTP operations, concentrate from the effluent management facility (EMF) may be sent back to the double-shell tank system rather than recycled internally within WTP. To bound operations, all EMF concentrate was assumed to be recycled back into the vitrification process.
- Immediate full-capacity LAW vitrification (at 100% capacity, 15 metric tons of glass per day [MTG/day] per melter) without a ramp-up feed delivery rate was assumed in order to maximize the amount of waste processed.
- To maximize the overall quantity of each constituent treated during the expected ten years of the DFLAW program, the waste sodium concentration was increased from 5.5±0.02 molar to 8.0 molar.

To develop a bounding feed vector for the baseline WTP operating configuration, HTWOS was run with the following modifications:

- Due to uncertainty that exists regarding the final treatment pathway of contact-handled transuranic (CH-TRU) waste, CH-TRU waste was immobilized as HLW via the WTP for the full-mission HTWOS scenario. In actuality, it could be treated at a Supplemental TRU Treatment Facility before being shipped off-site for disposal (DOE/EIS-0391, *Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington (TC & WM EIS)*).
- All concentrations were increased by a scalar equating to one standard deviation (based on a normal distribution).
- The total operating efficiency of the PT Facility was assumed to be at 100% instead of the nominal 70%, so that batch transfers to the PT Facility occurred at the maximum frequency. This also facilitated modeling full-capacity LAW and HLW vitrification (at 100% capacity, 15 MTG/day per LAW melter, 3.25 MTG/day per HLW melter).

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[1] Radionuclides are decayed by the HTWOS model to January 1 of the year each batch is delivered. DFLAW feed delivery was based on a date of 2022. The baseline WTP feed delivery was based on a date of 2031.

[2] The average kmol of liquid TOC in each LAW batch was adjusted in accordance with feed vector report (24590-WTP-RPT-ENV-16-001) to obtain the adjusted average mass of liquid TOC in each LAW batch in the baseline configuration

While the assumption of elevated sodium (scaled up by 1.83 in the feed vector) is conservative from a feed delivery perspective, emissions modeling indicated that this assumption, when coupled with the project feed concentration of sulfate, results in a throughput-limiting feed composition which could not support modeling melter throughput at its maximum. To compensate for this, and maintain a bounding throughput, the lower average mass of Na^+ and SO_4^{2-} of the nominal vector reported in the feed vector report was used for emissions modeling. This ensured that bounding air emissions are modeled by allowing the emissions model to maximize throughput (and resultant emissions).

A.2.2 Estimated Organic Constituents of Potential Concern

While HTWOS is capable of providing batch delivery data, this information is limited to the 83 inorganic/radionuclide COPCs found on the list of BBI standard analytes. HTWOS does not track any of the individual organic compounds on the list of COPCs, but does track TOC[3]. Of the 140 organic feed COPCs, at least one inventory estimate exists for 91 of them. Inventories for individually characterized analytes are only included within the BBI supplemental analytes database when available. To address this limitation, an average Tank-Farms-wide ratio for each quantifiable organic was calculated on a per-TOC-basis using the current waste inventory estimates. An estimate of the concentration of each organic within each batch of waste delivered to WTP was then made by applying that constituent's ratio as a multiplier to the TOC value reported by HTWOS. This approach is based on a general assumption that the TOC mass is a representative scaler for the mass of quantified organics in the waste feed. Using TOC as a surrogate to identify concentrations of unspeciated organic compounds is consistent with the total organic emissions approach for estimating emissions recommended in the US Environmental Protection Agency (EPA) hazardous waste combustion risk assessment guidance (EPA530-R-05-006, *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*). It was additionally assumed that not only would TOC reported by the BBI generally remain within the same phase it started in, but also that the distribution of organic analytes as it currently exists within tank farms is representative of the distribution of organics once waste is retrieved and delivered to WTP. Data used to develop these ratios were from from the BBI standard and supplemental datasets, and from 24590-WTP-RPT-MGT-04-001, *Regulatory Data Quality Objectives (RDQO) Optimization Report*.

There were 21 COPCs which have no inventory values above the detection limit. These were associated with the characterization work performed in the implementation of the RDQO (24590-WTP-RPT-MGT-04-001). The RDQO detection limits were therefore the basis for the COPC-to-TOC mass ratios reported in the feed vector.

The feed vector report provides the COPC-to-TOC mass ratios used to develop the feed vector concentration data for the organics reported in the BBI. The ratios reported have been developed from average reported inventories in the BBI, regardless of the corresponding waste layer[4] and WTP operating configuration. The feed vector report assumes the COPC-to-TOC ratio is applicable to all waste phases (supernatant, saltcake, and sludges) and waste types (low-level and high-level) since that value is an overall average computed from available data.

The feed vector report notes that polychlorinated biphenyl (PCB) Aroclors have been assigned an inventory within the BBI for every one of the 565 waste layers. This contrasts with the next most commonly reported COPC, for which there exists data for only 35 waste layers. This is because all

[3] The HTWOS feed vector files include spaces for approximately twenty individual organic species never implemented within the HTWOS model. No organics, other than oxalate ($C_2O_4^{-2}$) and TOC are currently tracked by HTWOS.

[4] A waste layer is combination of tank, waste type (a designation related to the process which generated the waste), and waste phase (the physical form of the waste; i.e., supernate, saltcake, sludge, or combinations of each).

Aroclor results are incorporated into the BBI using a template that computes their inventory based upon available data. This is important because all of the liquid sample PCB analytical results were either reported as being less than the detection limit, or were reported as being very close to the detection limit (RPP-RPT-26878, *Best-Basis Inventory Templates for Polychlorinated Biphenyls*). The template adds further conservatism to the estimated inventory by utilizing a 97.5 percentile upper confidence limit for the mean or 97.5 percentile upper prediction limit, depending on the data source, to represent PCBs. The net impact is to assume PCBs are present in many tanks for which they otherwise would not be present. In all other cases of undetected COPCs, the feed vector used the reported detection limit as the basis for the inventory of the COPC.

A.2.3 Unquantified Constituents

The feed vector report did not provide information for five inorganic and 48 organic COPCs. Quantification and assessment of the potential impacts of these constituents adds conservatism to the overall risk assessment, and also provides information to determine whether any COPC for which there is no data could be a potential risk contributor. This section describes the approach taken to derive non-zero concentrations for all but two of these constituents. For additional details, Supplement 2 of the RAWP should be consulted.

The five inorganic COPCs included total sulfur (7704-34-9)[5], phosphorus (7723-14-0), bromide (24959-67-9), tin (7440-31-5), and dimethyl mercury (593-74-8). Sulfur is tracked as sulfate in the feed, and phosphorus as phosphate. Bromide and tin were not reported in the BBI at the time of feed vector development and emissions modeling. Bromine and tin were originally considered a COPCs because they were identified as a toxic air pollutants (TAP), however, since a revision to WAC 173-460-150 (Washington State Code Reviser's Office 2009), they are no longer TAPs. Tin is in the feed vector as the isotope, ^{126}Sn. Bromide was not modeled since its feed concentration could not be determined and its health impact cannot be modelled due to a lack of carcinogen and toxic effects data.

Dimethyl mercury is an organo-metallic compound that exhibits characteristics of both organic and inorganic chemicals. Its 24-hour acceptable source impact level (ASIL) is 1.00E-99 $\mu g/m^3$ (WAC 173-460-150), therefore emissions were quantified and it was evaluated in the risk assessment. Although there were no data in the feed vector for dimethyl mercury, it has been detected in the tank headspace vapors. Dimethyl mercury is likely formed from a reaction between elemental mercury and organic constituents in the tank waste. A 2004 study concluded the origin of headspace vapors can be related back to original chemicals placed in the tanks, and existing headspace data are indicative of probable identities and approximated concentrations of headspace constituents (RPP-22491, *Industrial Hygiene Chemical Vapor Technical Basis*). Data for headspace sample results (CCN 301135, *Mercury/Dimethyl Mercury Data*) were cross referenced to headspace pressure measurements at the time of sampling to describe the conditions in which the samples were taken[6]. The sample collection temperature was used to derive a corresponding partial pressure using the Antoine equation coefficients. The dimethyl mercury partitioning coefficient was then corrected for pressure, and used to determine a theoretical waste concentration of dimethyl mercury. Assuming "less than" values at the reported quantity, the corresponding average theoretical concentration was 7.74E-07 mg/L. For conservatism, a slightly higher value of 1.0E-6 mg/L was used in the emissions model runs.

[5] The parenthesis contains the corresponding CASRN.
[6] Pressure and temperature measurements were from the Tank Waste Information Network System (TWINS, PNNL 2017), queried September 21, 2017.

There were 48 organic COPCs for which there were no data to establish a quantity. The feed vector report states that only eight of the 48 COPCs without inventory estimates have been detected in the tank vapor space. There is no reason to believe the remaining 40 constituents were added to tank waste, however, they remain COPCs due to their toxicity and lack of tank waste characterization data. To assess the potential impact of the 48 unquantified COPCs, and whether they could be risk contributors in the risk assessment, an approach to quantify these COPCs for inclusion in emissions modeling was developed. It was assumed that the proportion of all unknown organic COPCs-as-carbon mass to TOC mass is similar to the proportion of all known organic COPC-as-carbon mass to TOC mass. An average ratio of organic COPC (as carbon)-to-TOC mass ratio was estimated. A COPC-to-TOC mass ratio was then derived by multiplying this ratio by the molar weight of the COPC, divided by its molar mass of carbon. This results in a complete set of COPC-to-TOC mass ratios for use in quantifying all organics COPC for emissions modeling.

A.2.4 Refinement of the Feed Vector

A screening assessment was performed in which the potential impact of total PCB (1336-36-6) hazards exceeded ecological thresholds below which no adverse effects are expected. Since hazards are proportional to the emissions, which in-turn are proportional to the feed vector, refinement of the feed vector used for emissions modeling was warranted. The original basis for PCB concentration in the feed vector, the feed vector report, relies heavily upon BBI data for the quantification of organics constituents. The methods used to derive the concentration of organics resulted in an extremely conservative and unlikely concentration of total PCBs in the supernatant in excess of the PCB aqueous solubility limit. The resulting feed vector was deemed sufficient for an initial screening of potential risks, but inappropriate for a more detailed analysis. The discussions which follow present additional detail and provide the derivation of a weighted average feed vector specifically for PCBs for use in a more refined estimate of potential ecological exposures.

A.2.4.1 Background

As discussed in Section A.2.2, the feed vector report established quantities for individual organic constituents based upon their ratio to TOC, the presumption being that in lieu of data to indicate otherwise, the general concentration of organic constituents in the tank waste is proportional to the TOC. This assumption was expected to be reasonably accurate for organic constituents present in high concentration such as oxalate. Other organics used during spent nuclear fuel reprocessing such as tributyl phosphate, normal paraffin hydrocarbons, and organic complexants may also be reasonably assumed to be proportional to TOC (minus oxalate). When these concentrated and commonly observed organic constituents are present in a waste, the concentration of TOC is typically so much higher than trace organic constituents such as PCBs that the concentration of the trace organics may be well within the uncertainty of the TOC measurements or process knowledge estimates. Therefore, any correlation of PCBs to TOC would have a high degree of uncertainty. The initial approach generated rough PCBs estimates that may be used in an initial screening and further refinement of the estimate was not unexpected.

The feed vector report assumes the COPC-to-TOC ratio is applicable to all waste phases (supernatant, saltcake, and sludges) and waste types (low-level and high-level) since that value is an overall average computed from available data. The PCBs are known to have a strong affinity for solids and have very low solubilities in aqueous liquids, so this assumption is likely to result in a supernatant PCB concentration that is biased high. The feed vector report is based on a BBI query. The BBI is the official database for Hanford Site tank waste inventory estimates and contains data on the current state of constituent inventories as they are determined to currently exist within Tank Farms. The BBI contains

estimates for up to 112 organic analytes. Inventory data is included only when either: (1) sample data are available for all waste phases in a tank, or (2) process knowledge values can be calculated from combined sample results. Two exceptions exist to these rules: (1) total PCB inventories are calculated for all waste phases using sample-based template concentrations if sample data are not available (RPP-RPT-26878), and (2) free OH^- inventories are calculated for all waste phases using various methods.

Prior to the availability of a sample-based PCB template, the BBI used "default" concentration values that were selected to ensure tank waste PCB levels are maintained below regulatory thresholds. The default concentrations were known to be highly conservative for most tank wastes. The default values in BBIs essentially have been replaced by more realistic sample-based template values. Upon detailed examination, it appeared that some default concentrations may have been used in the feed vector report which would result in overly conservative PCB estimates.

These issues have a predominately conservative impact on the waste delivery feed vectors. TOC itself is not a COPC, while the individual organic constituents effected (i.e., total PCBs) are. This results in overall increases of individual COPC mass quantities delivered to WTP. The feed vector report recommended a PCB-to-TOC ratio of 1.53E-03 kg/kg TOC (mass-mass ratio of PCB to tank TOC). WTP Process Engineering personnel used this ratio and quantities from the feed vector report to generate the batch inventory values for total PCBs in Table A-3.

Table A-3 WTP PCB Screening Feed Vector

Waste Type	TOC[1] (kg)	PCB-to-TOC mass ratio (kg/kg)	Total PCB (kg)	Average Batch Volume[1] (L)	Average Batch Concentration (mg/L)
LAW liquids	1.33E+04	1.53E-03	20.5	3.71E+06	5.51
LAW solids	0.00E+00		0.00		0.00
HLW liquids	9.68E+02		1.49	5.15E+05	2.89
HLW solids	1.22E+03		1.87		3.63

1. Average TOC values (with oxalate included) and batch volume. Refer to HTWOS run "batches-to-wtp-fully-water-washed" (MMR-50067_rev1-Inv-8.1-8.3r1-2015-09-23-at-09-54-00), dated 9/22/15.

The levels in Table A-3 are not consistent with the basic PCB chemistry. Subsequent investigation of the BBI data indicated many PCB inventories were computed using the PCB template as discussed above. RPP-RPT-26878 describes values used in the BBI for tanks for which sample data does not exist or was below method detection limit (MDL). The result of using the BBI is an inventory of PCBs for every tank, regardless of whether the analytical data exist to back the inventory. The feed vector report (24590-WTP-RPT-ENV-16-001) noted that BBI estimates were available for all 565 waste layers. Use of the PCB-to-TOC ratio value in the feed vector report results in a PCB feed concentration that is high-biased and is likely impossible given what is known regarding PCB solubility. RPP-RPT-26878 notes that "PCBs are non-polar compounds. This non-polar characteristic makes them only slightly soluble in water. However, PCBs have a strong affinity for solid precipitates and are freely soluble in non-polar organic solvents (ATSDR 2000, *Toxicological Profile for Polychlorinated Biphenyls (PCBs)*)." This is supported by the sample results for the tank waste (CCN 308074, *Refined PBC Feed Vector*). The clear majority of PCBs detected in tank waste are associated with the solids fraction. In discussions with WRPS personnel familiar with the tank characterization data, it was indicated a PCB solubility limit similar to that of water was not unexpected. In all likelihood, the liquid concentration values shown in the table above are not physically possible.

A.2.4.2 Methodology

To determine a more realistic feed vector for total PCBs all sample data for Aroclors was queried from the Tank Waste Inventory Network System (TWINS). A methodology similar to that used to develop the PCB template values of RPP-RPT-26878 was employed. Primary and duplicate sample results were extracted from the TWINS. Only "reviewed" data were used, and quality flags were reviewed to ensure the suitability of the sample data. Data marked "suspect" or "not reviewed" were not used. The analytical data were assigned to one of three primary waste phases: supernatant, saltcake (including saltcake solids, and mixed saltcake/sludge), and sludge (sludge, sludge solids). The assignment of waste phases was based on the sample description, sample state, results units, and associated tank. The "Waste Type Report" from TWINS was used to confirm waste phase assignments when the sample state for an analytical result did not match sample units. Waste phase volume, density, and water content information for each tank and associated waste phase was combined with the TWINS analytical data. Phase assignments (supernatant, saltcake, or sludge) were made according to the sample descriptions, and the waste phases indicated in the waste type report queried from TWINS. All solids results were converted to dry weight, where necessary, in accordance with the methodology in RPP-RPT-26878.

The Aroclor results were then transposed by sample number, and assessed in accordance with the approach described Action Item 13 of the *Regulatory Data Quality Objectives Optimization Report* (24590-WTP-RPT-MGT-04-001) in order to compute a total PCB value.

- If no Aroclors are detected, the total PCB concentration is considered the highest single Aroclor MDL for the tank waste matrix.
- If one or more Aroclors are detected, the total PCBs in a sample is calculated by summing the detected Aroclors, but does not include Aroclor values below the MDL.

In all, there were 493 samples were associated with supernatant, 120 samples associated with saltcake, and 176 samples associated with sludge. Table A-4 summarizes the data.

Table A-4 Summary of PCB Aroclor Sample Data

Waste Phase	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Aroclor 1262	Total PCBs
Supernatant									
Percentage of Non-detects	100%	100%	100%	100%	99.8%	99.0%	100%	100%	98.8%
Number of Detects	0	0	0	0	1	5	0	0	6
Minimum Detected (mg/L)	n/a	n/a	n/a	n/a	0.0062 J	0.0054 J	n/a	n/a	0.0054 J
Maximum Detected (mg/L)	n/a	n/a	n/a	n/a	0.0062 J	0.011 J	n/a	n/a	0.011 J
Saltcake									
Percentage of Non-detects	100%	100%	100%	100%	99.2%	69.2%	99.2%	100%	69.2%
Number of Detects	0	0	0	0	1	37	1	0	37
Minimum Detected (dry wt., µg/g)	n/a	n/a	n/a	n/a	0.12	0.012 J	0.048	n/a	0.012 J
Maximum Detected (dry wt., µg/g)	n/a	n/a	n/a	n/a	0.12	17.0	0.048	n/a	17.0
Sludge									
Percentage of Non-detects	100%	100%	100%	100%	96.6%	62.5%	100%	100%	62.5%
Number of Detects	0	0	0	0	6	66	0	0	66
Minimum Detected (dry wt., µg/g)	n/a	n/a	n/a	n/a	0.091 J	0.011	n/a	n/a	0.011
Maximum Detected (dry wt., µg/g)	n/a	n/a	n/a	n/a	38.3	370	n/a	n/a	370

n/a indicates “not applicable,” no Aroclors were detected.
J indicates an estimated value, less than the estimated quantitation limit.

Results for primary and duplicate samples were averaged as appropriate, and then the results were averaged for each source tank.

Average Aroclor concentrations were then cross-referenced with their respective waste phase density and volume information, and the analytical data were used to compute an inventory in kg for each Aroclor and total PCBs in each tank. By dividing their total inventory by the total amount attributed to each waste phase, a weighted average concentration was derived for each constituent and waste phase. Results are presented Section A.2.4.3. The attachment at the end of this appendix provides a summary of the average tank concentration (by constituent and waste phase) and the associated waste phase volume and density.

A.2.4.3 Results

The Aroclor inventories and weighted average concentrations for each waste phase are provided in Table A-5.

Table A-5 PCB Aroclor Inventory and Weighted Average Concentration

Waste Phase	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Aroclor 1262	Total PCBs
Supernatant									
Inventory (kg)	< 4.18	< 1.90	< 2.39	< 2.07	1.14	0.662	< 3.29	< 0.186	5.03
Concentration (mg/L)	< 0.0542	< 0.0246	< 0.0311	< 0.0268	0.0148	0.00859	< 0.0427	< 0.00241	0.0652
Saltcake									
Inventory (kg)	< 24.8	< 41.8	< 51.0	< 31.3	20.9	45.3	26.6	< 2.02	67.8
Concentration (dry wt., µg/g)	< 0.295	< 0.497	< 0.607	< 0.372	0.249	0.539	0.317	< 0.0240	0.807
Sludge									
Inventory (kg)	< 13.2	< 10.9	< 67.4	< 15.0	11.1	117.3	< 17.5	< 1.62	127
Concentration (dry wt., µg/g)	< 0.833	< 0.686	< 4.26	< 0.947	0.702	7.40	< 1.10	< 0.102	8.00

"<" indicates all associated sample results were less than detection. All other results shown (without "<") have at least one estimated and/or detected result associated with the value shown (refer to Table A-4).

It is important to note that most of the analytical results for Aroclors were below the MDL. The data indicate Aroclors 1248, 1254, and 1260 are the only Aroclors detected in tank waste to date. Also, it is important to note the solids data presented represents dry weight results. In addition, when no Aroclors were detected in a sample, undetected Aroclors were assumed present at the reported quantity in accordance with the approach described in 24590-WTP-RPT-MGT-01-001, with the highest of non-detected Aroclors presumed to represent the total PCB concentration. This would tend to result in an over-estimate of the PCB concentrations presented in this data evaluation.

The TWINS analytical data is subject to uncertainty. Detection limits for sludges vary by orders of magnitude, most likely due to the nature of the matrix, weathering, and the need for sample dilution to both clean the matrix and permit safe handling. The data do not appear to be described by any particular distribution given that the majority are beneath the MDL. MDL values are highly matrix-specific for tank waste and may not necessarily reflect the population of potential Aroclor concentrations. Also noteworthy is that data for the T and TY tank farms are included in the values presented in Table A-5. RPP-RPT-26878 notes that these tanks most likely received a greater volume of PCBs and should be treated as a different population than other waste tanks.

In lieu of more data, the sample-based inventories provide a reasonable basis for Table A-5 concentrations. Computing the inventory with the assumption that MDLs represent PCB concentrations in the waste is a conservative approach designed to account for data uncertainty as the actual PCB concentration is below the MDL, or zero. Table A-6 provides a summary of the inputs derived from the original feed vector, and the refined inputs recommended for additional assessment. Note the total inventory in the refined feed vector is greater than the original, and thus should be considered conservative.

Table A-6 WTP PCB Screening and Refined Feed Vector Comparison

	Screening Feed Vector		Refined Feed Vector	
Waste Type	**Total PCB Inventory (kg)**	**Average Batch Concentration (mg/L)**	**Total PCB Inventory (kg)**	**Average Batch Concentration (mg/L for liquids, µg/g for solids)**
LAW liquids	20.5	5.51	5.03	0.0652
LAW solids	0.00	0.00	0.00	0.00
HLW liquids	1.49	2.89	67.8 [1]	0.807
HLW solids	1.87	3.63	127	8.00

[1.] For simplicity, although classified as a LAW stream, the saltcake concentration is presumed for HLW liquids. This is a conservative assumption as the saltcake concentration is likely above the solubility limit of HLW liquids, and there is no accounting for liquid additions that will be required to dissolve the saltcake for transfer to WTP.

A.3 Summary of Flowsheet Model

The methods, assumptions, and resulting process emission rates are summarized in this section. Supplements 2 and 3 of the RAWP should be consulted for additional details.

An emissions estimate for the PT Facility, LAW Facility, and HLW Facility was prepared using a Process Emissions Model (PEM) developed from Aspen Process Performance Simulation version 3.0 (APPS). The APPS program is modeled using the commercial off-the-shelf Aspen Custom Modeler (ACM) software developed and licensed by Aspen Technology, Inc., aka AspenTech. The ACM program consists of a chemical process simulation compiler with a graphical user interface, built-in physical property models, and a simultaneous equation-solving engine. The PEM is designed to estimate emissions using a steady-state mass and energy balance for the standard set of plant unit operations identified in Section 2. The constituents identified in Section 2 are tracked in the PEM. The PEM tracks constituent mass through each unit process, including effluents recycled to the PT Facility, to derive a final emissions' estimate for each facility. In addition, the PEM provides the stream composition throughout unit operations. The composition of streams (mass fractions) is used both to estimate potential cell emissions and sample content. The impact of unit operations such as entrainment, release, volatilization, condensation, oxidation (via combustion or chemical reaction), incomplete combustion, glass production, and abatement by offgas equipment is accounted for in the PEM.

The PEM tracks constituents by their phases; aqueous, solid, and vapor, including particle-bound phases. A constituent can exist in more than a single phase and the PEM takes this into account as it performs a mass balance around each unit operation. This is a crucial element to the emissions modeling because the phase(s) of the constituent determine the mechanisms by which a constituent is released into the ventilation system as well as the effectiveness of the offgas controls.

Emissions are primarily generated by two unit operations; vessel mixing and ventilation, and melter operation. Within each facility, waste within vessels (including evaporators) is subject to ventilation under a negative pressure confinement system. The negative pressure ensures that should a leak occur

within the ventilation system, potential contaminates will not escape. The PEM uses Henry's Law Constants to predict the partitioning of organic constituents into vapor and liquid phases. Some vessels are also subject to agitation by pulse-jet mixers (PJM) which can generate aerosols and entrained solids which are swept into the ventilation system. The entrained mass rate of aerosols into PJM vent and equipment offgas streams is estimated using release fractions and entrainment factors, as appropriate to the system. For evaporators and condensers only, in addition to applying Henry's Law Constants to predict vapor diffusion into the ventilation system, a mass distribution ratio is used to predict the quantities of inorganics and radionuclides released from the aqueous phase.

Melter offgas is also controlled with a negative pressure confinement system. Within the melters, waste boils off the cold cap producing vapors and entrained solids (particles and particle-bound constituents) which are ventilated from the melter plenum into the offgas controls. Products of incomplete combustion (PIC) are produced within the emissions model according to a conversion factor proportional to the total organic carbon fed to the melter. Combustion is modeled in the melter and thermal catalytic oxidizer, as well as PIC production. Decontamination factors (DF) are applied to the incoming quantity and phase of COPCs to predict removal efficiency by unit operations within the offgas treatment system. Lastly, an offgas system destruction and removal efficiency (DRE) is applied in accordance with permit conditions specifying a minimum DRE of 99.99%.

A.4 Flowsheet Model Results for the DFLAW Operating Configuration

This section summarizes the emission estimate results of the PEM for the DFLAW operating configuration. The RAWP Supplements 2 and 3 should be consulted for further detail.

A.4.1 LAW Facility

The PEM results for the LAW Facility in the DFLAW operating configuration are provided in Table A-7 below. Note that units of g/s apply to organics and inorganics, and units of Ci/s apply to radionuclides.

Table A-7 Process Emissions Model Results for LAW Facility for the DFLAW Operating Configuration

CASRN	COPC	LAW Facility Emissions Rate
Organics		**g/s**
100-02-7	p-Nitrophenol	9.60E-05
100-21-0	Phthalic acid	1.16E-11
100-25-4	1,4-Dinitrobenzene	2.58E-10
100-40-3	4-Ethenylcyclohexene	6.43E-08
100-41-4	Ethyl benzene	1.75E-12
100-42-5	Styrene	3.17E-05
100-44-7	Benzyl chloride	0.00E+00
100-47-0	Benzonitrile	0.00E+00
100-51-6	Benzyl alcohol	0.00E+00
100-52-7	Benzaldehyde	0.00E+00
10061-01-5	cis-1,3-Dichloropropene	3.11E-12
10061-02-6	trans-1,3-Dichloropropene	3.24E-12
101-55-3	4-Bromophenylphenyl ether	9.88E-08
101-77-9	4,4-Methylenedianiline	0.00E+00
103-33-3	Azobenzene	0.00E+00
103-65-1	n-Propyl benzene (Isocumene)	0.00E+00
104-51-8	n-Butylbenzene	0.00E+00
104-76-7	2-Ethyl-1-hexanol	7.76E-08

Table A-7 Process Emissions Model Results for LAW Facility for the DFLAW Operating Configuration

CASRN	COPC	LAW Facility Emissions Rate
105-67-9	2,4-Dimethylphenol	1.42E-05
10595-95-6	n-Nitrosomethylethylamine	1.48E-07
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	0.00E+00
106-44-5	p-Cresol (4-methyl phenol)	0.00E+00
106-46-7	1,4-Dichlorobenzene	3.46E-06
106-47-8	p-Chloroaniline	1.45E-05
106-49-0	p-Toluidine	0.00E+00
106-51-4	Quinone	0.00E+00
106-88-7	1,2-Epoxybutane	8.58E-08
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	0.00E+00
106-93-4	Ethylene dibromide	8.41E-13
106-99-0	1,3-Butadiene	2.82E-11
107-02-8	Acrolein	4.56E-11
107-05-1	3-Chloropropene	3.10E-12
107-06-2	1,2-Dichloroethane	3.17E-05
107-12-0	Propionitrile	2.85E-10
107-13-1	Acrylonitrile	3.17E-05
107-19-7	Propargyl alcohol	0.00E+00
107-21-1	Ethylene glycol (1,2-ethanediol)	0.00E+00
107-98-2	Propylene glycol monomethyl ether	0.00E+00
108-05-4	Acetic acid vinyl ester	1.03E-07
108-10-1	4-Methyl-2-pentanone	1.09E-11
108-39-4	m-Cresol	2.47E-07
108-60-1	bis(2-Chloroisopropyl)ether	0.00E+00
108-67-8	1,3,5-Trimethylbenzene	0.00E+00
108-86-1	Bromobenzene (Phenyl bromide)	0.00E+00
108-87-2	Methylcyclohexane	3.57E-12
108-88-3	Toluene	3.17E-05
108-90-7	Chlorobenzene	3.17E-05
108-94-1	Cyclohexanone	3.05E-09
108-95-2	Phenol	7.23E-06
109-74-0	n-Butanenitrile	8.23E-08
109-75-1	3-Butenenitrile	0.00E+00
109-77-3	Malononitrile	0.00E+00
109-86-4	2-Methoxyethanol	0.00E+00
109-99-9	Tetrahydrofuran	3.38E-11
110-00-9	Furan	0.00E+00
110-54-3	n-Hexane	1.64E-10
110-59-8	Pentanenitrile	7.92E-08
110-80-5	2-Ethoxyethanol	7.00E-07
110-82-7	Cyclohexane	3.10E-12
110-83-8	Cyclohexene	3.10E-12
110-86-1	Pyridine	7.36E-10
111-15-9	Ethylene glycol monoethyl ether acetate	0.00E+00
111-44-4	bis(2-Chloroethyl)ether	2.95E-06
111-65-9	n-Octane	3.74E-11
111-76-2	2-Butoxyethanol	9.83E-08
111-84-2	n-Nonane	2.51E-11
111-91-1	bis(2-Chloroethoxy)methane	2.61E-06
1120-21-4	Undecane	0.00E+00
1120-71-4	1,3-Propane sultone	0.00E+00
112-30-1	1-Decanol	0.00E+00
112-31-2	Decanal	0.00E+00

Table A-7 Process Emissions Model Results for LAW Facility for the DFLAW Operating Configuration

CASRN	COPC	LAW Facility Emissions Rate
112-40-3	Dodecane	0.00E+00
117-81-7	bis(2-Ethylhexyl)phthalate	3.45E-05
117-84-0	Di-n-octylphthalate	3.39E-07
118-74-1	Hexachlorobenzene	2.98E-06
119-90-4	3,3'-Dimethoxybenzidine	0.00E+00
120-12-7	Anthracene	2.39E-06
120-82-1	1,2,4-Trichlorobenzene	6.23E-11
120-83-2	2,4-Dichlorophenol	1.29E-07
121-14-2	2,4-Dinitrotoluene	3.69E-05
122-39-4	N,N-Diphenylamine	9.77E-11
122-66-7	1,2-Diphenylhydrazine	0.00E+00
123-33-1	Maleic hydrazide	0.00E+00
123-38-6	Propionaldehyde	1.03E-10
123-72-8	Butanal	8.58E-08
123-91-1	1,4-Dioxan	3.15E-11
124-18-5	Decane	0.00E+00
124-48-1	Chlorodibromomethane	3.17E-05
126-73-8	Tributyl phosphate	9.58E-08
126-98-7	2-Methyl-2-propenenitrile	3.11E-11
127-18-4	1,1,2,2-Tetrachloroethene	1.02E-12
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	1.52E-09
129-00-0	Pyrene	2.91E-06
131-11-3	Dimethyl Phthalate	1.87E-05
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	0.00E+00
132-64-9	Dibenzofuran	2.45E-05
1330-20-7	Xylenes (total)	3.16E-05
133-06-2	Captan	0.00E+00
1336-36-3	Polychlorinated biphenyls – Note 1	1.37E-07
134-32-7	alpha-Naphthylamine	1.34E-07
135-98-8	sec-Butylbenzene	0.00E+00
141-78-6	Acetic acid ethyl ester	3.32E-12
145-73-3	Endothall	0.00E+00
156-59-2	cis-1,2-Dichloroethene	0.00E+00
156-60-5	1,2-trans-Dichloroethene	2.30E-07
1634-04-4	Methyl tert-butyl ether	8.39E-08
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	2.02E-12
189-55-9	Dibenzo[a,i]pyrene	1.75E-07
189-64-0	Dibenzo[a,h]pyrene	1.75E-07
191-24-2	Benzo(g,h,i)perylene	4.92E-05
191-30-0	Dibenzo(a,l)pyrene	1.75E-07
192-65-4	Dibenzo[a,e]pyrene	1.75E-07
192-97-2	Benzo(e)pyrene	0.00E+00
193-39-5	Indeno(1,2,3-cd)pyrene	4.11E-05
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	2.27E-12
205-82-3	Benzo[j]fluoranthene	0.00E+00
205-99-2	Benzo(b)fluoranthene	4.78E-05
206-44-0	Fluoranthene	2.76E-06
207-08-9	Benzo(k)fluoranthene	5.61E-05
208-96-8	Acenaphthylene	1.87E-05
218-01-9	Chrysene	2.95E-06
224-42-0	Dibenz[a,j]acridine	3.31E-08
2245-38-7	2,3,5-Trimethylnaphthalene	0.00E+00
226-36-8	Dibenz[a,h]acridine	3.30E-08

Table A-7 Process Emissions Model Results for LAW Facility for the DFLAW Operating Configuration

CASRN	COPC	LAW Facility Emissions Rate
23950-58-5	Pronamide	0.00E+00
27154-33-2	Trichlorofluoroethane	3.60E-07
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	1.24E-09
319-84-6	alpha-BHC	3.49E-12
319-85-7	beta-BHC	5.49E-12
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	3.77E-10
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	5.17E-10
3268-87-9	Octachlorodibenzo(p)dioxin	3.27E-11
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	2.46E-10
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	9.56E-12
3697-24-3	5-Methylchrysene	6.16E-08
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	2.17E-10
39001-02-0	Octachlorodibenzofuran	5.22E-11
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	1.73E-12
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	4.86E-11
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	1.30E-12
4170-30-3	Crotonaldehyde (Propylene aldehyde)	4.26E-11
41851-50-7	Chlorocyclopentadiene	0.00E+00
460-19-5	Cyanogen (oxalonitrile)	0.00E+00
4786-20-3	2-Butenenitrile	0.00E+00
50-00-0	Formaldehyde	1.76E-07
50-32-8	Benzo(a)pyrene	2.58E-05
506-68-3	Cyanogen bromide (bromocyanide)	0.00E+00
506-77-4	Cyanogen chloride	0.00E+00
510-15-6	Chlorobenzilate	0.00E+00
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	1.06E-11
51-28-5	2,4-Dinitrophenol	3.38E-04
51-79-6	Ethyl carbamate (urethane)	0.00E+00
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	1.77E-10
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	0.00E+00
532-27-4	2-Chloroacetophenone	0.00E+00
534-52-1	4,6-Dinitro-o-cresol	2.95E-05
53-70-3	Dibenz[a,h]anthracene	4.32E-05
5385-75-1	Dibenzo(a,e)fluoranthene	0.00E+00
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	3.17E-05
540-73-8	1,2-Dimethylhydrazine	0.00E+00
540-84-1	2,2,4-Trimethylpentane	0.00E+00
541-73-1	1,3-Dichlorobenzene	4.08E-11
542-75-6	1,3-Dichloropropene	0.00E+00
542-88-1	bis(Chloromethyl)ether	0.00E+00
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	2.41E-11
56-23-5	Carbon tetrachloride	3.17E-05
56-49-5	3-Methylcholanthrene	6.18E-08
56-55-3	Benzo(a)anthracene	2.98E-06
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	7.92E-12
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	1.06E-11
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	1.73E-11
57-24-9	Strychnine	0.00E+00
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	2.63E-10
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	1.62E-12
57-74-9	Chlordane	0.00E+00
581-42-0	2,6-Dimethylnaphthalene	0.00E+00
584-84-9	2,4-Toluene diisocyanate	0.00E+00

Table A-7 Process Emissions Model Results for LAW Facility for the DFLAW Operating Configuration

CASRN	COPC	LAW Facility Emissions Rate
58-89-9	gamma-BHC (Lindane)	4.78E-12
58-90-2	2,3,4,6-Tetrachlorophenol	1.88E-07
589-38-8	3-Hexanone	7.95E-08
591-50-4	Benzene, iodo-	0.00E+00
591-78-6	2-Hexanone	1.34E-10
593-60-2	Bromoethene (Vinyl bromide)	0.00E+00
59-50-7	4-Chloro-3-methylphenol	2.91E-07
59-89-2	N-Nitrosomorpholine	1.24E-06
60-11-7	Dimethyl aminoazobenzene	0.00E+00
602-87-9	5-Nitroacenaphthene	8.77E-08
60-29-7	Ethyl ether	1.17E-10
60-35-5	Acetamide	7.71E-08
606-20-2	2,6-Dinitrotoluene	3.04E-05
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	7.36E-12
608-93-5	Pentachlorobenzene	0.00E+00
61626-71-9	Dichloropentadiene	0.00E+00
621-64-7	N-Nitroso-di-n-propylamine	2.73E-07
624-83-9	Methyl isocyanate	0.00E+00
62-50-0	Ethyl methanesulfonate	0.00E+00
62-53-3	Aniline	0.00E+00
62-75-9	N-Nitroso-N,N-dimethylamine	1.46E-09
628-73-9	Hexanenitrile	7.71E-08
630-20-6	1,1,1,2-Tetrachloroethane	4.00E-07
64-18-6	Formic acid (methanoic acid)	0.00E+00
65510-44-3	2’,3,4,4’,5-Pentachlorobiphenyl (PCB 123)	1.21E-10
65-85-0	Benzoic acid	0.00E+00
67-56-1	Methyl alcohol	1.55E-07
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	5.88E-11
67-63-0	2-Propyl alcohol	8.71E-11
67-64-1	2-Propanone (Acetone)	9.99E-05
67-66-3	Chloroform	3.17E-05
67-72-1	Hexachloroethane	1.24E-08
69782-90-7	2,3,3’,4,4’,5’-Hexachlorobiphenyl (PCB 157)	2.17E-10
70-30-4	Hexachlorophene	0.00E+00
70362-50-4	3,4,4’,5-Tetrachlorobiphenyl (PCB 81)	6.52E-11
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	3.97E-11
71-36-3	n-Butyl alcohol	2.52E-09
71-43-2	Benzene	3.17E-05
71-55-6	1,1,1-Trichloroethane	1.04E-12
72-43-5	Methoxychlor	0.00E+00
72-55-9	4,4-DDE	1.08E-07
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	4.35E-12
74472-37-0	2,3,4,4’,5-Pentachlorobiphenyl (PCB 114)	1.04E-10
74-83-9	Bromomethane	2.67E-03
74-87-3	Chloromethane	1.30E-03
74-88-4	Iodomethane	2.28E-03
74-95-3	Methylene bromide	0.00E+00
74-97-5	Bromochloromethane	0.00E+00
75-00-3	Chloroethane	2.10E-12
75-01-4	1-Chloroethene	2.13E-12
75-02-5	Fluoroethene (vinyl fluoride)	1.09E-07
75-05-8	Acetonitrile	4.41E-04
75-07-0	Acetaldehyde	1.05E-07

Table A-7 Process Emissions Model Results for LAW Facility for the DFLAW Operating Configuration

CASRN	COPC	LAW Facility Emissions Rate
75-09-2	Dichloromethane (Methylene Chloride)	1.12E-01
75-15-0	Carbon disulfide	3.16E-05
75-21-8	Ethylene oxide (Oxirane)	1.81E-10
75-25-2	Bromoform	3.17E-05
75-27-4	Bromodichloromethane	7.80E-07
75-29-6	2-Chloropropane	0.00E+00
75-34-3	1,1-Dichloroethane	8.41E-13
75-35-4	1,1-Dichloroethene	1.32E-12
75-44-5	Phosgene (hydrogen phosphide)	0.00E+00
75-45-6	Chlorodifluoromethane	3.10E-12
75-50-3	Trimethylamine	9.38E-08
75-69-4	Trichlorofluoromethane	2.55E-12
75-71-8	Dichlorodifluoromethane	2.60E-12
76-01-7	Pentachloroethane	0.00E+00
76-13-1	1,2,2-Trichlorotrifluoroethane	2.57E-12
764-41-0	1,4-Dichloro-2-butene	0.00E+00
76-44-8	Heptachlor	2.41E-12
765-34-4	Glycidylaldehyde	0.00E+00
77-47-4	Hexachlorocyclopentadiene	2.70E-04
77-78-1	Dimethyl sulfate	0.00E+00
78-83-1	2-Methylpropyl alcohol	1.47E-06
78-87-5	1,2-Dichloropropane	8.41E-13
78-93-3	2-Butanone	3.41E-05
79-00-5	1,1,2-Trichloroethane	9.86E-13
79-01-6	1,1,2-Trichloroethylene	3.17E-05
79-10-7	2-Propenoic acid	2.67E-07
79-34-5	1,1,2,2-Tetrachloroethane	9.86E-13
79-46-9	2-Nitropropane	2.08E-10
80-62-6	Methyl methacrylate	0.00E+00
822-06-0	Hexamethylene-1,5-diisocyanate	0.00E+00
823-40-5	Toluene-2,6-diamine	0.00E+00
82-68-8	Pentachloronitrobenzene (PCNB)	1.96E-10
832-69-9	1-Methylphenanthrene	0.00E+00
83-32-9	Acenaphthene	2.02E-05
84-66-2	Diethyl phthalate	3.29E-05
84-74-2	Di-n-butylphthalate	1.93E-05
85-01-8	Phenanthrene	2.53E-06
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	0.00E+00
85-68-7	Butylbenzylphthalate	5.76E-06
86-73-7	Fluorene	2.34E-05
87-61-6	1,2,3-Trichlorobenzene	0.00E+00
87-68-3	Hexachlorobutadiene	5.33E-10
87-86-5	Pentachlorophenol	1.81E-09
88-06-2	2,4,6-Trichlorophenol	2.64E-07
88-74-4	o-Nitroaniline (2-nitroaniline)	2.58E-05
88-75-5	2-Nitrophenol	1.03E-05
90-04-0	o-Anisidine	0.00E+00
90-12-0	1-Methylnaphthalene	0.00E+00
91-20-3	Naphthalene	1.70E-05
91-22-5	Quinoline	0.00E+00
91-57-6	2-Methylnaphthalene	2.81E-06
91-58-7	2-Chloronaphthalene	7.74E-08
91-94-1	3,3'-Dichlorobenzidine	1.88E-05

Table A-7 Process Emissions Model Results for LAW Facility for the DFLAW Operating Configuration

CASRN	COPC	LAW Facility Emissions Rate
924-16-3	N-Nitroso-di-n-Buetylamine	0.00E+00
92-52-4	1,1`-Biphenyl	1.96E-10
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	0.00E+00
94-75-7	2,4-D	0.00E+00
95-48-7	o-Cresol	3.34E-07
95-49-8	o-Chlorotoluene	0.00E+00
95-50-1	1,2-Dichlorobenzene	8.11E-10
95-53-4	o-Toluidine	0.00E+00
95-57-8	2-Chlorophenol	2.82E-07
95-63-6	1,2,4-Trimethyl benzene	0.00E+00
95-94-3	1,2,4,5-Tetrachlorobenzene	0.00E+00
95-95-4	2,4,5-Trichlorophenol	2.60E-07
96-12-8	1,2-Dibromo-3-chloropropane	0.00E+00
96-18-4	1,2,3-Trichloropropane	0.00E+00
96-45-7	Ethylene thiourea	0.00E+00
97-63-2	Ethyl methacrylate	0.00E+00
98-01-1	Furfural	0.00E+00
98-06-6	tert-Butyl benzene	0.00E+00
98-07-7	Benzotrichloride	0.00E+00
98-82-8	Cumene	6.33E-08
98-83-9	Methyl styrene (mixed isomers)	0.00E+00
98-86-2	Acetophenone	1.97E-10
98-95-3	Nitrobenzene	3.85E-06
99-35-4	1,3,5-Trinitrobenzene	0.00E+00
99-65-0	1,3-Dinitrobenzene	0.00E+00
99-87-6	p-Cymene	0.00E+00
Inorganics		**g/s**
10028-15-6	Ozone	N/A
10102-44-0	Nitrogen dioxide	1.26E-01
124-38-9	Carbon dioxide	6.61E+01
14265-44-2	Phosphate	4.30E-09
14265-44-2	Phosphate (ppt) - Note 7	0.00E+00
14797-55-8	Nitrate	4.89E-09
14797-65-0	Nitrite	1.68E-11
14808-79-8	Sulfate	9.52E-12
16887-00-6	Chloride	1.63E-07
16984-48-8	Fluoride	3.42E-09
16984-48-8	Fluoride (ppt) - Note 6	0.00E+00
22967-92-6	Methylmercury	N/A
24959-67-9	Bromide	N/A
57-12-5	Cyanide	4.51E-16
593-74-8	Dimethylmercury	3.84E-08
630-08-0	Carbon monoxide	1.62E-02
7429-90-5	Aluminum	1.23E-10
7429-90-5	Aluminum (ppt) - Note 2	4.91E-15
7439-89-6	Iron - Note 4	6.09E-11
7439-92-1	Lead	2.02E-11
7439-93-2	Lithium	7.84E-14
7439-95-4	Magnesium	1.00E-10
7439-96-5	Manganese	4.28E-10
7439-97-6	Mercury (elemental)	6.34E-07
7439-97-6	Mercury (Hg^{+2})	8.41E-15
7439-98-7	Molybdenum	2.09E-10

Table A-7 Process Emissions Model Results for LAW Facility for the DFLAW Operating Configuration

CASRN	COPC	LAW Facility Emissions Rate
7440-02-0	Nickel	1.87E-10
7440-16-6	Rhodium	4.70E-20
7440-22-4	Silver	6.58E-12
7440-23-5	Sodium	1.00E-06
7440-23-5	Sodium (ppt) - Note 5	0.00E+00
7440-24-6	Strontium (total) - Note 11	3.29E-13
7440-25-7	Tantalum	1.86E-18
7440-28-0	Thallium	1.60E-16
7440-31-5	Tin	N/A
7440-33-7	Tungsten	6.72E-12
7440-36-0	Antimony	2.01E-09
7440-38-2	Arsenic	2.69E-09
7440-39-3	Barium	4.41E-14
7440-41-7	Beryllium	1.68E-13
7440-43-9	Cadmium	1.92E-13
7440-47-3	Chromium - Note 3	8.71E-10
7440-48-4	Cobalt	7.50E-16
7440-50-8	Copper	6.04E-11
7440-61-1	Uranium	3.62E-12
7440-62-2	Vanadium	2.90E-10
7440-65-5	Yttrium	4.35E-13
7440-66-6	Zinc	8.52E-10
7440-67-7	Zirconium	1.54E-10
7446-09-5	Sulfur dioxide	1.18E-06
7647-01-0	Hydrogen chloride	2.65E-02
7664-39-3	Hydrogen fluoride	5.60E-04
7664-41-7	Ammonia/Ammonium	2.56E+00
7704-34-9	Total sulfur - Note 9	7.11E-07
7723-14-0	Phosphorus - Note 8	1.40E-09
7782-41-4	Fluorine gas	0.00E+00
7782-49-2	Selenium	5.01E-13
7782-50-5	Chlorine	0.00E+00
PM	Particulate Matter - Note 11	2.26E-04
Radionuclides		**Ci/s**
10028-17-8	Tritium	1.19E-07
10045-97-3	Cesium-137	1.00E-14
10098-91-6	Yttrium-90	N/A
10098-97-2	Strontium-90	9.21E-14
10198-40-0	Cobalt-60	4.53E-23
13966-29-5	Uranium-234	5.23E-20
13967-48-1	Ruthenium-106	3.88E-23
13967-70-9	Cesium-134	1.44E-21
13968-55-3	Uranium-233	1.78E-19
13981-15-2	Curium-244	5.92E-18
13981-16-3	Plutonium-238	7.34E-19
13981-37-8	Nickel-63	1.73E-16
13982-10-0	Plutonium-242	5.89E-22
13982-63-3	Radium-226	1.04E-20
13982-70-2	Uranium-236	1.73E-21
13994-20-2	Neptunium-237	5.09E-19
14119-32-5	Plutonium-241	1.03E-17
14119-33-6	Plutonium-240	3.80E-18
14133-76-7	Technetium-99	3.78E-13

Table A-7 Process Emissions Model Results for LAW Facility for the DFLAW Operating Configuration

CASRN	COPC	LAW Facility Emissions Rate
14158-29-3	Uranium-232	3.29E-21
14234-35-6	Antimony-125	3.12E-15
14331-85-2	Protactinium-231	7.37E-27
14336-70-0	Nickel-59	2.30E-18
14391-16-3	Europium-155	5.96E-24
14596-10-2	Americium-241	1.80E-16
14683-23-9	Europium-152	2.79E-24
14762-75-5	Carbon-14	1.13E-06
14952-40-0	Actinium-227	5.31E-20
14993-75-0	Americium-243	1.04E-19
15046-84-1	Iodine-129	4.40E-10
15117-48-3	Plutonium-239	1.63E-17
15117-96-1	Uranium-235	2.12E-21
15262-20-1	Radium-228	6.37E-19
15510-73-3	Curium-242	4.83E-18
15585-10-1	Europium-154	1.62E-23
15594-54-4	Thorium-229	3.70E-27
15715-94-3	Samarium-151	1.64E-20
15751-77-6	Zirconium-93	1.53E-22
15757-87-6	Curium-243	3.43E-19
15758-45-9	Selenium-79	7.95E-17
15832-50-5	Tin-126	1.94E-17
378253-40-8	Barium-137m	N/A
378253-44-2	Cadmium-113m	1.73E-16
378782-82-2	Niobium-93m	5.92E-23
7440-29-1	Thorium-232	8.14E-27
7440-61-1R	Uranium-238	4.69E-20

Notes:
1. The estimated LAW Facility exhaust mass flowrate of total PCBs for the refined feed vector is 2.30E-09 g/s.
2. Aluminum (ppt) is aluminum ion precipitated as gibbsite.
3. Chromium includes Cr^{3+} and Cr^{6+} ions.
4. Iron includes Fe^{2+} and Fe^{3+} ions.
5. Sodium (ppt) is sodium ion precipitated as sodium fluoride phosphate, sodium phosphate, or sodium oxalate.
6. Fluoride (ppt) is fluoride ion precipitated as sodium fluoride phosphate.
7. Phosphate (ppt) is phosphate ion precipitated as sodium fluoride phosphate or sodium phosphate
8. Phosphorus includes portions of phosphate, phosphate (ppt), dihydrogen phosphate, hydrogen phosphate, phosphorus dioxide, and diphosphorus pentoxide(s).
9. Total sulfur includes portions of sulfate, hydrogen sulfite, hydrogen sulfate, sulfite, sulfur dioxide, and sulfur trioxide(s).
10. Particulate matter includes solid organics, solid cations, solid anions, solid radionuclides, sodium chloride(s), sodium cyanide(s), sodium fluoride(s), sodium iodide(s), diphosphorus pentoxide(s), and sulfur trioxide(s).
11. Strontium (total) includes strontium as an inorganic and radionuclide.

A.4.2 EMF

The PEM results for the EMF in the DFLAW operating configuration are provided in Table A-8 below. Note that units of g/s apply to organics and inorganics, and units of Ci/s apply to radionuclides.

Table A-8 Process Emissions Model Results for the EMF for the DFLAW Operating Configuration

CASRN	COPC	EMF Emissions Rate
Organics		**g/s**
100-02-7	p-Nitrophenol	1.39E-07
100-21-0	Phthalic acid	3.25E-11
100-25-4	1,4-Dinitrobenzene	6.93E-09
100-40-3	4-Ethenylcyclohexene	6.49E-06
100-41-4	Ethyl benzene	1.83E-10
100-42-5	Styrene	2.60E-05
100-44-7	Benzyl chloride	0.00E+00
100-47-0	Benzonitrile	0.00E+00
100-51-6	Benzyl alcohol	0.00E+00
100-52-7	Benzaldehyde	0.00E+00
10061-01-5	cis-1,3-Dichloropropene	3.79E-10
10061-02-6	trans-1,3-Dichloropropene	5.89E-10
101-55-3	4-Bromophenylphenyl ether	3.13E-05
101-77-9	4,4-Methylenedianiline	0.00E+00
103-33-3	Azobenzene	0.00E+00
103-65-1	n-Propyl benzene (Isocumene)	0.00E+00
104-51-8	n-Butylbenzene	0.00E+00
104-76-7	2-Ethyl-1-hexanol	2.22E-05
105-67-9	2,4-Dimethylphenol	8.55E-05
10595-95-6	n-Nitrosomethylethylamine	9.19E-06
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	0.00E+00
106-44-5	p-Cresol (4-methyl phenol)	0.00E+00
106-46-7	1,4-Dichlorobenzene	1.05E-05
106-47-8	p-Chloroaniline	5.91E-05
106-49-0	p-Toluidine	0.00E+00
106-51-4	Quinone	0.00E+00
106-88-7	1,2-Epoxybutane	2.58E-05
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	0.00E+00
106-93-4	Ethylene dibromide	1.64E-10
106-99-0	1,3-Butadiene	2.85E-09
107-02-8	Acrolein	1.44E-08
107-05-1	3-Chloropropene	3.19E-10
107-06-2	1,2-Dichloroethane	6.68E-05
107-12-0	Propionitrile	8.69E-08
107-13-1	Acrylonitrile	2.61E-04
107-19-7	Propargyl alcohol	0.00E+00
107-21-1	Ethylene glycol (1,2-ethanediol)	0.00E+00
107-98-2	Propylene glycol monomethyl ether	0.00E+00
108-05-4	Acetic acid vinyl ester	2.30E-05
108-10-1	4-Methyl-2-pentanone	3.43E-09
108-39-4	m-Cresol	1.06E-05
108-60-1	bis(2-Chloroisopropyl)ether	0.00E+00
108-67-8	1,3,5-Trimethylbenzene	0.00E+00
108-86-1	Bromobenzene (Phenyl bromide)	0.00E+00
108-87-2	Methylcyclohexane	3.60E-10
108-88-3	Toluene	1.07E-05
108-90-7	Chlorobenzene	1.90E-05
108-94-1	Cyclohexanone	6.05E-07
108-95-2	Phenol	7.77E-06
109-74-0	n-Butanenitrile	2.60E-05
109-75-1	3-Butenenitrile	0.00E+00

Table A-8 Process Emissions Model Results for the EMF for the DFLAW Operating Configuration

CASRN	COPC	EMF Emissions Rate
109-77-3	Malononitrile	0.00E+00
109-86-4	2-Methoxyethanol	0.00E+00
109-99-9	Tetrahydrofuran	1.09E-08
110-00-9	Furan	0.00E+00
110-54-3	n-Hexane	1.65E-08
110-59-8	Pentanenitrile	2.54E-05
110-80-5	2-Ethoxyethanol	1.92E-05
110-82-7	Cyclohexane	3.13E-10
110-83-8	Cyclohexene	3.13E-10
110-86-1	Pyridine	1.45E-07
111-15-9	Ethylene glycol monoethyl ether acetate	0.00E+00
111-44-4	bis(2-Chloroethyl)ether	5.63E-05
111-65-9	n-Octane	3.78E-09
111-76-2	2-Butoxyethanol	6.61E-06
111-84-2	n-Nonane	2.53E-09
111-91-1	bis(2-Chloroethoxy)methane	2.44E-05
1120-21-4	Undecane	0.00E+00
1120-71-4	1,3-Propane sultone	0.00E+00
112-30-1	1-Decanol	0.00E+00
112-31-2	Decanal	0.00E+00
112-40-3	Dodecane	0.00E+00
117-81-7	bis(2-Ethylhexyl)phthalate	1.84E-05
117-84-0	Di-n-octylphthalate	1.14E-04
118-74-1	Hexachlorobenzene	1.64E-05
119-90-4	3,3’-Dimethoxybenzidine	0.00E+00
120-12-7	Anthracene	7.20E-05
120-82-1	1,2,4-Trichlorobenzene	9.33E-09
120-83-2	2,4-Dichlorophenol	1.62E-05
121-14-2	2,4-Dinitrotoluene	9.94E-06
122-39-4	N,N-Diphenylamine	9.85E-09
122-66-7	1,2-Diphenylhydrazine	0.00E+00
123-33-1	Maleic hydrazide	0.00E+00
123-38-6	Propionaldehyde	3.33E-08
123-72-8	Butanal	2.72E-05
123-91-1	1,4-Dioxan	4.44E-09
124-18-5	Decane	0.00E+00
124-48-1	Chlorodibromomethane	8.11E-05
126-73-8	Tributyl phosphate	6.24E-06
126-98-7	2-Methyl-2-propenenitrile	8.74E-09
127-18-4	1,1,2,2-Tetrachloroethene	1.04E-10
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	2.00E-07
129-00-0	Pyrene	1.09E-04
131-11-3	Dimethyl Phthalate	1.97E-06
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	0.00E+00
132-64-9	Dibenzofuran	5.49E-05
1330-20-7	Xylenes (total)	1.37E-05
133-06-2	Captan	0.00E+00
1336-36-3	Polychlorinated biphenyls – Note 1	4.05E-05
134-32-7	alpha-Naphthylamine	1.54E-06
135-98-8	sec-Butylbenzene	0.00E+00
141-78-6	Acetic acid ethyl ester	1.04E-09
145-73-3	Endothall	0.00E+00

Table A-8 Process Emissions Model Results for the EMF for the DFLAW Operating Configuration

CASRN	COPC	EMF Emissions Rate
156-59-2	cis-1,2-Dichloroethene	0.00E+00
156-60-5	1,2-trans-Dichloroethene	2.38E-05
1634-04-4	Methyl tert-butyl ether	1.79E-05
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	2.12E-13
189-55-9	Dibenzo[a,i]pyrene	4.83E-07
189-64-0	Dibenzo[a,h]pyrene	4.83E-07
191-24-2	Benzo(g,h,i)perylene	1.53E-05
191-30-0	Dibenzo(a,l)pyrene	4.83E-07
192-65-4	Dibenzo[a,e]pyrene	4.83E-07
192-97-2	Benzo(e)pyrene	0.00E+00
193-39-5	Indeno(1,2,3-cd)pyrene	3.37E-05
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	1.27E-13
205-82-3	Benzo[j]fluoranthene	0.00E+00
205-99-2	Benzo(b)fluoranthene	1.30E-04
206-44-0	Fluoranthene	1.17E-04
207-08-9	Benzo(k)fluoranthene	2.60E-05
208-96-8	Acenaphthylene	6.84E-05
218-01-9	Chrysene	7.10E-05
224-42-0	Dibenz[a,j]acridine	9.76E-08
2245-38-7	2,3,5-Trimethylnaphthalene	0.00E+00
226-36-8	Dibenz[a,h]acridine	9.40E-08
23950-58-5	Pronamide	0.00E+00
27154-33-2	Trichlorofluoroethane	3.71E-05
31508-00-6	2,3’,4,4’,5-Pentachlorobiphenyl (PCB 118)	3.26E-11
319-84-6	alpha-BHC	7.65E-10
319-85-7	beta-BHC	2.31E-10
32598-13-3	3,3’,4,4’-Tetrachlorobiphenyl (PCB 77)	7.15E-12
32598-14-4	2,3,3’,4,4’-Pentachlorobiphenyl (PCB 105)	5.54E-12
3268-87-9	Octachlorodibenzo(p)dioxin	2.25E-12
32774-16-6	3,3’,4,4’,5,5’-Hexachlorobiphenyl (PCB 169)	5.89E-12
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	6.41E-13
3697-24-3	5-Methylchrysene	9.68E-06
38380-08-4	2,3,3’,4,4’,5-Hexachlorobiphenyl (PCB 156)	6.71E-12
39001-02-0	Octachlorodibenzofuran	2.03E-13
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	8.66E-14
39635-31-9	2,3,3’,4,4’,5,5’-Heptachlorobiphenyl (PCB 189)	2.20E-12
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	8.10E-14
4170-30-3	Crotonaldehyde (Propylene aldehyde)	8.74E-09
41851-50-7	Chlorocyclopentadiene	0.00E+00
460-19-5	Cyanogen (oxalonitrile)	0.00E+00
4786-20-3	2-Butenenitrile	0.00E+00
50-00-0	Formaldehyde	3.82E-06
50-32-8	Benzo(a)pyrene	2.93E-05
506-68-3	Cyanogen bromide (bromocyanide)	0.00E+00
506-77-4	Cyanogen chloride	0.00E+00
510-15-6	Chlorobenzilate	0.00E+00
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	6.57E-13
51-28-5	2,4-Dinitrophenol	9.67E-05
51-79-6	Ethyl carbamate (urethane)	0.00E+00
52663-72-6	2,3’,4,4’,5,5’-Hexachlorobiphenyl (PCB 167)	5.57E-12
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	0.00E+00
532-27-4	2-Chloroacetophenone	0.00E+00

Table A-8 Process Emissions Model Results for the EMF for the DFLAW Operating Configuration

CASRN	COPC	EMF Emissions Rate
534-52-1	4,6-Dinitro-o-cresol	1.01E-04
53-70-3	Dibenz[a,h]anthracene	1.03E-06
5385-75-1	Dibenzo(a,e)fluoranthene	0.00E+00
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	1.73E-05
540-73-8	1,2-Dimethylhydrazine	0.00E+00
540-84-1	2,2,4-Trimethylpentane	0.00E+00
541-73-1	1,3-Dichlorobenzene	4.83E-09
542-75-6	1,3-Dichloropropene	0.00E+00
542-88-1	bis(Chloromethyl)ether	0.00E+00
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	1.32E-13
56-23-5	Carbon tetrachloride	2.36E-06
56-49-5	3-Methylcholanthrene	9.49E-06
56-55-3	Benzo(a)anthracene	2.80E-05
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	2.02E-13
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	1.37E-13
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	1.19E-13
57-24-9	Strychnine	0.00E+00
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	2.70E-12
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	1.55E-13
57-74-9	Chlordane	0.00E+00
581-42-0	2,6-Dimethylnaphthalene	0.00E+00
584-84-9	2,4-Toluene diisocyanate	0.00E+00
58-89-9	gamma-BHC (Lindane)	7.16E-10
58-90-2	2,3,4,6-Tetrachlorophenol	2.58E-05
589-38-8	3-Hexanone	2.50E-05
591-50-4	Benzene, iodo-	0.00E+00
591-78-6	2-Hexanone	4.30E-08
593-60-2	Bromoethene (Vinyl bromide)	0.00E+00
59-50-7	4-Chloro-3-methylphenol	1.59E-05
59-89-2	N-Nitrosomorpholine	3.22E-06
60-11-7	Dimethyl aminoazobenzene	0.00E+00
602-87-9	5-Nitroacenaphthene	4.84E-06
60-29-7	Ethyl ether	1.84E-08
60-35-5	Acetamide	1.64E-07
606-20-2	2,6-Dinitrotoluene	1.22E-05
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	8.38E-14
608-93-5	Pentachlorobenzene	0.00E+00
61626-71-9	Dichloropentadiene	0.00E+00
621-64-7	N-Nitroso-di-n-propylamine	2.34E-05
624-83-9	Methyl isocyanate	0.00E+00
62-50-0	Ethyl methanesulfonate	0.00E+00
62-53-3	Aniline	0.00E+00
62-75-9	N-Nitroso-N,N-dimethylamine	1.07E-07
628-73-9	Hexanenitrile	2.47E-05
630-20-6	1,1,1,2-Tetrachloroethane	5.02E-05
64-18-6	Formic acid (methanoic acid)	0.00E+00
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	4.10E-12
65-85-0	Benzoic acid	0.00E+00
67-56-1	Methyl alcohol	2.11E-05
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	4.04E-13
67-63-0	2-Propyl alcohol	1.64E-08
67-64-1	2-Propanone (Acetone)	4.36E-04

Table A-8 Process Emissions Model Results for the EMF for the DFLAW Operating Configuration

CASRN	COPC	EMF Emissions Rate
67-66-3	Chloroform	1.90E-05
67-72-1	Hexachloroethane	1.41E-06
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	7.31E-12
70-30-4	Hexachlorophene	0.00E+00
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	2.56E-12
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	2.54E-13
71-36-3	n-Butyl alcohol	4.95E-07
71-43-2	Benzene	1.26E-05
71-55-6	1,1,1-Trichloroethane	1.06E-10
72-43-5	Methoxychlor	0.00E+00
72-55-9	4,4-DDE	2.95E-05
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	5.04E-14
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	2.96E-12
74-83-9	Bromomethane	1.13E-05
74-87-3	Chloromethane	8.02E-06
74-88-4	Iodomethane	1.29E-05
74-95-3	Methylene bromide	0.00E+00
74-97-5	Bromochloromethane	0.00E+00
75-00-3	Chloroethane	2.18E-10
75-01-4	1-Chloroethene	2.15E-10
75-02-5	Fluoroethene (vinyl fluoride)	1.11E-05
75-05-8	Acetonitrile	4.22E-03
75-07-0	Acetaldehyde	3.38E-05
75-09-2	Dichloromethane (Methylene Chloride)	8.27E-04
75-15-0	Carbon disulfide	2.41E-06
75-21-8	Ethylene oxide (Oxirane)	5.59E-08
75-25-2	Bromoform	1.10E-08
75-27-4	Bromodichloromethane	1.11E-04
75-29-6	2-Chloropropane	0.00E+00
75-34-3	1,1-Dichloroethane	9.05E-11
75-35-4	1,1-Dichloroethene	1.34E-10
75-44-5	Phosgene (hydrogen phosphide)	0.00E+00
75-45-6	Chlorodifluoromethane	3.13E-10
75-50-3	Trimethylamine	3.00E-05
75-69-4	Trichlorofluoromethane	2.58E-10
75-71-8	Dichlorodifluoromethane	2.62E-10
76-01-7	Pentachloroethane	0.00E+00
76-13-1	1,2,2-Trichlorotrifluoroethane	2.59E-10
764-41-0	1,4-Dichloro-2-butene	0.00E+00
76-44-8	Heptachlor	2.44E-10
765-34-4	Glycidylaldehyde	0.00E+00
77-47-4	Hexachlorocyclopentadiene	9.11E-06
77-78-1	Dimethyl sulfate	0.00E+00
78-83-1	2-Methylpropyl alcohol	3.02E-04
78-87-5	1,2-Dichloropropane	1.02E-10
78-93-3	2-Butanone	2.20E-04
79-00-5	1,1,2-Trichloroethane	1.76E-10
79-01-6	1,1,2-Trichloroethylene	7.07E-06
79-10-7	2-Propenoic acid	6.16E-06
79-34-5	1,1,2,2-Tetrachloroethane	2.55E-10
79-46-9	2-Nitropropane	6.56E-08
80-62-6	Methyl methacrylate	0.00E+00

Table A-8 Process Emissions Model Results for the EMF for the DFLAW Operating Configuration

CASRN	COPC	EMF Emissions Rate
822-06-0	Hexamethylene-1,5-diisocyanate	0.00E+00
823-40-5	Toluene-2,6-diamine	0.00E+00
82-68-8	Pentachloronitrobenzene (PCNB)	4.90E-08
832-69-9	1-Methylphenanthrene	0.00E+00
83-32-9	Acenaphthene	1.39E-04
84-66-2	Diethyl phthalate	1.28E-05
84-74-2	Di-n-butylphthalate	2.50E-04
85-01-8	Phenanthrene	6.79E-05
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	0.00E+00
85-68-7	Butylbenzylphthalate	5.68E-05
86-73-7	Fluorene	8.53E-05
87-61-6	1,2,3-Trichlorobenzene	0.00E+00
87-68-3	Hexachlorobutadiene	5.55E-08
87-86-5	Pentachlorophenol	5.99E-09
88-06-2	2,4,6-Trichlorophenol	4.88E-05
88-74-4	o-Nitroaniline (2-nitroaniline)	2.78E-06
88-75-5	2-Nitrophenol	1.60E-04
90-04-0	o-Anisidine	0.00E+00
90-12-0	1-Methylnaphthalene	0.00E+00
91-20-3	Naphthalene	4.13E-03
91-22-5	Quinoline	0.00E+00
91-57-6	2-Methylnaphthalene	3.11E-05
91-58-7	2-Chloronaphthalene	2.05E-05
91-94-1	3,3'-Dichlorobenzidine	8.71E-07
924-16-3	N-Nitroso-di-n-Buetylamine	0.00E+00
92-52-4	1,1`-Biphenyl	5.21E-08
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	0.00E+00
94-75-7	2,4-D	0.00E+00
95-48-7	o-Cresol	1.83E-05
95-49-8	o-Chlorotoluene	0.00E+00
95-50-1	1,2-Dichlorobenzene	1.10E-07
95-53-4	o-Toluidine	0.00E+00
95-57-8	2-Chlorophenol	6.97E-05
95-63-6	1,2,4-Trimethyl benzene	0.00E+00
95-94-3	1,2,4,5-Tetrachlorobenzene	0.00E+00
95-95-4	2,4,5-Trichlorophenol	3.45E-05
96-12-8	1,2-Dibromo-3-chloropropane	0.00E+00
96-18-4	1,2,3-Trichloropropane	0.00E+00
96-45-7	Ethylene thiourea	0.00E+00
97-63-2	Ethyl methacrylate	0.00E+00
98-01-1	Furfural	0.00E+00
98-06-6	tert-Butyl benzene	0.00E+00
98-07-7	Benzotrichloride	0.00E+00
98-82-8	Cumene	6.40E-06
98-83-9	Methyl styrene (mixed isomers)	0.00E+00
98-86-2	Acetophenone	4.22E-08
98-95-3	Nitrobenzene	5.92E-05
99-35-4	1,3,5-Trinitrobenzene	0.00E+00
99-65-0	1,3-Dinitrobenzene	0.00E+00
99-87-6	p-Cymene	0.00E+00

Table A-8 Process Emissions Model Results for the EMF for the DFLAW Operating Configuration

CASRN	COPC	EMF Emissions Rate
Inorganics		**g/s**
10028-15-6	Ozone	N/A
10102-44-0	Nitrogen dioxide	0.00E+00
124-38-9	Carbon dioxide	3.57E-02
14265-44-2	Phosphate	4.16E-12
14265-44-2	Phosphate (ppt) - Note 7	0.00E+00
14797-55-8	Nitrate	6.41E-11
14797-65-0	Nitrite	3.01E-11
14808-79-8	Sulfate	1.81E-12
16887-00-6	Chloride	1.01E-10
16984-48-8	Fluoride	2.56E-11
16984-48-8	Fluoride (ppt) - Note 6	0.00E+00
22967-92-6	Methylmercury	N/A
24959-67-9	Bromide	N/A
57-12-5	Cyanide	8.12E-16
593-74-8	Dimethylmercury	9.55E-07
630-08-0	Carbon monoxide	0.00E+00
7429-90-5	Aluminum	3.87E-12
7429-90-5	Aluminum (ppt) - Note 2	9.47E-16
7439-89-6	Iron - Note 4	2.20E-12
7439-92-1	Lead	1.73E-13
7439-93-2	Lithium	5.30E-15
7439-95-4	Magnesium	8.82E-14
7439-96-5	Manganese	6.65E-14
7439-97-6	Mercury (elemental)	0.00E+00
7439-97-6	Mercury (Hg^{+2})	3.84E-13
7439-98-7	Molybdenum	2.02E-14
7440-02-0	Nickel	2.37E-14
7440-16-6	Rhodium	1.97E-19
7440-22-4	Silver	6.51E-16
7440-23-5	Sodium	1.52E-10
7440-23-5	Sodium (ppt) - Note 5	0.00E+00
7440-24-6	Strontium (total) - Note 11	4.80E-17
7440-25-7	Tantalum	8.19E-21
7440-28-0	Thallium	2.28E-18
7440-31-5	Tin	N/A
7440-33-7	Tungsten	2.95E-14
7440-36-0	Antimony	1.14E-13
7440-38-2	Arsenic	1.53E-13
7440-39-3	Barium	8.85E-18
7440-41-7	Beryllium	7.40E-16
7440-43-9	Cadmium	3.43E-15
7440-47-3	Chromium - Note 3	2.10E-12
7440-48-4	Cobalt	5.60E-18
7440-50-8	Copper	3.76E-15
7440-61-1	Uranium	1.59E-14
7440-62-2	Vanadium	1.53E-14
7440-65-5	Yttrium	6.03E-17
7440-66-6	Zinc	2.48E-12
7440-67-7	Zirconium	1.32E-13
7446-09-5	Sulfur dioxide	0.00E+00
7647-01-0	Hydrogen chloride	0.00E+00

Table A-8 Process Emissions Model Results for the EMF for the DFLAW Operating Configuration

CASRN	COPC	EMF Emissions Rate
7664-39-3	Hydrogen fluoride	0.00E+00
7664-41-7	Ammonia/Ammonium	1.51E-08
7704-34-9	Total sulfur - Note 9	6.35E-13
7723-14-0	Phosphorus - Note 8	1.36E-12
7782-41-4	Fluorine gas	0.00E+00
7782-49-2	Selenium	2.57E-13
7782-50-5	Chlorine	0.00E+00
PM	Particulate Matter - Note 10	4.91E-11
Radionuclides		**Ci/s**
10028-17-8	Tritium	2.55E-12
10045-97-3	Cesium-137	1.88E-16
10098-91-6	Yttrium-90	N/A
10098-97-2	Strontium-90	3.01E-16
10198-40-0	Cobalt-60	1.45E-25
13966-29-5	Uranium-234	5.93E-21
13967-48-1	Ruthenium-106	1.12E-24
13967-70-9	Cesium-134	2.71E-23
13968-55-3	Uranium-233	2.02E-20
13981-15-2	Curium-244	6.72E-19
13981-16-3	Plutonium-238	8.31E-20
13981-37-8	Nickel-63	2.28E-18
13982-10-0	Plutonium-242	6.67E-23
13982-63-3	Radium-226	5.82E-22
13982-70-2	Uranium-236	1.96E-22
13994-20-2	Neptunium-237	5.76E-20
14119-32-5	Plutonium-241	1.16E-18
14119-33-6	Plutonium-240	4.30E-19
14133-76-7	Technetium-99	6.97E-15
14158-29-3	Uranium-232	3.74E-22
14234-35-6	Antimony-125	4.82E-18
14331-85-2	Protactinium-231	8.17E-28
14336-70-0	Nickel-59	3.02E-20
14391-16-3	Europium-155	6.61E-25
14596-10-2	Americium-241	1.52E-17
14683-23-9	Europium-152	3.09E-25
14762-75-5	Carbon-14	2.26E-13
14952-40-0	Actinium-227	6.03E-21
14993-75-0	Americium-243	8.81E-21
15046-84-1	Iodine-129	5.34E-20
15117-48-3	Plutonium-239	1.85E-18
15117-96-1	Uranium-235	2.40E-22
15262-20-1	Radium-228	3.56E-20
15510-73-3	Curium-242	5.48E-19
15585-10-1	Europium-154	1.79E-24
15594-54-4	Thorium-229	4.11E-28
15715-94-3	Samarium-151	1.82E-21
15751-77-6	Zirconium-93	4.03E-24
15757-87-6	Curium-243	3.90E-20
15758-45-9	Selenium-79	4.07E-17
15832-50-5	Tin-126	2.20E-18
378253-40-8	Barium-137m	N/A
378253-44-2	Cadmium-113m	3.58E-18

Table A-8 Process Emissions Model Results for the EMF for the DFLAW Operating Configuration

CASRN	COPC	EMF Emissions Rate
378782-82-2	Niobium-93m	6.57E-24
7440-29-1	Thorium-232	9.03E-28
7440-61-1R	Uranium-238	5.33E-21

Notes:
1. The estimated EMF exhaust mass flowrate of total PCBs for the refined feed vector is 6.81E-07 g/s.
2. Aluminum (ppt) is aluminum ion precipitated as gibbsite.
3. Chromium includes Cr^{3+} and Cr^{6+} ions.
4. Iron includes Fe^{2+} and Fe^{3+} ions.
5. Sodium (ppt) is sodium ion precipitated as sodium fluoride phosphate, sodium phosphate, or sodium oxalate.
6. Fluoride (ppt) is fluoride ion precipitated as sodium fluoride phosphate.
7. Phosphate (ppt) is phosphate ion precipitated as sodium fluoride phosphate or sodium phosphate
8. Phosphorus includes portions of phosphate, phosphate (ppt), dihydrogen phosphate, hydrogen phosphate, phosphorus dioxide, and diphosphorus pentoxide(s).
9. Total sulfur includes portions of sulfate, hydrogen sulfite, hydrogen sulfate, sulfite, sulfur dioxide, and sulfur trioxide(s).
10. Particulate matter includes solid organics, solid cations, solid anions, solid radionuclides, sodium chloride(s), sodium cyanide(s), sodium fluoride(s), sodium iodide(s), diphosphorus pentoxide(s), and sulfur trioxide(s).
11. Strontium (total) includes strontium as an inorganic and radionuclide.

A.5 Process Upsets

Process upset conditions include periods of startup, shutdown, process malfunction (e.g., the unit is operating outside the permitted operating conditions), or equipment failure. Periods when process equipment is being maintained or in an idle condition are also included. Process upset conditions are generally assumed to result in greater than normal stack emissions during the short period of the upset.

The potential for increased emissions during upset events were addressed through the application of upset factors. The default upset factors are 2.8 for organic chemicals and 1.45 for metals (RAWP Section 5.3). These upset factors were applied to the estimated vapor-phase emissions that were environmentally modeled. These upset factors are based on the amount of time the facility is expected to operate in an upset condition and the estimated magnitude of stack emissions during upset relative to routine operating conditions. Refer to Section 5.3 of the RAWP for more details on Process upsets and their calculations.

A.6 Management of Nondetect COPCs, DFLAW Operating Configuration

After the environmental performance demonstration test (EPDT), the human health and ecological risk assessment will be finalized by supplementing the modeled emissions with the actual emissions test results, and the corresponding human health and ecological impacts will be reassessed. Since emissions modeling for this pre-demonstration risk assessment estimated some emissions below anticipated measurable levels, where appropriate, some estimated emissions were increased to reflect expected analytical detection limits. Per the RAWP, Section 5.2.2, if during the EPDT a COPC is not detected, it is to be assumed present at one-half the detection limit, and if a COPC is a risk driver (e.g., a PCB or polycyclic aromatic hydrocarbon (PAH)) and not detected, it is to be assumed present at the detection limit. PEM estimated emissions were increased in a similar manner to reflect expected analytical detection limits. Given the uncertainty in emissions modeling, for simplicity, COPCs' melter emissions that were estimated below detection limits were adjusted (increased) to equal half the projected MDL, or the whole MDL for PCBs and PAHs. The MDLs used were taken from CCN 283075, *Environmental Performance Test Laboratory Detection Limits*; for analytes for which no MDL was provided, a reporting limit (RL) was used in lieu of a MDL. The MDLs were converted to emission units by dividing the MDL, as mass collected by sampling, by the volume of gas sampled, and multiplying by the estimated

stack emissions flowrate derived from the PEM. Table A-9 provides the projected MDL-based flowrates. These rates were applied only for emissions estimates for the LAW melter flue in cases where estimated emissions, before applying upset factors, were below these values (e.g., less than detectable), where available. Per the RAWP, half the rate shown was applied to non-risk drivers, while the rate shown in the table as applied for PCBs and PAHs.

Table A-9 MDL-based Emission Rates for the DFLAW Operating Configuration

CASRN	COPC	MDL-based LAW Facility Emissions Rate (g/s)
Organics		
100-02-7	p-Nitrophenol	8.73E-06
100-41-4	Ethyl benzene	1.75E-07
100-42-5	Styrene	2.18E-07
100-51-6	Benzyl alcohol	2.72E-06
100-52-7	Benzaldehyde	1.46E-05
10061-01-5	cis-1,3-Dichloropropene	2.91E-07
10061-02-6	trans-1,3-Dichloropropene	2.15E-07
101-55-3	4-Bromophenylphenyl ether	1.89E-06
103-33-3	Azobenzene	1.70E-06
103-65-1	n-Propyl benzene (Isocumene)	2.18E-07
104-51-8	n-Butylbenzene	1.73E-07
105-67-9	2,4-Dimethylphenol	7.23E-06
10595-95-6	n-Nitrosomethylethylamine	1.84E-06
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	2.40E-07
106-44-5	p-Cresol (4-methyl phenol)	2.67E-06
106-46-7	1,4-Dichlorobenzene	1.53E-06
106-47-8	p-Chloroaniline	3.54E-06
106-93-4	Ethylene dibromide	2.73E-07
106-99-0	1,3-Butadiene	2.98E-07
107-06-2	1,2-Dichloroethane	3.93E-07
107-13-1	Acrylonitrile	4.95E-06
108-05-4	Acetic acid vinyl ester	1.10E-05
108-10-1	4-Methyl-2-pentanone	1.55E-05
108-39-4	m-Cresol	2.67E-06
108-60-1	bis(2-Chloroisopropyl)ether	1.65E-06
108-67-8	1,3,5-Trimethylbenzene	3.35E-07
108-86-1	Bromobenzene (Phenyl bromide)	3.27E-07
108-88-3	Toluene	1.80E-07
108-90-7	Chlorobenzene	1.75E-07
108-95-2	Phenol	1.49E-06
109-99-9	Tetrahydrofuran	2.20E-05
110-54-3	n-Hexane	3.64E-07
110-86-1	Pyridine	4.17E-06
111-44-4	bis(2-Chloroethyl)ether	1.57E-06
111-91-1	bis(2-Chloroethoxy)methane	1.24E-06
117-81-7	Bis(2-Ethylhexyl)phthalate	5.19E-06
117-84-0	Di-n-octylphthalate	2.23E-06
118-74-1	Hexachlorobenzene	1.60E-06
120-12-7	Anthracene	1.85E-09
120-82-1	1,2,4-Trichlorobenzene	1.60E-06
120-83-2	2,4-Dichlorophenol	1.45E-06
121-14-2	2,4-Dinitrotoluene	3.15E-06
122-39-4	N,N-Diphenylamine	1.00E-08
122-66-7	1,2-Diphenylhydrazine	1.34E-06

Table A-9 MDL-based Emission Rates for the DFLAW Operating Configuration

CASRN	COPC	MDL-based LAW Facility Emissions Rate (g/s)
124-48-1	Chlorodibromomethane	3.71E-07
127-18-4	1,1,2,2-Tetrachloroethene	1.96E-07
129-00-0	Pyrene	1.74E-08
131-11-3	Dimethyl Phthalate	1.42E-06
132-64-9	Dibenzofuran	1.34E-06
1330-20-7	Xylenes (total)	4.37E-07
1336-36-3	Polychlorinated biphenyls	5.09E-09
134-32-7	alpha-Naphthylamine	2.81E-06
135-98-8	sec-Butylbenzene	1.71E-07
156-59-2	cis-1,2-Dichloroethene	1.86E-07
156-60-5	1,2-trans-Dichloroethene	3.17E-07
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1.18E-11
191-24-2	Benzo(g,h,i)perylene	2.48E-09
192-97-2	Benzo(e)pyrene	2.72E-09
193-39-5	Indeno(1,2,3-cd)pyrene	1.28E-09
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	4.27E-12
205-82-3	Benzo[j]fluoranthene	1.46E-08
205-99-2	Benzo(b)fluoranthene	1.46E-08
206-44-0	Fluoranthene	3.10E-09
207-08-9	Benzo(k)fluoranthene	2.08E-08
208-96-8	Acenaphthylene	1.16E-09
218-01-9	Chrysene	1.21E-09
2245-38-7	2,3,5-Trimethylnaphthalene	1.88E-09
23950-58-5	Pronamide	2.91E-05
31508-00-6	2,3’,4,4’,5-Pentachlorobiphenyl (PCB 118)	2.26E-11
32598-13-3	3,3’,4,4’-Tetrachlorobiphenyl (PCB 77)	2.45E-11
32598-14-4	2,3,3’,4,4’-Pentachlorobiphenyl (PCB 105)	2.35E-11
3268-87-9	Octachlorodibenzo(p)dioxin	4.80E-12
32774-16-6	3,3’,4,4’,5,5’-Hexachlorobiphenyl (PCB 169)	2.29E-11
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	4.27E-12
38380-08-4	2,3,3’,4,4’,5-Hexachlorobiphenyl (PCB 156)	3.83E-11
39001-02-0	Octachlorodibenzofuran	7.47E-12
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	5.53E-12
39635-31-9	2,3,3’,4,4’,5,5’-Heptachlorobiphenyl (PCB 189)	1.78E-11
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	6.84E-12
50-32-8	Benzo(a)pyrene	1.38E-09
510-15-6	Chlorobenzilate	1.46E-05
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	4.61E-12
51-28-5	2,4-Dinitrophenol	2.09E-05
52663-72-6	2,3’,4,4’,5,5’-Hexachlorobiphenyl (PCB 167)	2.29E-11
534-52-1	4,6-Dinitro-o-cresol	6.65E-06
53-70-3	Dibenz[a,h]anthracene	1.88E-09
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	3.31E-07
541-73-1	1,3-Dichlorobenzene	1.61E-06
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	4.90E-12
56-23-5	Carbon tetrachloride	2.15E-07
56-49-5	3-Methylcholanthrene	1.41E-06
56-55-3	Benzo(a)anthracene	1.82E-09
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	2.81E-12
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	2.62E-12
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	2.81E-12
57465-28-8	3,3’,4,4’,5-Pentachlorobiphenyl (PCB 126)	1.41E-10

Table A-9 MDL-based Emission Rates for the DFLAW Operating Configuration

CASRN	COPC	MDL-based LAW Facility Emissions Rate (g/s)
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	5.53E-12
581-42-0	2,6-Dimethylnaphthalene	7.03E-09
58-90-2	2,3,4,6-Tetrachlorophenol	5.05E-06
591-78-6	2-Hexanone	1.24E-06
593-60-2	Bromoethene (Vinyl bromide)	4.46E-05
59-50-7	4-Chloro-3-methylphenol	4.03E-06
59-89-2	N-Nitrosomorpholine	1.50E-06
60-11-7	Dimethyl aminoazobenzene	1.16E-06
606-20-2	2,6-Dinitrotoluene	3.20E-06
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	6.69E-12
608-93-5	Pentachlorobenzene	1.53E-06
621-64-7	N-Nitroso-di-n-propylamine	1.53E-06
62-50-0	Ethyl methanesulfonate	1.19E-06
62-53-3	Aniline	4.17E-06
62-75-9	N-Nitroso-N,N-dimethylamine	1.54E-06
630-20-6	1,1,1,2-Tetrachloroethane	2.00E-07
65510-44-3	2’,3,4,4’,5-Pentachlorobiphenyl (PCB 123)	1.25E-10
65-85-0	Benzoic acid	2.86E-05
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	5.53E-12
67-63-0	2-Propyl alcohol	4.00E-04
67-64-1	2-Propanone (Acetone)	5.82E-06
67-66-3	Chloroform	1.86E-07
67-72-1	Hexachloroethane	1.44E-06
69782-90-7	2,3,3’,4,4’,5’-Hexachlorobiphenyl (PCB 157)	3.83E-11
70362-50-4	3,4,4’,5-Tetrachlorobiphenyl (PCB 81)	2.43E-11
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	2.77E-12
71-43-2	Benzene	5.28E-07
71-55-6	1,1,1-Trichloroethane	1.96E-07
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	6.69E-12
74472-37-0	2,3,4,4’,5-Pentachlorobiphenyl (PCB 114)	2.26E-11
74-83-9	Bromomethane	9.61E-07
74-87-3	Chloromethane	6.55E-07
74-88-4	Iodomethane	9.17E-07
74-95-3	Methylene bromide	3.78E-07
74-97-5	Bromochloromethane	4.78E-07
75-00-3	Chloroethane	9.97E-07
75-01-4	1-Chloroethene	5.97E-07
75-05-8	Acetonitrile	1.53E-04
75-09-2	Dichloromethane (Methylene Chloride)	3.71E-07
75-15-0	Carbon disulfide	3.06E-07
75-25-2	Bromoform	1.82E-06
75-27-4	Bromodichloromethane	2.37E-07
75-29-6	2-Chloropropane	1.50E-06
75-34-3	1,1-Dichloroethane	1.71E-07
75-35-4	1,1-Dichloroethene	2.66E-07
75-69-4	Trichlorofluoromethane	3.93E-07
75-71-8	Dichlorodifluoromethane	6.95E-07
76-01-7	Pentachloroethane	1.27E-06
76-13-1	1,2,2-Trichlorotrifluoroethane	1.10E-05
764-41-0	1,4-Dichloro-2-butene	8.00E-06
77-47-4	Hexachlorocyclopentadiene	1.16E-05
78-87-5	1,2-Dichloropropane	2.82E-07

Table A-9 MDL-based Emission Rates for the DFLAW Operating Configuration

CASRN	COPC	MDL-based LAW Facility Emissions Rate (g/s)
78-93-3	2-Butanone	1.55E-05
79-00-5	1,1,2-Trichloroethane	1.51E-06
79-01-6	1,1,2-Trichloroethylene	3.60E-07
79-34-5	1,1,2,2-Tetrachloroethane	3.55E-06
82-68-8	Pentachloronitrobenzene (PCNB)	7.62E-06
832-69-9	1-Methylphenanthrene	2.09E-09
83-32-9	Acenaphthene	2.35E-09
84-66-2	Diethyl phthalate	1.58E-06
84-74-2	Di-n-butylphthalate	2.28E-06
85-01-8	Phenanthrene	1.15E-08
85-68-7	Butylbenzylphthalate	2.18E-06
86-73-7	Fluorene	1.97E-09
87-61-6	1,2,3-Trichlorobenzene	2.47E-07
87-68-3	Hexachlorobutadiene	1.33E-06
87-86-5	Pentachlorophenol	8.34E-06
88-06-2	2,4,6-Trichlorophenol	1.39E-06
88-74-4	o-Nitroaniline (2-nitroaniline)	1.99E-06
88-75-5	2-Nitrophenol	1.99E-06
90-12-0	1-Methylnaphthalene	5.14E-09
91-20-3	Naphthalene	1.21E-07
91-57-6	2-Methylnaphthalene	9.99E-09
91-58-7	2-Chloronaphthalene	1.50E-06
91-94-1	3,3'-Dichlorobenzidine	4.04E-06
924-16-3	N-Nitroso-di-n-Buetylamine	2.23E-06
92-52-4	1,1`-Biphenyl	1.29E-08
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	1.65E-06
95-48-7	o-Cresol	1.28E-06
95-49-8	o-Chlorotoluene	2.11E-07
95-50-1	1,2-Dichlorobenzene	1.65E-06
95-53-4	o-Toluidine	1.36E-06
95-57-8	2-Chlorophenol	1.47E-06
95-63-6	1,2,4-Trimethyl benzene	2.40E-07
95-94-3	1,2,4,5-Tetrachlorobenzene	1.33E-06
95-95-4	2,4,5-Trichlorophenol	1.33E-06
96-12-8	1,2-Dibromo-3-chloropropane	2.15E-06
96-18-4	1,2,3-Trichloropropane	3.77E-06
98-06-6	tert-Butyl benzene	1.86E-07
98-82-8	Cumene	1.71E-07
98-86-2	Acetophenone	1.23E-06
98-95-3	Nitrobenzene	1.38E-06
99-35-4	1,3,5-Trinitrobenzene	7.28E-05
99-65-0	1,3-Dinitrobenzene	7.91E-06
99-87-6	p-Cymene	1.71E-07
Inorganics		
7429-90-5	Aluminum	5.29E-06
7439-89-6	Iron	6.02E-06
7439-92-1	Lead	3.88E-07
7439-93-2	Lithium	2.81E-07
7439-95-4	Magnesium	3.30E-06
7439-96-5	Manganese	9.95E-08
7439-97-6	Mercury	1.94E-08
7439-98-7	Molybdenum	4.03E-07

Table A-9 MDL-based Emission Rates for the DFLAW Operating Configuration

CASRN	COPC	MDL-based LAW Facility Emissions Rate (g/s)
7440-02-0	Nickel	8.39E-08
7440-22-4	Silver	2.67E-07
7440-23-5	Sodium	2.52E-04
7440-24-6	Strontium (total)	8.54E-08
7440-28-0	Thallium	3.40E-07
7440-31-5	Tin	1.51E-05
7440-36-0	Antimony	3.30E-07
7440-38-2	Arsenic	3.01E-07
7440-39-3	Barium	4.56E-07
7440-41-7	Beryllium	1.46E-08
7440-43-9	Cadmium	2.04E-08
7440-47-3	Chromium	2.23E-07
7440-48-4	Cobalt	6.16E-08
7440-50-8	Copper	2.09E-07
7440-62-2	Vanadium	8.73E-08
7440-66-6	Zinc	4.17E-07
7647-01-0	Hydrogen chloride	2.04E-05
7664-39-3	Hydrogen fluoride	2.43E-04
7723-14-0	Phosphorus	4.27E-07
7782-49-2	Selenium	3.40E-07
7782-50-5	Chlorine	2.04E-05

A.7 Other Emissions Sources, DFLAW Operating Configuration

A.7.1 Analytical Laboratory

Lab emissions for the baseline WTP configuration are less than 1% of the total risk and are not included in this report (24590-LAB-RPT-ENV-18-001).

A.7.2 Cell Emissions Estimate

The Washington State Department of Ecology (Ecology) has agreed (CCN 023430, *Discuss Proposed Final Resolution of Remaining Open Comments on the Risk Assessment Work Plan*) that fugitive emissions are not applicable to the WTP. Fugitive emissions "means emissions that could not reasonably pass through a stack, chimney, vent, or other functionally equivalent opening", as defined in WAC-173-400-030(39), *Definitions*. Conversely, for WTP, the cell emissions are those vapor emissions that leak from valve, connectors, etc. within the facility that are incidental to waste processing and considered uncontrolled, with the exception of high-efficiency particulate air (HEPA) filtration control of the particle phase constituents. Such constituents are primarily volatile organics, but dimethylmercury, tritium, and ammonia are also considered due to their ability to exist in the vapor phase under standard conditions. The estimated release of organic material from ancillary equipment is calculated using EPA-453/R-95-017, *Protocol for Equipment Leak Emission Estimates*, and from the composition of representative process streams as provided in the emissions estimate. Refer to report 24590-WTP-RPT-ENV-17-008, *Cell Emissions Estimate* (Supplement 3 of the RAWP) for a detailed description. Table A-17 provides the total process cell emissions, summed for each LAW Facility system identified in 24590-WTP-RPT-ENV-17-008.

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Table A-10 Cell Emission Rates for the DFLAW Operating Configuration

CASRN	COPC	LAW Facility Cell Emissions Rate (g/s)
100-02-7	p-Nitrophenol	3.87E-06
100-21-0	Phthalic acid	9.85E-07
100-25-4	1,4-Dinitrobenzene	4.48E-10
100-40-3	4-Ethenylcyclohexene	2.14E-08
100-41-4	Ethyl benzene	1.56E-12
100-42-5	Styrene	2.45E-10
10061-01-5	cis-1,3-Dichloropropene	3.93E-12
10061-02-6	trans-1,3-Dichloropropene	4.87E-12
101-55-3	4-Bromophenylphenyl ether	1.61E-07
104-76-7	2-Ethyl-1-hexanol	1.29E-07
105-67-9	2,4-Dimethylphenol	1.50E-07
10595-95-6	n-Nitrosomethylethylamine	2.55E-07
106-46-7	1,4-Dichlorobenzene	7.90E-10
106-47-8	p-Chloroaniline	2.07E-07
106-88-7	1,2-Epoxybutane	1.39E-07
106-93-4	Ethylene dibromide	1.28E-12
106-99-0	1,3-Butadiene	6.52E-12
107-02-8	Acrolein	7.45E-11
107-05-1	3-Chloropropene	2.37E-12
107-06-2	1,2-Dichloroethane	6.70E-10
107-12-0	Propionitrile	4.73E-10
107-13-1	Acrylonitrile	7.38E-09
108-05-4	Acetic acid vinyl ester	1.60E-07
108-10-1	4-Methyl-2-pentanone	1.78E-11
108-39-4	m-Cresol	4.28E-07
108-87-2	Methylcyclohexane	1.79E-13
108-88-3	Toluene	1.04E-10
108-90-7	Chlorobenzene	1.79E-10
108-94-1	Cyclohexanone	5.16E-09
108-95-2	Phenol	1.12E-07
109-74-0	n-Butanenitrile	1.36E-07
109-99-9	Tetrahydrofuran	5.56E-11
110-54-3	n-Hexane	2.06E-12
110-59-8	Pentanenitrile	1.30E-07
110-80-5	2-Ethoxyethanol	1.22E-06
110-82-7	Cyclohexane	4.02E-13
110-83-8	Cyclohexene	1.02E-12
110-86-1	Pyridine	1.25E-09
111-44-4	bis(2-Chloroethyl)ether	7.77E-09
111-65-9	n-Octane	2.70E-13
111-76-2	2-Butoxyethanol	1.70E-07
111-84-2	n-Nonane	1.70E-13
111-91-1	bis(2-Chloroethoxy)methane	1.86E-08
117-81-7	Bis(2-ethylhexyl) phthalate	1.74E-06
117-84-0	Di-n-octylphthalate	5.59E-07
118-74-1	Hexachlorobenzene	1.62E-10
120-12-7	Anthracene	1.02E-07
120-82-1	1,2,4-Trichlorobenzene	8.86E-11
120-83-2	2,4-Dichlorophenol	1.68E-07
121-14-2	2,4-Dinitrotoluene	1.41E-06
122-39-4	N,N-Diphenylamine	1.68E-10

Table A-10 Cell Emission Rates for the DFLAW Operating Configuration

CASRN	COPC	LAW Facility Cell Emissions Rate (g/s)
123-38-6	Propionaldehyde	1.70E-10
123-72-8	Butanal	1.40E-07
123-91-1	1,4-Dioxan	5.38E-11
124-48-1	Chlorodibromomethane	8.41E-10
126-73-8	Tributyl phosphate	1.66E-07
126-98-7	2-Methyl-2-propenenitrile	4.99E-11
127-18-4	1,1,2,2-Tetrachloroethene	6.04E-13
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	2.60E-09
129-00-0	Pyrene	5.10E-07
131-11-3	Dimethyl Phthalate	1.65E-07
132-64-9	Dibenzofuran	9.41E-10
1330-20-7	Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations)	4.43E-10
1336-36-3	Polychlorinated biphenyls	2.21E-07
134-32-7	alpha-Naphthylamine	2.33E-07
141-78-6	Acetic acid ethyl ester	5.40E-12
156-60-5	1,2-trans-Dichloroethene	1.91E-07
1634-04-4	Methyl tert-butyl ether	1.30E-07
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1.62E-17
189-55-9	Dibenzo[a,i]pyrene	4.32E-07
189-64-0	Dibenzo[a,h]pyrene	4.32E-07
191-24-2	Benzo(g,h,i)perylene	4.39E-07
191-30-0	Dibenzo(a,l)pyrene	4.32E-07
192-65-4	Dibenzo[a,e]pyrene	4.32E-07
193-39-5	Indeno(1,2,3-cd)pyrene	1.96E-07
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	3.11E-17
205-99-2	Benzo(b)fluoranthene	3.48E-09
206-44-0	Fluoranthene	5.06E-07
207-08-9	Benzo(k)fluoranthene	1.77E-07
208-96-8	Acenaphthylene	1.00E-07
218-01-9	Chrysene	2.13E-09
224-42-0	Dibenz[a,j]acridine	5.93E-07
226-36-8	Dibenz[a,h]acridine	5.94E-07
27154-33-2	Trichlorofluoroethane	2.84E-07
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	4.75E-16
319-84-6	alpha-BHC	5.90E-12
319-85-7	beta-BHC	9.53E-12
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	2.05E-15
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	5.70E-17
3268-87-9	Octachlorodibenzo(p)dioxin	9.71E-16
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	2.32E-16
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	1.40E-16
3697-24-3	5-Methylchrysene	1.05E-07
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	1.48E-16
39001-02-0	Octachlorodibenzofuran	4.55E-16
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	2.14E-17
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	1.13E-16
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	1.02E-16
4170-30-3	Crotonaldehyde (Propylene aldehyde)	7.21E-11
50-00-0	Formaldehyde	3.06E-07
50-32-8	Benzo(a)pyrene	3.08E-08
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	1.17E-16
51-28-5	2,4-Dinitrophenol	1.44E-06
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	2.20E-16

Table A-10 Cell Emission Rates for the DFLAW Operating Configuration

CASRN	COPC	LAW Facility Cell Emissions Rate (g/s)
534-52-1	4,6-Dinitro-o-cresol	3.14E-07
53-70-3	Dibenz[a,h]anthracene	6.66E-07
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	1.61E-10
541-73-1	1,3-Dichlorobenzene	5.00E-11
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	2.41E-17
56-23-5	Carbon tetrachloride	2.27E-11
56-49-5	3-Methylcholanthrene	1.06E-07
56-55-3	Benzo(a)anthracene	2.86E-08
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	1.32E-16
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	8.84E-17
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	4.63E-17
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	7.70E-16
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	3.73E-17
58-89-9	gamma-BHC (Lindane)	8.15E-12
58-90-2	2,3,4,6-Tetrachlorophenol	3.21E-07
589-38-8	3-Hexanone	1.30E-07
591-78-6	2-Hexanone	2.20E-10
59-50-7	4-Chloro-3-methylphenol	5.04E-07
59-89-2	N-Nitrosomorpholine	2.17E-06
602-87-9	5-Nitroacenaphthene	1.52E-07
60-29-7	Ethyl ether	1.69E-10
60-35-5	Acetamide	5.79E-07
606-20-2	2,6-Dinitrotoluene	9.37E-08
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	2.01E-17
621-64-7	N-Nitroso-di-n-propylamine	4.71E-07
62-75-9	N-Nitroso-N,N-dimethylamine	2.52E-09
628-73-9	Hexanenitrile	1.26E-07
630-20-6	1,1,1,2-Tetrachloroethane	5.18E-07
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	4.41E-16
67-56-1	Methyl alcohol	2.64E-07
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	7.43E-17
67-63-0	2-Propyl alcohol	1.48E-10
67-64-1	2-Propanone (Acetone)	3.06E-08
67-66-3	Chloroform	1.79E-10
67-72-1	Hexachloroethane	1.43E-08
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	3.76E-16
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	2.88E-16
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	4.45E-17
71-36-3	n-Butyl alcohol	4.27E-09
71-43-2	Benzene	1.21E-10
71-55-6	1,1,1-Trichloroethane	6.33E-13
72-55-9	4,4-DDE	1.81E-07
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	1.22E-17
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	9.16E-17
74-83-9	Bromomethane	1.08E-10
74-87-3	Chloromethane	7.84E-11
74-88-4	Iodomethane	1.20E-10
75-00-3	Chloroethane	1.78E-12
75-01-4	1-Chloroethene	9.88E-13
75-02-5	Fluoroethene (vinyl fluoride)	1.74E-08
75-05-8	Acetonitrile	3.06E-07
75-07-0	Acetaldehyde	1.72E-07
75-09-2	Dichloromethane (Methylene Chloride)	8.62E-09

Table A-10 Cell Emission Rates for the DFLAW Operating Configuration

CASRN	COPC	LAW Facility Cell Emissions Rate (g/s)
75-15-0	Carbon disulfide	2.25E-11
75-21-8	Ethylene oxide (Oxirane)	2.94E-10
75-25-2	Bromoform	1.02E-13
75-27-4	Bromodichloromethane	1.09E-06
75-34-3	1,1-Dichloroethane	8.60E-13
75-35-4	1,1-Dichloroethene	6.28E-13
75-45-6	Chlorodifluoromethane	1.11E-12
75-50-3	Trimethylamine	1.53E-07
75-69-4	Trichlorofluoromethane	4.75E-13
75-71-8	Dichlorodifluoromethane	1.61E-13
76-13-1	1,2,2-Trichlorotrifluoroethane	1.06E-13
76-44-8	Heptachlor	3.63E-14
77-47-4	Hexachlorocyclopentadiene	8.51E-11
78-83-1	2-Methylpropyl alcohol	2.48E-06
78-87-5	1,2-Dichloropropane	1.06E-12
78-93-3	2-Butanone	1.08E-08
79-00-5	1,1,2-Trichloroethane	1.47E-12
79-01-6	1,1,2-Trichloroethylene	6.70E-11
79-10-7	2-Propenoic acid	4.64E-07
79-34-5	1,1,2,2-Tetrachloroethane	1.57E-12
79-46-9	2-Nitropropane	3.39E-10
82-68-8	Pentachloronitrobenzene (PCNB)	3.10E-10
83-32-9	Acenaphthene	4.84E-07
84-66-2	Diethyl phthalate	3.33E-07
84-74-2	Di-n-butylphthalate	3.52E-06
85-01-8	Phenanthrene	1.07E-07
85-68-7	Butylbenzylphthalate	1.15E-06
86-73-7	Fluorene	1.03E-07
87-68-3	Hexachlorobutadiene	4.70E-10
87-86-5	Pentachlorophenol	3.15E-09
88-06-2	2,4,6-Trichlorophenol	4.48E-07
88-74-4	o-Nitroaniline (2-nitroaniline)	2.23E-07
88-75-5	2-Nitrophenol	4.80E-07
91-20-3	Naphthalene	4.83E-07
91-57-6	2-Methylnaphthalene	3.57E-10
91-58-7	2-Chloronaphthalene	1.23E-07
91-94-1	3,3'-Dichlorobenzidine	2.07E-06
92-52-4	1,1`-Biphenyl	3.13E-10
95-48-7	o-Cresol	5.77E-07
95-50-1	1,2-Dichlorobenzene	1.10E-09
95-57-8	2-Chlorophenol	4.46E-07
95-95-4	2,4,5-Trichlorophenol	4.44E-07
98-82-8	Cumene	1.19E-09
98-86-2	Acetophenone	3.33E-10
98-95-3	Nitrobenzene	7.22E-09
593-74-8	Dimethyl Mercury	6.34E-11
7664-41-7	Ammonia/Ammonium	1.90E-06
10028-17-8	Tritium	1.25E-10

A.8 Emissions Consolidation, DFLAW Operating Configuration

The data provided in Table A-11 indicate the final estimated emissions rates used to evaluate the DFLAW operating configuration in the PRA. The final rates include the estimated emissions from process modeling, the impact of upset factors, then application of MDLs where appropriate, and the addition of process cell emissions. For example, the 2,3,7,8-tetrachlorodibenzo(p)dioxin (TCDD) (1746-01-6) emissions estimated for the LAW melter were 2.02E-12 g/s (Table A-7). After applying an upset factor of 2.8 (refer to Section A.5), this value is further increased to 5.65E-12 g/s. However, the emission rate based on the MDL for this constituent is forecasted to be 1.18E-11 g/s (Table A-9), so the constituent is presumed to be emitted at a rate equal to one-half the MDL[7]. When LAW cell emissions of 1.63E-17 g/s (Table A-10) are added, the total corresponding emission rate evaluated in the risk assessment is 5.92E-12 g/s (Table A-11). The process for non-organics is similar, only an upset factor of 1.45 was used.

A.8.1 LAW Facility

The LAW Facility emissions include the contribution of the melter flue, with an upset factor applied, and then with MDLs applied for constituents estimated below the forecasted MDL, plus related LAW Facility cell emissions. Note that units of g/s apply to organics and inorganics, and units of Ci/s apply to radionuclides. The PRA emission rates for the LAW Facility in the DFLAW operating configuration are presented in Table A-11.

Table A-11 LAW Facility Emission Rates for the Pre-Demonstration Risk Assessment for the DFLAW Operating Configuration

COPC	CASRN	LAW Facility Emission Rates
Organics		**g/s**
p-Nitrophenol	100-02-7	2.73E-04
Phthalic acid	100-21-0	9.85E-07
1,4-Dinitrobenzene	100-25-4	1.17E-09
4-Ethenylcyclohexene	100-40-3	2.01E-07
Ethyl benzene	100-41-4	8.73E-08
Styrene	100-42-5	8.87E-05
Benzyl chloride	100-44-7	0.00E+00
Benzonitrile	100-47-0	0.00E+00
Benzyl alcohol	100-51-6	1.36E-06
Benzaldehyde	100-52-7	7.28E-06
cis-1,3-Dichloropropene	10061-01-5	1.46E-07
trans-1,3-Dichloropropene	10061-02-6	1.07E-07
4-Bromophenylphenyl ether	101-55-3	1.11E-06
4,4-Methylenedianiline	101-77-9	0.00E+00
Azobenzene	103-33-3	8.49E-07
n-Propyl benzene (Isocumene)	103-65-1	1.09E-07
n-Butylbenzene	104-51-8	8.64E-08
2-Ethyl-1-hexanol	104-76-7	3.47E-07
2,4-Dimethylphenol	105-67-9	3.98E-05
n-Nitrosomethylethylamine	10595-95-6	1.18E-06
4-Chlorotoluene (p-Tolyl chloride)	106-43-4	1.20E-07
p-Cresol (4-methyl phenol)	106-44-5	1.33E-06
1,4-Dichlorobenzene	106-46-7	9.69E-06

[7] If a COPC is not detected, and is a potential risk driver (e.g., PCB or PAH), it is presumed present at the MDL, otherwise, it is presumed present at one-half the MDL (refer to Section 5.2.2 of the RAWP).

Table A-11 LAW Facility Emission Rates for the Pre-Demonstration Risk Assessment for the DFLAW Operating Configuration

COPC	CASRN	LAW Facility Emission Rates
p-Chloroaniline	106-47-8	4.09E-05
p-Toluidine	106-49-0	0.00E+00
Quinone	106-51-4	0.00E+00
1,2-Epoxybutane	106-88-7	3.79E-07
Epichlorohydrin (1-chloro-2,3 epoxypropane)	106-89-8	0.00E+00
Ethylene dibromide	106-93-4	1.36E-07
1,3-Butadiene	106-99-0	1.49E-07
Acrolein	107-02-8	2.02E-10
3-Chloropropene	107-05-1	1.11E-11
1,2-Dichloroethane	107-06-2	8.87E-05
Propionitrile	107-12-0	1.27E-09
Acrylonitrile	107-13-1	8.87E-05
Propargyl alcohol	107-19-7	0.00E+00
Ethylene glycol (1,2-ethanediol)	107-21-1	0.00E+00
Propylene glycol monomethyl ether	107-98-2	0.00E+00
Acetic acid vinyl ester	108-05-4	5.66E-06
4-Methyl-2-pentanone	108-10-1	7.75E-06
m-Cresol	108-39-4	1.76E-06
bis (2-Chloroisopropyl)ether	108-60-1	8.25E-07
1,3,5-Trimethylbenzene	108-67-8	1.67E-07
Bromobenzene (Phenyl bromide)	108-86-1	1.64E-07
Methylcyclohexane	108-87-2	1.02E-11
Toluene	108-88-3	8.87E-05
Chlorobenzene	108-90-7	8.87E-05
Cyclohexanone	108-94-1	1.37E-08
Phenol	108-95-2	2.04E-05
n-Butanenitrile	109-74-0	3.66E-07
3-Butenenitrile	109-75-1	0.00E+00
Malononitrile	109-77-3	0.00E+00
2-Methoxyethanol	109-86-4	0.00E+00
Tetrahydrofuran	109-99-9	1.10E-05
Furan	110-00-9	0.00E+00
n-Hexane	110-54-3	1.82E-07
Pentanenitrile	110-59-8	3.52E-07
2-Ethoxyethanol	110-80-5	3.17E-06
Cyclohexane	110-82-7	9.09E-12
Cyclohexene	110-83-8	9.71E-12
Pyridine	110-86-1	2.09E-06
Ethylene glycol monoethyl ether acetate	111-15-9	0.00E+00
Bis(2-chloroethyl)ether	111-44-4	8.26E-06
n-Octane	111-65-9	1.05E-10
2-Butoxyethanol	111-76-2	4.45E-07
n-Nonane	111-84-2	7.04E-11
Bis(2-chloroethoxy)methane	111-91-1	7.33E-06
Undecane	1120-21-4	0.00E+00
1,3-Propane sultone	1120-71-4	0.00E+00
1-Decanol	112-30-1	0.00E+00
Decanal	112-31-2	0.00E+00
Dodecane	112-40-3	0.00E+00
Bis(2-ethylhexyl) phthalate	117-81-7	9.84E-05
Di-n-octylphthalate	117-84-0	1.67E-06

Table A-11 LAW Facility Emission Rates for the Pre-Demonstration Risk Assessment for the DFLAW Operating Configuration

COPC	CASRN	LAW Facility Emission Rates
Hexachlorobenzene	118-74-1	8.34E-06
3,3'-Dimethoxybenzidine	119-90-4	0.00E+00
Anthracene	120-12-7	6.78E-06
1,2,4-Trichlorobenzene	120-82-1	8.01E-07
2,4-Dichlorophenol	120-83-2	8.91E-07
2,4-Dinitrotoluene	121-14-2	1.05E-04
N,N-Diphenylamine	122-39-4	5.19E-09
1,2-Diphenylhydrazine	122-66-7	6.69E-07
Maleic hydrazide	123-33-1	0.00E+00
Propionaldehyde	123-38-6	4.60E-10
Butanal	123-72-8	3.80E-07
1,4-Dioxan	123-91-1	1.42E-10
Decane	124-18-5	0.00E+00
Chlorodibromomethane	124-48-1	8.87E-05
Tributyl phosphate	126-73-8	4.34E-07
2-Methyl-2-propenenitrile	126-98-7	1.37E-10
1,1,2,2-Tetrachloroethene	127-18-4	9.82E-08
2,6-Bis(tert-butyl)-4-methylphenol	128-37-0	6.85E-09
Pyrene	129-00-0	8.65E-06
Dimethyl Phthalate	131-11-3	5.26E-05
2-Cycloyhexyl-4,6-dinitrophenol	131-89-5	0.00E+00
Dibenzofuran	132-64-9	6.85E-05
Xylenes (mixed isomers)	1330-20-7	8.86E-05
Captan	133-06-2	0.00E+00
Polychlorinated biphenyls – Note 1	1336-36-3	6.03E-07
alpha-Naphthylamine	134-32-7	1.64E-06
sec-Butylbenzene	135-98-8	8.55E-08
Acetic acid ethyl ester	141-78-6	1.47E-11
Endothall	145-73-3	0.00E+00
cis-1,2-Dichloroethene	156-59-2	9.28E-08
1,2-trans-Dichloroethene	156-60-5	8.36E-07
Methyl tert-butyl ether	1634-04-4	3.65E-07
2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1746-01-6	5.92E-12
Dibenzo[a,i]pyrene	189-55-9	9.22E-07
Dibenzo[a,h]pyrene	189-64-0	9.22E-07
Benzo(g,h,i)perylene	191-24-2	1.38E-04
Dibenzo(a,l)pyrene	191-30-0	9.22E-07
Dibenzo[a,e]pyrene	192-65-4	9.22E-07
Benzo(e)pyrene	192-97-2	2.72E-09
Indeno(1,2,3-cd)pyrene	193-39-5	1.15E-04
1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	19408-74-3	6.37E-12
Benzo[j]fluoranthene	205-82-3	7.28E-09
Benzo(b)fluoranthene	205-99-2	1.34E-04
Fluoranthene	206-44-0	8.22E-06
Benzo(k)fluoranthene	207-08-9	1.57E-04
Acenaphthylene	208-96-8	5.25E-05
Chrysene	218-01-9	8.26E-06
Dibenz[a,j]acridine	224-42-0	6.85E-07
2,3,5-Trimethylnaphthalene	2245-38-7	1.88E-09
Dibenz[a,h]acridine	226-36-8	6.86E-07
Pronamide	23950-58-5	1.46E-05

Table A-11 LAW Facility Emission Rates for the Pre-Demonstration Risk Assessment for the DFLAW Operating Configuration

COPC	CASRN	LAW Facility Emission Rates
Trichlorofluoroethane	27154-33-2	1.29E-06
2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	31508-00-6	3.47E-09
alpha-BHC	319-84-6	1.57E-11
beta-BHC	319-85-7	2.49E-11
3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	32598-13-3	1.06E-09
2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	32598-14-4	1.45E-09
Octachlorodibenzo(p)dioxin	3268-87-9	9.15E-11
3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	32774-16-6	6.89E-10
1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	35822-46-9	2.68E-11
5-Methylchrysene	3697-24-3	2.78E-07
2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	38380-08-4	6.07E-10
Octachlorodibenzofuran	39001-02-0	1.46E-10
1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	39227-28-6	2.77E-12
2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	39635-31-9	1.36E-10
1,2,3,7,8-Pentachlorodibenzo(p)dioxin	40321-76-4	3.42E-12
Crotonaldehyde (Propylene aldehyde)	4170-30-3	1.91E-10
Chlorocyclopentadiene	41851-50-7	0.00E+00
Cyanogen (oxalonitrile)	460-19-5	0.00E+00
2-Butenenitrile	4786-20-3	0.00E+00
Formaldehyde	50-00-0	7.99E-07
Benzo(a)pyrene	50-32-8	7.22E-05
Cyanogen bromide (bromocyanide)	506-68-3	0.00E+00
Cyanogen chloride	506-77-4	0.00E+00
Chlorobenzilate	510-15-6	7.28E-06
2,3,7,8-Tetrachlorodibenzofuran	51207-31-9	2.97E-11
2,4-Dinitrophenol	51-28-5	9.47E-04
Ethyl carbamate (urethane)	51-79-6	0.00E+00
2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	52663-72-6	4.96E-10
1,2-Dinitrobenzene (o-Dinitrobenzene)	528-29-0	0.00E+00
2-Chloroacetophenone	532-27-4	0.00E+00
4,6-Dinitro-o-cresol	534-52-1	8.29E-05
Dibenz[a,h]anthracene	53-70-3	1.22E-04
Dibenzo(a,e)fluoranthene	5385-75-1	0.00E+00
1,2-Dichloroethene (total) (1,2-Dichloroethylene)	540-59-0	8.87E-05
1,2-Dimethylhydrazine	540-73-8	0.00E+00
2,2,4-Trimethylpentane	540-84-1	0.00E+00
1,3-Dichlorobenzene	541-73-1	8.03E-07
1,3-Dichloropropene	542-75-6	0.00E+00
Bis(chloromethyl)ether	542-88-1	0.00E+00
1,2,3,4,7,8,9-Heptachlorodibenzofuran	55673-89-7	6.76E-11
Carbon tetrachloride	56-23-5	8.87E-05
3-Methylcholanthrene	56-49-5	8.09E-07
Benzo(a)anthracene	56-55-3	8.37E-06
2,3,4,7,8-Pentachlorodibenzofuran	57117-31-4	2.22E-11
1,2,3,7,8-Pentachlorodibenzofuran	57117-41-6	2.97E-11
1,2,3,6,7,8-Hexachlorodibenzofuran	57117-44-9	4.83E-11
Strychnine	57-24-9	0.00E+00
3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	57465-28-8	7.36E-10
1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	57653-85-7	2.77E-12
Chlordane	57-74-9	0.00E+00
2,6-Dimethylnaphthalene	581-42-0	7.03E-09

Table A-11 LAW Facility Emission Rates for the Pre-Demonstration Risk Assessment for the DFLAW Operating Configuration

COPC	CASRN	LAW Facility Emission Rates
2,4-Toluene diisocyanate	584-84-9	0.00E+00
gamma-BHC (Lindane)	58-89-9	2.15E-11
2,3,4,6-Tetrachlorophenol	58-90-2	2.84E-06
3-Hexanone	589-38-8	3.52E-07
Benzene, iodo-	591-50-4	0.00E+00
2-Hexanone	591-78-6	6.22E-07
Bromoethene (Vinyl bromide)	593-60-2	2.23E-05
4-Chloro-3-methylphenol	59-50-7	2.52E-06
N-Nitrosomorpholine	59-89-2	5.65E-06
Dimethyl aminoazobenzene	60-11-7	5.80E-07
5-Nitroacenaphthene	602-87-9	3.97E-07
Ethyl ether	60-29-7	4.95E-10
Acetamide	60-35-5	7.95E-07
2,6-Dinitrotoluene	606-20-2	8.51E-05
2,3,4,6,7,8-Hexachlorodibenzofuran	60851-34-5	2.06E-11
Pentachlorobenzene	608-93-5	7.64E-07
Dichloropentadiene	61626-71-9	0.00E+00
N-Nitroso-di-n-propylamine	621-64-7	1.24E-06
Methyl isocyanate	624-83-9	0.00E+00
Ethyl methanesulfonate	62-50-0	5.97E-07
Aniline	62-53-3	2.09E-06
N-Nitroso-N,N-dimethylamine	62-75-9	7.71E-07
Hexanenitrile	628-73-9	3.42E-07
1,1,1,2-Tetrachloroethane	630-20-6	1.64E-06
Formic acid (methanoic acid)	64-18-6	0.00E+00
2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	65510-44-3	3.38E-10
Benzoic acid	65-85-0	1.43E-05
Methyl alcohol	67-56-1	6.97E-07
1,2,3,4,6,7,8-Heptachlorodibenzofuran	67562-39-4	1.65E-10
2-Propyl alcohol	67-63-0	2.00E-04
2-Propanone (Acetone)	67-64-1	2.80E-04
Chloroform	67-66-3	8.87E-05
Hexachloroethane	67-72-1	7.35E-07
2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	69782-90-7	6.07E-10
Hexachlorophene	70-30-4	0.00E+00
3,4,4',5-Tetrachlorobiphenyl (PCB 81)	70362-50-4	1.82E-10
1,2,3,4,7,8-Hexachlorodibenzofuran	70648-26-9	1.11E-10
n-Butyl alcohol	71-36-3	1.13E-08
Benzene	71-43-2	8.87E-05
1,1,1-Trichloroethane	71-55-6	9.82E-08
Methoxychlor	72-43-5	0.00E+00
4,4-DDE	72-55-9	4.84E-07
1,2,3,7,8,9-Hexachlorodibenzofuran	72918-21-9	1.22E-11
2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	74472-37-0	2.91E-10
Bromomethane	74-83-9	7.49E-03
Chloromethane	74-87-3	3.64E-03
Iodomethane	74-88-4	6.37E-03
Methylene bromide	74-95-3	1.89E-07
Bromochloromethane	74-97-5	2.39E-07
Chloroethane	75-00-3	4.98E-07
1-Chloroethene	75-01-4	2.98E-07

Table A-11 LAW Facility Emission Rates for the Pre-Demonstration Risk Assessment for the DFLAW Operating Configuration

COPC	CASRN	LAW Facility Emission Rates
Fluoroethene (vinyl fluoride)	75-02-5	3.24E-07
Acetonitrile	75-05-8	1.23E-03
Acetaldehyde	75-07-0	4.66E-07
Dichloromethane (Methylene Chloride)	75-09-2	3.14E-01
Carbon disulfide	75-15-0	8.86E-05
Ethylene oxide (Oxirane)	75-21-8	8.01E-10
Bromoform	75-25-2	8.87E-05
Bromodichloromethane	75-27-4	3.27E-06
2-Chloropropane	75-29-6	7.51E-07
1,1-Dichloroethane	75-34-3	8.55E-08
1,1-Dichloroethene	75-35-4	1.33E-07
Phosgene (hydrogen phosphide)	75-44-5	0.00E+00
Chlorodifluoromethane	75-45-6	9.79E-12
Trimethylamine	75-50-3	4.16E-07
Trichlorofluoromethane	75-69-4	1.96E-07
Dichlorodifluoromethane	75-71-8	3.47E-07
Pentachloroethane	76-01-7	6.36E-07
1,2,2-Trichlorotrifluoroethane	76-13-1	5.50E-06
1,4-Dichloro-2-butene	764-41-0	4.00E-06
Heptachlor	76-44-8	6.80E-12
Glycidylaldehyde	765-34-4	0.00E+00
Hexachlorocyclopentadiene	77-47-4	7.56E-04
Dimethyl sulfate	77-78-1	0.00E+00
2-Methylpropyl alcohol	78-83-1	6.58E-06
1,2-Dichloropropane	78-87-5	1.41E-07
2-Butanone	78-93-3	9.55E-05
1,1,2-Trichloroethane	79-00-5	7.57E-07
1,1,2-Trichloroethylene	79-01-6	8.87E-05
2-Propenoic acid	79-10-7	1.21E-06
1,1,2,2-Tetrachloroethane	79-34-5	1.78E-06
2-Nitropropane	79-46-9	9.21E-10
Methyl methacrylate	80-62-6	0.00E+00
Hexamethylene-1,5-diisocyanate	822-06-0	0.00E+00
Toluene-2,6-diamine	823-40-5	0.00E+00
Pentachloronitrobenzene (PCNB)	82-68-8	3.81E-06
1-Methylphenanthrene	832-69-9	2.09E-09
Acenaphthene	83-32-9	5.71E-05
Diethyl phthalate	84-66-2	9.24E-05
Di-n-butylphthalate	84-74-2	5.76E-05
Phenanthrene	85-01-8	7.19E-06
Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	85-44-9	0.00E+00
Butylbenzylphthalate	85-68-7	1.73E-05
Fluorene	86-73-7	6.57E-05
1,2,3-Trichlorobenzene	87-61-6	1.24E-07
Hexachlorobutadiene	87-68-3	6.68E-07
Pentachlorophenol	87-86-5	4.18E-06
2,4,6-Trichlorophenol	88-06-2	1.14E-06
o-Nitroaniline (2-nitroaniline)	88-74-4	7.25E-05
2-Nitrophenol	88-75-5	2.94E-05
o-Anisidine	90-04-0	0.00E+00
1-Methylnaphthalene	90-12-0	5.14E-09

Table A-11 LAW Facility Emission Rates for the Pre-Demonstration Risk Assessment for the DFLAW Operating Configuration

COPC	CASRN	LAW Facility Emission Rates
Naphthalene	91-20-3	4.82E-05
Quinoline	91-22-5	0.00E+00
2-Methylnaphthalene	91-57-6	7.87E-06
2-Chloronaphthalene	91-58-7	8.75E-07
3,3'-Dichlorobenzidine	91-94-1	5.48E-05
N-Nitroso-di-n-Buetylamine	924-16-3	1.12E-06
1,1`-Biphenyl	92-52-4	6.77E-09
Safrole (5-(2-Propenyl)-1,3-benzodioxole)	94-59-7	8.25E-07
2,4-D	94-75-7	0.00E+00
o-Cresol	95-48-7	1.22E-06
o-Chlorotoluene	95-49-8	1.06E-07
1,2-Dichlorobenzene	95-50-1	8.26E-07
o-Toluidine	95-53-4	6.79E-07
2-Chlorophenol	95-57-8	1.18E-06
1,2,4-Trimethyl benzene	95-63-6	1.20E-07
1,2,4,5-Tetrachlorobenzene	95-94-3	6.65E-07
2,4,5-Trichlorophenol	95-95-4	1.11E-06
1,2-Dibromo-3-chloropropane	96-12-8	1.07E-06
1,2,3-Trichloropropane	96-18-4	1.88E-06
Ethylene thiourea	96-45-7	0.00E+00
Ethyl methacrylate	97-63-2	0.00E+00
Furfural	98-01-1	0.00E+00
tert-Butyl benzene	98-06-6	9.28E-08
Benzotrichloride	98-07-7	0.00E+00
Cumene	98-82-8	1.79E-07
Methyl styrene (mixed isomers)	98-83-9	0.00E+00
Acetophenone	98-86-2	6.16E-07
Nitrobenzene	98-95-3	1.08E-05
1,3,5-Trinitrobenzene	99-35-4	3.64E-05
1,3-Dinitrobenzene	99-65-0	3.95E-06
p-Cymene	99-87-6	8.55E-08
Inorganics		**g/s**
Ozone	10028-15-6	0.00E+00
Nitrogen dioxide	10102-44-0	1.83E-01
Phosphate	14265-44-2	6.24E-09
Nitrate	14797-55-8	7.10E-09
Nitrite	14797-65-0	2.43E-11
Sulfate	14808-79-8	1.38E-11
Chloride	16887-00-6	2.36E-07
Fluoride	16984-48-8	4.96E-09
Methyl mercury	22967-92-6	0.00E+00
Bromide	24959-67-9	0.00E+00
Cyanide	57-12-5	6.53E-16
Dimethyl Mercury	593-74-8	3.84E-08
Carbon monoxide	630-08-0	2.35E-02
Aluminum	7429-90-5	2.64E-06
Iron	7439-89-6	3.01E-06
Lead	7439-92-1	1.94E-07
Lithium	7439-93-2	1.41E-07
Magnesium	7439-95-4	1.65E-06
Manganese	7439-96-5	4.97E-08

Table A-11 LAW Facility Emission Rates for the Pre-Demonstration Risk Assessment for the DFLAW Operating Configuration

COPC	CASRN	LAW Facility Emission Rates
Mercury	7439-97-6	6.34E-07
Molybdenum	7439-98-7	2.01E-07
Nickel	7440-02-0	4.20E-08
Rhodium	7440-16-6	6.81E-20
Silver	7440-22-4	1.33E-07
Sodium	7440-23-5	1.26E-04
Strontium (total)	7440-24-6	4.27E-08
Tantalum	7440-25-7	2.70E-18
Thallium	7440-28-0	1.70E-07
Tin	7440-31-5	7.56E-06
Tungsten	7440-33-7	9.74E-12
Antimony	7440-36-0	1.65E-07
Arsenic	7440-38-2	1.50E-07
Barium	7440-39-3	2.28E-07
Beryllium	7440-41-7	7.28E-09
Cadmium	7440-43-9	1.02E-08
Chromium	7440-47-3	1.12E-07
Cobalt	7440-48-4	3.08E-08
Copper	7440-50-8	1.04E-07
Uranium	7440-61-1	5.25E-12
Vanadium	7440-62-2	4.37E-08
Yttrium	7440-65-5	6.31E-13
Zinc	7440-66-6	2.09E-07
Zirconium	7440-67-7	2.24E-10
Sulfur dioxide	7446-09-5	1.72E-06
Hydrogen chloride	7647-01-0	3.84E-02
Hydrogen fluoride	7664-39-3	8.13E-04
Ammonia/Ammonium	7664-41-7	3.71E+00
Total sulfur	7704-34-9	1.03E-06
Phosphorus	7723-14-0	2.13E-07
Fluorine gas	7782-41-4	0.00E+00
Selenium	7782-49-2	1.70E-07
Chlorine	7782-50-5	0.00E+00
Radionuclides		**Ci/s**
Tritium	10028-17-8	1.72E-07
Cesium-137	10045-97-3	1.45E-14
Yttrium-90 – Note 2	10098-91-6	1.34E-13
Strontium-90	10098-97-2	1.34E-13
Cobalt-60	10198-40-0	6.57E-23
Uranium-234	13966-29-5	7.58E-20
Ruthenium-106	13967-48-1	5.62E-23
Cesium-134	13967-70-9	2.09E-21
Uranium-233	13968-55-3	2.58E-19
Curium-244	13981-15-2	8.58E-18
Plutonium-238	13981-16-3	1.06E-18
Nickel-63	13981-37-8	2.51E-16
Plutonium-242	13982-10-0	8.55E-22
Radium-226	13982-63-3	1.51E-20
Uranium-236	13982-70-2	2.51E-21
Neptunium-237	13994-20-2	7.37E-19
Plutonium-241	14119-32-5	1.49E-17

Table A-11 LAW Facility Emission Rates for the Pre-Demonstration Risk Assessment for the DFLAW Operating Configuration

COPC	CASRN	LAW Facility Emission Rates
Plutonium-240	14119-33-6	5.51E-18
Technetium-99	14133-76-7	5.48E-13
Uranium-232	14158-29-3	4.77E-21
Antimony-125	14234-35-6	4.52E-15
Protactinium-231	14331-85-2	1.07E-26
Nickel-59	14336-70-0	3.33E-18
Europium-155	14391-16-3	8.64E-24
Americium-241	14596-10-2	2.61E-16
Europium-152	14683-23-9	4.04E-24
Carbon-14	14762-75-5	1.64E-06
Actinium-227	14952-40-0	7.71E-20
Americium-243	14993-75-0	1.51E-19
Iodine-129	15046-84-1	6.39E-10
Plutonium-239	15117-48-3	2.37E-17
Uranium-235	15117-96-1	3.07E-21
Radium-228	15262-20-1	9.24E-19
Curium-242	15510-73-3	7.00E-18
Europium-154	15585-10-1	2.35E-23
Thorium-229	15594-54-4	5.37E-27
Samarium-151	15715-94-3	2.38E-20
Zirconium-93	15751-77-6	2.22E-22
Curium-243	15757-87-6	4.98E-19
Selenium-79	15758-45-9	1.15E-16
Tin-126	15832-50-5	2.81E-17
Barium-137m – Note 3	378253-40-8	1.37E-14
Cadmium-113m	378253-44-2	2.51E-16
Niobium-93m	378782-82-2	8.59E-23
Thorium-232	7440-29-1	1.18E-26
Uranium-238	7440-61-1R	6.81E-20

Notes:
1. The estimated LAW Facility exhaust mass flowrate of total PCBs for the refined feed vector is 1.06E-08 g/s.
2. ^{90}Y is assumed to be present in secular equilibrium with ^{90}Sr (Cember 1983, *Introduction to Health Physics*).
3. The activity of ^{137}mBa is in secular equilibrium with ^{137}Cs (at 94.6% of the activity of ^{137}Cs) (24590-WTP-3DG-W12W-00002).

A.8.2 EMF

The EMF emissions include the contribution of the process system ventilation and the vessel vent process system. Since EMF is a wastewater treatment facility (evaporator/condenser) upset factors and cell emissions are not applied. Note that units of g/s apply to organics and inorganics, and units of Ci/s apply to radionuclides. The PRA emission rates for the EMF in the DFLAW operating configuration are presented in Table A-12.

Table A-12 EMF Emission Rates for the Pre-Demonstration Risk Assessment for the DFLAW Operating Configuration

COPC	CASRN	EMF Emissions Rate
Organics		**g/s**
p-Nitrophenol	100-02-7	1.39E-07
Phthalic acid	100-21-0	3.25E-11
1,4-Dinitrobenzene	100-25-4	6.93E-09
4-Ethenylcyclohexene	100-40-3	6.49E-06
Ethyl benzene	100-41-4	1.83E-10
Styrene	100-42-5	2.60E-05
Benzyl chloride	100-44-7	0.00E+00
Benzonitrile	100-47-0	0.00E+00
Benzyl alcohol	100-51-6	0.00E+00
Benzaldehyde	100-52-7	0.00E+00
cis-1,3-Dichloropropene	10061-01-5	3.79E-10
trans-1,3-Dichloropropene	10061-02-6	5.89E-10
4-Bromophenylphenyl ether	101-55-3	3.13E-05
4,4-Methylenedianiline	101-77-9	0.00E+00
Azobenzene	103-33-3	0.00E+00
n-Propyl benzene (Isocumene)	103-65-1	0.00E+00
n-Butylbenzene	104-51-8	0.00E+00
2-Ethyl-1-hexanol	104-76-7	2.22E-05
2,4-Dimethylphenol	105-67-9	8.55E-05
n-Nitrosomethylethylamine	10595-95-6	9.19E-06
4-Chlorotoluene (p-Tolyl chloride)	106-43-4	0.00E+00
p-Cresol (4-methyl phenol)	106-44-5	0.00E+00
1,4-Dichlorobenzene	106-46-7	1.05E-05
p-Chloroaniline	106-47-8	5.91E-05
p-Toluidine	106-49-0	0.00E+00
Quinone	106-51-4	0.00E+00
1,2-Epoxybutane	106-88-7	2.58E-05
Epichlorohydrin (1-chloro-2,3 epoxypropane)	106-89-8	0.00E+00
Ethylene dibromide	106-93-4	1.64E-10
1,3-Butadiene	106-99-0	2.85E-09
Acrolein	107-02-8	1.44E-08
3-Chloropropene	107-05-1	3.19E-10
1,2-Dichloroethane	107-06-2	6.68E-05
Propionitrile	107-12-0	8.69E-08
Acrylonitrile	107-13-1	2.61E-04
Propargyl alcohol	107-19-7	0.00E+00
Ethylene glycol (1,2-ethanediol)	107-21-1	0.00E+00
Propylene glycol monomethyl ether	107-98-2	0.00E+00
Acetic acid vinyl ester	108-05-4	2.30E-05
4-Methyl-2-pentanone	108-10-1	3.43E-09
m-Cresol	108-39-4	1.06E-05
Bis(2-chloroisopropyl)ether	108-60-1	0.00E+00
1,3,5-Trimethylbenzene	108-67-8	0.00E+00
Bromobenzene (Phenyl bromide)	108-86-1	0.00E+00
Methylcyclohexane	108-87-2	3.60E-10
Toluene	108-88-3	1.07E-05
Chlorobenzene	108-90-7	1.90E-05
Cyclohexanone	108-94-1	6.05E-07
Phenol	108-95-2	7.77E-06
n-Butanenitrile	109-74-0	2.60E-05

Table A-12 EMF Emission Rates for the Pre-Demonstration Risk Assessment for the DFLAW Operating Configuration

COPC	CASRN	EMF Emissions Rate
3-Butenenitrile	109-75-1	0.00E+00
Malononitrile	109-77-3	0.00E+00
2-Methoxyethanol	109-86-4	0.00E+00
Tetrahydrofuran	109-99-9	1.09E-08
Furan	110-00-9	0.00E+00
n-Hexane	110-54-3	1.65E-08
Pentanenitrile	110-59-8	2.54E-05
2-Ethoxyethanol	110-80-5	1.92E-05
Cyclohexane	110-82-7	3.13E-10
Cyclohexene	110-83-8	3.13E-10
Pyridine	110-86-1	1.45E-07
Ethylene glycol monoethyl ether acetate	111-15-9	0.00E+00
Bis(2-chloroethyl)ether	111-44-4	5.63E-05
n-Octane	111-65-9	3.78E-09
2-Butoxyethanol	111-76-2	6.61E-06
n-Nonane	111-84-2	2.53E-09
Bis(2-chloroethoxy)methane	111-91-1	2.44E-05
Undecane	1120-21-4	0.00E+00
1,3-Propane sultone	1120-71-4	0.00E+00
1-Decanol	112-30-1	0.00E+00
Decanal	112-31-2	0.00E+00
Dodecane	112-40-3	0.00E+00
Bis(2-ethylhexyl)phthalate	117-81-7	1.84E-05
Di-n-octylphthalate	117-84-0	1.14E-04
Hexachlorobenzene	118-74-1	1.64E-05
3,3'-Dimethoxybenzidine	119-90-4	0.00E+00
Anthracene	120-12-7	7.20E-05
1,2,4-Trichlorobenzene	120-82-1	9.33E-09
2,4-Dichlorophenol	120-83-2	1.63E-05
2,4-Dinitrotoluene	121-14-2	9.94E-06
N,N-Diphenylamine	122-39-4	9.85E-09
1,2-Diphenylhydrazine	122-66-7	0.00E+00
Maleic hydrazide	123-33-1	0.00E+00
Propionaldehyde	123-38-6	3.33E-08
Butanal	123-72-8	2.72E-05
1,4-Dioxan	123-91-1	4.44E-09
Decane	124-18-5	0.00E+00
Chlorodibromomethane	124-48-1	8.11E-05
Tributyl phosphate	126-73-8	6.24E-06
2-Methyl-2-propenenitrile	126-98-7	8.74E-09
1,1,2,2-Tetrachloroethene	127-18-4	1.04E-10
2,6-Bis(tert-butyl)-4-methylphenol	128-37-0	2.00E-07
Pyrene	129-00-0	1.09E-04
Dimethyl Phthalate	131-11-3	1.97E-06
2-Cycloyhexyl-4,6-dinitrophenol	131-89-5	0.00E+00
Dibenzofuran	132-64-9	5.49E-05
Xylenes (total)	1330-20-7	1.37E-05
Captan	133-06-2	0.00E+00
Polychlorinated biphenyls – Note 1	1336-36-3	4.05E-05
alpha-Naphthylamine	134-32-7	1.54E-06
sec-Butylbenzene	135-98-8	0.00E+00

Table A-12 EMF Emission Rates for the Pre-Demonstration Risk Assessment for the DFLAW Operating Configuration

COPC	CASRN	EMF Emissions Rate
Acetic acid ethyl ester	141-78-6	1.04E-09
Endothall	145-73-3	0.00E+00
cis-1,2-Dichloroethene	156-59-2	0.00E+00
1,2-trans-Dichloroethene	156-60-5	2.38E-05
Methyl tert-butyl ether	1634-04-4	1.79E-05
2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1746-01-6	2.12E-13
Dibenzo[a,i]pyrene	189-55-9	4.83E-07
Dibenzo[a,h]pyrene	189-64-0	4.83E-07
Benzo[g,h,i]perylene	191-24-2	1.53E-05
Dibenzo[a,l]pyrene	191-30-0	4.83E-07
Dibenzo[a,e]pyrene	192-65-4	4.83E-07
Benzo(e)pyrene	192-97-2	0.00E+00
Indeno(1,2,3-cd)pyrene	193-39-5	3.37E-05
1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	19408-74-3	1.27E-13
Benzo[j]fluoranthene	205-82-3	0.00E+00
Benzo(b)fluoranthene	205-99-2	1.30E-04
Fluoranthene	206-44-0	1.17E-04
Benzo(k)fluoranthene	207-08-9	2.60E-05
Acenaphthylene	208-96-8	6.84E-05
Chrysene	218-01-9	7.10E-05
Dibenz[a,j]acridine	224-42-0	9.76E-08
2,3,5-Trimethylnaphthalene	2245-38-7	0.00E+00
Dibenz[a,h]acridine	226-36-8	9.40E-08
Pronamide	23950-58-5	0.00E+00
Trichlorofluoroethane	27154-33-2	3.71E-05
2,3’,4,4’,5-Pentachlorobiphenyl (PCB 118)	31508-00-6	3.26E-11
alpha-BHC	319-84-6	7.65E-10
beta-BHC	319-85-7	2.31E-10
3,3’,4,4’-Tetrachlorobiphenyl (PCB 77)	32598-13-3	7.15E-12
2,3,3’,4,4’-Pentachlorobiphenyl (PCB 105)	32598-14-4	5.54E-12
Octachlorodibenzo(p)dioxin	3268-87-9	2.25E-12
3,3’,4,4’,5,5’-Hexachlorobiphenyl (PCB 169)	32774-16-6	5.89E-12
1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	35822-46-9	6.41E-13
5-Methylchrysene	3697-24-3	9.68E-06
2,3,3’,4,4’,5-Hexachlorobiphenyl (PCB 156)	38380-08-4	6.71E-12
Octachlorodibenzofuran	39001-02-0	2.03E-13
1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	39227-28-6	8.66E-14
2,3,3’,4,4’,5,5’-Heptachlorobiphenyl (PCB 189)	39635-31-9	2.20E-12
1,2,3,7,8-Pentachlorodibenzo(p)dioxin	40321-76-4	8.10E-14
Crotonaldehyde (Propylene aldehyde)	4170-30-3	8.74E-09
Chlorocyclopentadiene	41851-50-7	0.00E+00
Cyanogen (oxalonitrile)	460-19-5	0.00E+00
2-Butenenitrile	4786-20-3	0.00E+00
Formaldehyde	50-00-0	3.82E-06
Benzo(a)pyrene	50-32-8	2.93E-05
Cyanogen bromide (bromocyanide)	506-68-3	0.00E+00
Cyanogen chloride	506-77-4	0.00E+00
Chlorobenzilate	510-15-6	0.00E+00
2,3,7,8-Tetrachlorodibenzofuran	51207-31-9	6.57E-13
2,4-Dinitrophenol	51-28-5	9.67E-05
Ethyl carbamate (urethane)	51-79-6	0.00E+00

Table A-12 EMF Emission Rates for the Pre-Demonstration Risk Assessment for the DFLAW Operating Configuration

COPC	CASRN	EMF Emissions Rate
2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	52663-72-6	5.57E-12
1,2-Dinitrobenzene (o-Dinitrobenzene)	528-29-0	0.00E+00
2-Chloroacetophenone	532-27-4	0.00E+00
4,6-Dinitro-o-cresol	534-52-1	1.01E-04
Dibenz[a,h]anthracene	53-70-3	1.03E-06
Dibenzo(a,e)fluoranthene	5385-75-1	0.00E+00
1,2-Dichloroethene (total) (1,2-Dichloroethylene)	540-59-0	1.73E-05
1,2-Dimethylhydrazine	540-73-8	0.00E+00
2,2,4-Trimethylpentane	540-84-1	0.00E+00
1,3-Dichlorobenzene	541-73-1	4.83E-09
1,3-Dichloropropene	542-75-6	0.00E+00
Bis(chloromethyl)ether	542-88-1	0.00E+00
1,2,3,4,7,8,9-Heptachlorodibenzofuran	55673-89-7	1.32E-13
Carbon tetrachloride	56-23-5	2.36E-06
3-Methylcholanthrene	56-49-5	9.49E-06
Benzo(a)anthracene	56-55-3	2.80E-05
2,3,4,7,8-Pentachlorodibenzofuran	57117-31-4	2.02E-13
1,2,3,7,8-Pentachlorodibenzofuran	57117-41-6	1.37E-13
1,2,3,6,7,8-Hexachlorodibenzofuran	57117-44-9	1.19E-13
Strychnine	57-24-9	0.00E+00
3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	57465-28-8	2.70E-12
1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	57653-85-7	1.55E-13
Chlordane	57-74-9	0.00E+00
2,6-Dimethylnaphthalene	581-42-0	0.00E+00
2,4-Toluene diisocyanate	584-84-9	0.00E+00
gamma-BHC (Lindane)	58-89-9	7.16E-10
2,3,4,6-Tetrachlorophenol	58-90-2	2.58E-05
3-Hexanone	589-38-8	2.50E-05
Benzene, iodo	591-50-4	0.00E+00
2-Hexanone	591-78-6	4.30E-08
Bromoethene (Vinyl bromide)	593-60-2	0.00E+00
4-Chloro-3-methylphenol	59-50-7	1.59E-05
N-Nitrosomorpholine	59-89-2	3.22E-06
Dimethyl aminoazobenzene	60-11-7	0.00E+00
5-Nitroacenaphthene	602-87-9	4.84E-06
Ethyl ether	60-29-7	1.84E-08
Acetamide	60-35-5	1.64E-07
2,6-Dinitrotoluene	606-20-2	1.22E-05
2,3,4,6,7,8-Hexachlorodibenzofuran	60851-34-5	8.38E-14
Pentachlorobenzene	608-93-5	0.00E+00
Dichloropentadiene	61626-71-9	0.00E+00
N-Nitroso-di-n-propylamine	621-64-7	2.34E-05
Methyl isocyanate	624-83-9	0.00E+00
Ethyl methanesulfonate	62-50-0	0.00E+00
Aniline	62-53-3	0.00E+00
N-Nitroso-N,N-dimethylamine	62-75-9	1.07E-07
Hexanenitrile	628-73-9	2.47E-05
1,1,1,2-Tetrachloroethane	630-20-6	5.02E-05
Formic acid (methanoic acid)	64-18-6	0.00E+00
2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	65510-44-3	4.10E-12
Benzoic acid	65-85-0	0.00E+00

Table A-12 EMF Emission Rates for the Pre-Demonstration Risk Assessment for the DFLAW Operating Configuration

COPC	CASRN	EMF Emissions Rate
Methyl alcohol	67-56-1	2.11E-05
1,2,3,4,6,7,8-Heptachlorodibenzofuran	67562-39-4	4.04E-13
2-Propyl alcohol	67-63-0	1.64E-08
2-Propanone (Acetone)	67-64-1	4.36E-04
Chloroform	67-66-3	1.90E-05
Hexachloroethane	67-72-1	1.41E-06
2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	69782-90-7	7.31E-12
Hexachlorophene	70-30-4	0.00E+00
3,4,4',5-Tetrachlorobiphenyl (PCB 81)	70362-50-4	2.56E-12
1,2,3,4,7,8-Hexachlorodibenzofuran	70648-26-9	2.54E-13
n-Butyl alcohol	71-36-3	4.95E-07
Benzene	71-43-2	1.26E-05
1,1,1-Trichloroethane	71-55-6	1.06E-10
Methoxychlor	72-43-5	0.00E+00
4,4-DDE	72-55-9	2.95E-05
1,2,3,7,8,9-Hexachlorodibenzofuran	72918-21-9	5.04E-14
2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	74472-37-0	2.96E-12
Bromomethane	74-83-9	1.13E-05
Chloromethane	74-87-3	8.02E-06
Iodomethane	74-88-4	1.29E-05
Methylene bromide	74-95-3	0.00E+00
Bromochloromethane	74-97-5	0.00E+00
Chloroethane	75-00-3	2.18E-10
1-Chloroethene	75-01-4	2.15E-10
Fluoroethene (vinyl fluoride)	75-02-5	1.11E-05
Acetonitrile	75-05-8	4.22E-03
Acetaldehyde	75-07-0	3.38E-05
Dichloromethane (Methylene Chloride)	75-09-2	8.27E-04
Carbon disulfide	75-15-0	2.41E-06
Ethylene oxide (Oxirane)	75-21-8	5.59E-08
Bromoform	75-25-2	1.10E-08
Bromodichloromethane	75-27-4	1.11E-04
2-Chloropropane	75-29-6	0.00E+00
1,1-Dichloroethane	75-34-3	9.05E-11
1,1-Dichloroethene	75-35-4	1.34E-10
Phosgene (hydrogen phosphide)	75-44-5	0.00E+00
Chlorodifluoromethane	75-45-6	3.13E-10
Trimethylamine	75-50-3	3.00E-05
Trichlorofluoromethane	75-69-4	2.58E-10
Dichlorodifluoromethane	75-71-8	2.62E-10
Pentachloroethane	76-01-7	0.00E+00
1,2,2-Trichlorotrifluoroethane	76-13-1	2.59E-10
1,4-Dichloro-2-butene	764-41-0	0.00E+00
Heptachlor	76-44-8	2.44E-10
Glycidylaldehyde	765-34-4	0.00E+00
Hexachlorocyclopentadiene	77-47-4	9.11E-06
Dimethyl sulfate	77-78-1	0.00E+00
2-Methylpropyl alcohol	78-83-1	3.02E-04
1,2-Dichloropropane	78-87-5	1.02E-10
2-Butanone	78-93-3	2.20E-04
1,1,2-Trichloroethane	79-00-5	1.76E-10

Table A-12 EMF Emission Rates for the Pre-Demonstration Risk Assessment for the DFLAW Operating Configuration

COPC	CASRN	EMF Emissions Rate
1,1,2-Trichloroethylene	79-01-6	7.07E-06
2-Propenoic acid	79-10-7	6.16E-06
1,1,2,2-Tetrachloroethane	79-34-5	2.55E-10
2-Nitropropane	79-46-9	6.56E-08
Methyl methacrylate	80-62-6	0.00E+00
Hexamethylene-1,5-diisocyanate	822-06-0	0.00E+00
Toluene-2,6-diamine	823-40-5	0.00E+00
Pentachloronitrobenzene (PCNB)	82-68-8	4.90E-08
1-Methylphenanthrene	832-69-9	0.00E+00
Acenaphthene	83-32-9	1.39E-04
Diethyl phthalate	84-66-2	1.28E-05
Di-n-butylphthalate	84-74-2	2.50E-04
Phenanthrene	85-01-8	6.79E-05
Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	85-44-9	0.00E+00
Butylbenzylphthalate	85-68-7	5.68E-05
Fluorene	86-73-7	8.53E-05
1,2,3-Trichlorobenzene	87-61-6	0.00E+00
Hexachlorobutadiene	87-68-3	5.55E-08
Pentachlorophenol	87-86-5	5.99E-09
2,4,6-Trichlorophenol	88-06-2	4.88E-05
o-Nitroaniline (2-nitroaniline)	88-74-4	2.78E-06
2-Nitrophenol	88-75-5	1.60E-04
o-Anisidine	90-04-0	0.00E+00
1-Methylnaphthalene	90-12-0	0.00E+00
Naphthalene	91-20-3	4.13E-03
Quinoline	91-22-5	0.00E+00
2-Methylnaphthalene	91-57-6	3.11E-05
2-Chloronaphthalene	91-58-7	2.05E-05
3,3'-Dichlorobenzidine	91-94-1	8.71E-07
N-Nitroso-di-n-Buetylamine	924-16-3	0.00E+00
1,1`-Biphenyl	92-52-4	5.21E-08
Safrole (5-(2-Propenyl)-1,3-benzodioxole)	94-59-7	0.00E+00
2,4-D	94-75-7	0.00E+00
o-Cresol	95-48-7	1.83E-05
o-Chlorotoluene	95-49-8	0.00E+00
1,2-Dichlorobenzene	95-50-1	1.10E-07
o-Toluidine	95-53-4	0.00E+00
2-Chlorophenol	95-57-8	6.97E-05
1,2,4-Trimethyl benzene	95-63-6	0.00E+00
1,2,4,5-Tetrachlorobenzene	95-94-3	0.00E+00
2,4,5-Trichlorophenol	95-95-4	3.45E-05
1,2-Dibromo-3-chloropropane	96-12-8	0.00E+00
1,2,3-Trichloropropane	96-18-4	0.00E+00
Ethylene thiourea	96-45-7	0.00E+00
Ethyl methacrylate	97-63-2	0.00E+00
Furfural	98-01-1	0.00E+00
tert-Butyl benzene	98-06-6	0.00E+00
Benzotrichloride	98-07-7	0.00E+00
Cumene	98-82-8	6.40E-06
Methyl styrene (mixed isomers)	98-83-9	0.00E+00
Acetophenone	98-86-2	4.22E-08

Table A-12 EMF Emission Rates for the Pre-Demonstration Risk Assessment for the DFLAW Operating Configuration

COPC	CASRN	EMF Emissions Rate
Nitrobenzene	98-95-3	5.92E-05
1,3,5-Trinitrobenzene	99-35-4	0.00E+00
1,3-Dinitrobenzene	99-65-0	0.00E+00
p-Cymene	99-87-6	0.00E+00
Inorganics		**g/s**
Ozone	10028-15-6	0.00E+00
Nitrogen dioxide	10102-44-0	0.00E+00
Carbon dioxide	124-38-9	3.57E-02
Phosphate	14265-44-2	4.16E-12
Nitrate	14797-55-8	6.41E-11
Nitrite	14797-65-0	3.01E-11
Sulfate	14808-79-8	1.81E-12
Chloride	16887-00-6	1.01E-10
Fluoride	16984-48-8	2.56E-11
Methyl mercury	22967-92-6	0.00E+00
Bromide	24959-67-9	0.00E+00
Cyanide	57-12-5	8.12E-16
Dimethyl Mercury	593-74-8	9.55E-07
Carbon monoxide	630-08-0	0.00E+00
Aluminum	7429-90-5	3.87E-12
Iron	7439-89-6	2.20E-12
Lead	7439-92-1	1.73E-13
Lithium	7439-93-2	5.30E-15
Magnesium	7439-95-4	8.82E-14
Manganese	7439-96-5	6.65E-14
Mercury	7439-97-6	0.00E+00
Molybdenum	7439-98-7	2.02E-14
Nickel	7440-02-0	2.37E-14
Rhodium	7440-16-6	1.97E-19
Silver	7440-22-4	6.51E-16
Sodium	7440-23-5	1.52E-10
Strontium (total)	7440-24-6	4.80E-17
Tantalum	7440-25-7	8.19E-21
Thallium	7440-28-0	2.28E-18
Tin	7440-31-5	0.00E+00
Tungsten	7440-33-7	2.95E-14
Antimony	7440-36-0	1.14E-13
Arsenic	7440-38-2	1.53E-13
Barium	7440-39-3	8.85E-18
Beryllium	7440-41-7	7.40E-16
Cadmium	7440-43-9	3.43E-15
Chromium	7440-47-3	2.10E-12
Cobalt	7440-48-4	5.60E-18
Copper	7440-50-8	3.76E-15
Uranium	7440-61-1	1.59E-14
Vanadium	7440-62-2	1.53E-14
Yttrium	7440-65-5	6.03E-17
Zinc	7440-66-6	2.48E-12
Zirconium	7440-67-7	1.32E-13
Sulfur dioxide	7446-09-5	0.00E+00
Hydrogen chloride	7647-01-0	0.00E+00

Table A-12 EMF Emission Rates for the Pre-Demonstration Risk Assessment for the DFLAW Operating Configuration

COPC	CASRN	EMF Emissions Rate
Hydrogen fluoride	7664-39-3	0.00E+00
Ammonia/Ammonium	7664-41-7	1.51E-08
Total sulfur	7704-34-9	6.35E-13
Phosphorus	7723-14-0	1.36E-12
Fluorine gas	7782-41-4	0.00E+00
Selenium	7782-49-2	2.57E-13
Chlorine	7782-50-5	0.00E+00
Radionuclides		**Ci/s**
Tritium	10028-17-8	2.55E-12
Cesium-137	10045-97-3	1.88E-16
Yttrium-90 – Note 2	10098-91-6	3.01E-16
Strontium-90	10098-97-2	3.01E-16
Cobalt-60	10198-40-0	1.45E-25
Uranium-234	13966-29-5	5.93E-21
Ruthenium-106	13967-48-1	1.12E-24
Cesium-134	13967-70-9	2.71E-23
Uranium-233	13968-55-3	2.02E-20
Curium-244	13981-15-2	6.72E-19
Plutonium-238	13981-16-3	8.31E-20
Nickel-63	13981-37-8	2.28E-18
Plutonium-242	13982-10-0	6.67E-23
Radium-226	13982-63-3	5.82E-22
Uranium-236	13982-70-2	1.96E-22
Neptunium-237	13994-20-2	5.76E-20
Plutonium-241	14119-32-5	1.16E-18
Plutonium-240	14119-33-6	4.30E-19
Technetium-99	14133-76-7	6.97E-15
Uranium-232	14158-29-3	3.74E-22
Antimony-125	14234-35-6	4.82E-18
Protactinium-231	14331-85-2	8.17E-28
Nickel-59	14336-70-0	3.02E-20
Europium-155	14391-16-3	6.61E-25
Americium-241	14596-10-2	1.52E-17
Europium-152	14683-23-9	3.09E-25
Carbon-14	14762-75-5	2.26E-13
Actinium-227	14952-40-0	6.03E-21
Americium-243	14993-75-0	8.81E-21
Iodine-129	15046-84-1	5.34E-20
Plutonium-239	15117-48-3	1.85E-18
Uranium-235	15117-96-1	2.40E-22
Radium-228	15262-20-1	3.56E-20
Curium-242	15510-73-3	5.48E-19
Europium-154	15585-10-1	1.79E-24
Thorium-229	15594-54-4	4.11E-28
Samarium-151	15715-94-3	1.82E-21
Zirconium-93	15751-77-6	4.03E-24
Curium-243	15757-87-6	3.90E-20
Selenium-79	15758-45-9	4.07E-17
Tin-126	15832-50-5	2.20E-18
Barium-137m – Note 3	378253-40-8	1.78E-16
Cadmium-113m	378253-44-2	3.58E-18

Table A-12 EMF Emission Rates for the Pre-Demonstration Risk Assessment for the DFLAW Operating Configuration

COPC	CASRN	EMF Emissions Rate
Niobium-93m	378782-82-2	6.57E-24
Thorium-232	7440-29-1	9.03E-28
Uranium-238	7440-61-1R	5.33E-21

Notes:
1. The estimated EMF Facility exhaust mass flowrate of total PCBs for the refined feed vector is 6.81E-07 g/s.
2. ^{90}Y is assumed to be present in secular equilibrium with ^{90}Sr (Cember 1983).
3. The activity of ^{137}mBa is in secular equilibrium with ^{137}Cs (at 94.6% of the activity of ^{137}Cs) (24590-WTP-3DG-W12W-00002).

A.9 Flowsheet Model Results for the Baseline WTP Operating Configuration

This section summarizes the emission estimate results of the PEM for the baseline WTP operating configuration. The RAWP Supplements 2 and 3 should be consulted for further detail.

A.9.1 PT Facility

The PEM results for the PT Facility in baseline WTP operating configuration are provided in Table A-13 below. The table provides PEM results for the two main PT Facility exhaust flues, the pulse jet ventilation system (PJV) flue, and the pretreatment vessel vent process system (PVP) flue. Note that units of g/s apply to organics and inorganics, and units of Ci/s apply to radionuclides.

Table A-13 Process Emissions Model Results for PT Facility Emissions for the Baseline WTP Operating Configuration

CASRN	COPC	PT Facility PJV Emissions Rate	PT Facility PT Emissions Rate
Organics		**g/s**	**g/s**
100-02-7	p-Nitrophenol	3.11E-07	2.68E-12
100-21-0	Phthalic acid	1.56E-10	8.67E-16
100-25-4	1,4-Dinitrobenzene	2.83E-07	3.45E-10
100-40-3	4-Ethenylcyclohexene	5.10E-04	7.22E-07
100-41-4	Ethyl benzene	1.39E-08	1.99E-11
100-42-5	Styrene	9.48E-06	2.19E-08
100-44-7	Benzyl chloride	0.00E+00	0.00E+00
100-47-0	Benzonitrile	0.00E+00	0.00E+00
100-51-6	Benzyl alcohol	0.00E+00	0.00E+00
100-52-7	Benzaldehyde	0.00E+00	0.00E+00
10061-01-5	cis-1,3-Dichloropropene	2.45E-08	3.58E-11
10061-02-6	trans-1,3-Dichloropropene	2.54E-08	3.95E-11
101-55-3	4-Bromophenylphenyl ether	7.26E-04	4.41E-07
101-77-9	4,4-Methylenedianiline	0.00E+00	0.00E+00
103-33-3	Azobenzene	0.00E+00	0.00E+00
103-65-1	n-Propyl benzene (Isocumene)	0.00E+00	0.00E+00
104-51-8	n-Butylbenzene	0.00E+00	0.00E+00
104-76-7	2-Ethyl-1-hexanol	4.49E-04	5.62E-07
105-67-9	2,4-Dimethylphenol	1.60E-04	6.56E-07
10595-95-6	n-Nitrosomethylethylamine	1.50E-04	3.02E-07
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	0.00E+00	0.00E+00
106-44-5	p-Cresol (4-methyl phenol)	0.00E+00	0.00E+00
106-46-7	1,4-Dichlorobenzene	8.00E-06	3.81E-09

Table A-13 Process Emissions Model Results for PT Facility Emissions for the Baseline WTP Operating Configuration

CASRN	COPC	PT Facility PJV Emissions Rate	PT Facility PT Emissions Rate
106-47-8	p-Chloroaniline	1.14E-04	3.63E-07
106-49-0	p-Toluidine	0.00E+00	0.00E+00
106-51-4	Quinone	0.00E+00	0.00E+00
106-88-7	1,2-Epoxybutane	6.46E-04	3.36E-06
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	0.00E+00	0.00E+00
106-93-4	Ethylene dibromide	6.57E-09	5.19E-12
106-99-0	1,3-Butadiene	2.24E-07	1.58E-09
107-02-8	Acrolein	3.36E-07	2.02E-09
107-05-1	3-Chloropropene	2.46E-08	1.40E-10
107-06-2	1,2-Dichloroethane	2.39E-05	2.00E-07
107-12-0	Propionitrile	1.80E-06	1.91E-08
107-13-1	Acrylonitrile	1.44E-04	4.00E-06
107-19-7	Propargyl alcohol	0.00E+00	0.00E+00
107-21-1	Ethylene glycol (1,2-ethanediol)	0.00E+00	0.00E+00
107-98-2	Propylene glycol monomethyl ether	0.00E+00	0.00E+00
108-05-4	Acetic acid vinyl ester	7.96E-04	3.29E-06
108-10-1	4-Methyl-2-pentanone	8.14E-08	1.84E-10
108-39-4	m-Cresol	1.64E-04	2.83E-07
108-60-1	bis (2-Chloroisopropyl)ether	0.00E+00	0.00E+00
108-67-8	1,3,5-Trimethylbenzene	0.00E+00	0.00E+00
108-86-1	Bromobenzene (Phenyl bromide)	0.00E+00	0.00E+00
108-87-2	Methylcyclohexane	2.83E-08	4.01E-11
108-88-3	Toluene	4.03E-06	7.84E-09
108-90-7	Chlorobenzene	7.01E-06	1.51E-08
108-94-1	Cyclohexanone	1.12E-05	2.13E-08
108-95-2	Phenol	1.41E-05	2.13E-08
109-74-0	n-Butanenitrile	5.53E-04	1.97E-06
109-75-1	3-Butenenitrile	0.00E+00	0.00E+00
109-77-3	Malononitrile	0.00E+00	0.00E+00
109-86-4	2-Methoxyethanol	0.00E+00	0.00E+00
109-99-9	Tetrahydrofuran	2.38E-07	1.79E-09
110-00-9	Furan	0.00E+00	0.00E+00
110-54-3	n-Hexane	1.30E-06	4.59E-09
110-59-8	Pentanenitrile	5.56E-04	1.69E-06
110-80-5	2-Ethoxyethanol	2.68E-04	1.37E-06
110-82-7	Cyclohexane	2.46E-08	8.70E-11
110-83-8	Cyclohexene	2.46E-08	8.71E-11
110-86-1	Pyridine	2.68E-06	2.05E-08
111-15-9	Ethylene glycol monoethyl ether acetate	0.00E+00	0.00E+00
111-44-4	bis(2-Chloroethyl)ether	6.16E-05	2.94E-07
111-65-9	n-Octane	2.97E-07	4.20E-10
111-76-2	2-Butoxyethanol	1.08E-04	2.23E-07
111-84-2	n-Nonane	1.99E-07	7.03E-11
111-91-1	bis(2-Chloroethoxy)methane	4.12E-05	2.02E-07
1120-21-4	Undecane	0.00E+00	0.00E+00
1120-71-4	1,3-Propane sultone	0.00E+00	0.00E+00
112-30-1	1-Decanol	0.00E+00	0.00E+00
112-31-2	Decanal	0.00E+00	0.00E+00
112-40-3	Dodecane	0.00E+00	0.00E+00
117-81-7	Bis(2-ethylhexyl) phthalate	3.75E-05	1.15E-08
117-84-0	Di-n-octylphthalate	2.36E-03	1.85E-06
118-74-1	Hexachlorobenzene	5.88E-06	4.34E-09

Table A-13 Process Emissions Model Results for PT Facility Emissions for the Baseline WTP Operating Configuration

CASRN	COPC	PT Facility PJV Emissions Rate	PT Facility PT Emissions Rate
119-90-4	3,3'-Dimethoxybenzidine	0.00E+00	0.00E+00
120-12-7	Anthracene	4.57E-04	4.53E-07
120-82-1	1,2,4-Trichlorobenzene	4.89E-07	1.84E-10
120-83-2	2,4-Dichlorophenol	1.02E-03	3.74E-07
121-14-2	2,4-Dinitrotoluene	5.51E-05	1.68E-08
122-39-4	N,N-Diphenylamine	1.64E-07	3.58E-10
122-66-7	1,2-Diphenylhydrazine	0.00E+00	0.00E+00
123-33-1	Maleic hydrazide	0.00E+00	0.00E+00
123-38-6	Propionaldehyde	7.29E-07	8.74E-09
123-72-8	Butanal	6.30E-04	3.86E-06
123-91-1	1,4-Dioxan	7.89E-08	6.76E-10
124-18-5	Decane	0.00E+00	0.00E+00
124-48-1	Chlorodibromomethane	2.90E-05	5.40E-08
126-73-8	Tributyl phosphate	9.80E-05	1.95E-07
126-98-7	2-Methyl-2-propenenitrile	2.37E-07	1.13E-09
127-18-4	1,1,2,2-Tetrachloroethene	8.10E-09	5.76E-12
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	3.53E-06	7.84E-09
129-00-0	Pyrene	1.29E-03	2.55E-06
131-11-3	Dimethyl Phthalate	2.39E-06	7.12E-10
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	0.00E+00	0.00E+00
132-64-9	Dibenzofuran	2.48E-05	4.67E-08
1330-20-7	Xylenes (total)	7.43E-06	1.36E-08
133-06-2	Captan	0.00E+00	0.00E+00
1336-36-3	Polychlorinated biphenyls – Note 1	1.03E-03	1.04E-05
134-32-7	alpha-Naphthylamine	1.27E-05	4.66E-09
135-98-8	sec-Butylbenzene	0.00E+00	0.00E+00
141-78-6	Acetic acid ethyl ester	2.46E-08	1.42E-10
145-73-3	Endothall	0.00E+00	0.00E+00
156-59-2	cis-1,2-Dichloroethene	0.00E+00	0.00E+00
156-60-5	1,2-trans-Dichloroethene	1.82E-03	6.51E-06
1634-04-4	Methyl tert-butyl ether	6.53E-04	2.65E-06
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1.96E-13	8.06E-16
189-55-9	Dibenzo[a,i]pyrene	1.80E-06	1.89E-09
189-64-0	Dibenzo[a,h]pyrene	1.80E-06	1.89E-09
191-24-2	Benzo(g,h,i)perylene	4.82E-05	3.88E-08
191-30-0	Dibenzo(a,l)pyrene	1.80E-06	1.89E-09
192-65-4	Dibenzo[a,e]pyrene	1.80E-06	1.89E-09
192-97-2	Benzo(e)pyrene	0.00E+00	0.00E+00
193-39-5	Indeno(1,2,3-cd)pyrene	1.28E-04	3.13E-07
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	2.07E-13	4.82E-16
205-82-3	Benzo[j]fluoranthene	0.00E+00	0.00E+00
205-99-2	Benzo(b)fluoranthene	1.28E-04	6.23E-07
206-44-0	Fluoranthene	1.49E-03	2.50E-06
207-08-9	Benzo(k)fluoranthene	4.65E-05	8.68E-08
208-96-8	Acenaphthylene	4.70E-04	3.43E-07
218-01-9	Chrysene	4.52E-05	1.27E-07
224-42-0	Dibenz[a,j]acridine	2.99E-07	8.12E-11
2245-38-7	2,3,5-Trimethylnaphthalene	0.00E+00	0.00E+00
226-36-8	Dibenz[a,h]acridine	2.89E-07	7.88E-11
23950-58-5	Pronamide	0.00E+00	0.00E+00
27154-33-2	Trichlorofluoroethane	2.85E-03	2.03E-05
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	1.55E-11	4.97E-13

Table A-13 Process Emissions Model Results for PT Facility Emissions for the Baseline WTP Operating Configuration

CASRN	COPC	PT Facility PJV Emissions Rate	PT Facility PT Emissions Rate
319-84-6	alpha-BHC	1.43E-08	2.54E-11
319-85-7	beta-BHC	5.46E-07	1.28E-09
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	1.02E-11	1.07E-12
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	2.40E-12	4.34E-14
3268-87-9	Octachlorodibenzo(p)dioxin	4.53E-12	2.16E-14
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	3.81E-12	1.26E-14
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	1.10E-12	1.01E-13
3697-24-3	5-Methylchrysene	1.70E-04	7.13E-06
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	3.71E-12	1.74E-13
39001-02-0	Octachlorodibenzofuran	4.33E-13	1.43E-15
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	2.36E-13	2.00E-14
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	1.74E-12	1.28E-13
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	2.11E-13	1.79E-14
4170-30-3	Crotonaldehyde (Propylene aldehyde)	3.90E-07	5.67E-10
41851-50-7	Chlorocyclopentadiene	0.00E+00	0.00E+00
460-19-5	Cyanogen (oxalonitrile)	0.00E+00	0.00E+00
4786-20-3	2-Butenenitrile	0.00E+00	0.00E+00
50-00-0	Formaldehyde	4.90E-05	1.01E-06
50-32-8	Benzo(a)pyrene	5.12E-05	2.17E-07
506-68-3	Cyanogen bromide (bromocyanide)	0.00E+00	0.00E+00
506-77-4	Cyanogen chloride	0.00E+00	0.00E+00
510-15-6	Chlorobenzilate	0.00E+00	0.00E+00
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	9.78E-13	4.45E-15
51-28-5	2,4-Dinitrophenol	1.64E-04	2.09E-07
51-79-6	Ethyl carbamate (urethane)	0.00E+00	0.00E+00
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	3.77E-12	2.59E-13
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	0.00E+00	0.00E+00
532-27-4	2-Chloroacetophenone	0.00E+00	0.00E+00
534-52-1	4,6-Dinitro-o-cresol	1.91E-04	5.88E-07
53-70-3	Dibenz[a,h]anthracene	8.54E-07	1.72E-11
5385-75-1	Dibenzo(a,e)fluoranthene	0.00E+00	0.00E+00
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	6.37E-06	3.36E-08
540-73-8	1,2-Dimethylhydrazine	0.00E+00	0.00E+00
540-84-1	2,2,4-Trimethylpentane	0.00E+00	0.00E+00
541-73-1	1,3-Dichlorobenzene	3.22E-07	1.17E-10
542-75-6	1,3-Dichloropropene	0.00E+00	0.00E+00
542-88-1	bis(Chloromethyl)ether	0.00E+00	0.00E+00
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	1.75E-13	1.67E-14
56-23-5	Carbon tetrachloride	9.08E-07	1.58E-09
56-49-5	3-Methylcholanthrene	1.65E-04	6.96E-06
56-55-3	Benzo(a)anthracene	4.85E-05	2.06E-07
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	3.32E-13	1.54E-15
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	2.53E-13	1.15E-15
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	1.86E-13	1.84E-14
57-24-9	Strychnine	0.00E+00	0.00E+00
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	3.50E-12	1.77E-14
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	2.90E-13	2.59E-14
57-74-9	Chlordane	0.00E+00	0.00E+00
581-42-0	2,6-Dimethylnaphthalene	0.00E+00	0.00E+00
584-84-9	2,4-Toluene diisocyanate	0.00E+00	0.00E+00
58-89-9	gamma-BHC (Lindane)	1.28E-08	5.50E-10
58-90-2	2,3,4,6-Tetrachlorophenol	4.45E-04	9.59E-07

Table A-13 Process Emissions Model Results for PT Facility Emissions for the Baseline WTP Operating Configuration

CASRN	COPC	PT Facility PJV Emissions Rate	PT Facility PT Emissions Rate
589-38-8	3-Hexanone	5.87E-04	1.39E-06
591-50-4	Benzene, iodo-	0.00E+00	0.00E+00
591-78-6	2-Hexanone	9.69E-07	2.60E-09
593-60-2	Bromoethene (Vinyl bromide)	0.00E+00	0.00E+00
59-50-7	4-Chloro-3-methylphenol	4.34E-04	9.46E-07
59-89-2	N-Nitrosomorpholine	2.04E-05	2.30E-09
60-11-7	Dimethyl aminoazobenzene	0.00E+00	0.00E+00
602-87-9	5-Nitroacenaphthene	7.35E-05	2.72E-06
60-29-7	Ethyl ether	9.16E-07	5.55E-09
60-35-5	Acetamide	7.78E-07	2.24E-11
606-20-2	2,6-Dinitrotoluene	2.25E-05	4.51E-08
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	1.15E-13	1.13E-14
608-93-5	Pentachlorobenzene	0.00E+00	0.00E+00
61626-71-9	Dichloropentadiene	0.00E+00	0.00E+00
621-64-7	N-Nitroso-di-n-propylamine	3.95E-04	8.55E-07
624-83-9	Methyl isocyanate	0.00E+00	0.00E+00
62-50-0	Ethyl methanesulfonate	0.00E+00	0.00E+00
62-53-3	Aniline	0.00E+00	0.00E+00
62-75-9	N-Nitroso-N,N-dimethylamine	1.79E-06	3.76E-09
628-73-9	Hexanenitrile	5.57E-04	3.70E-07
630-20-6	1,1,1,2-Tetrachloroethane	3.15E-03	2.31E-06
64-18-6	Formic acid (methanoic acid)	0.00E+00	0.00E+00
65510-44-3	2’,3,4,4’,5-Pentachlorobiphenyl (PCB 123)	4.37E-10	1.13E-10
65-85-0	Benzoic acid	0.00E+00	0.00E+00
67-56-1	Methyl alcohol	3.70E-04	7.87E-06
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	5.49E-13	5.24E-14
67-63-0	2-Propyl alcohol	3.02E-07	5.89E-09
67-64-1	2-Propanone (Acetone)	3.52E-04	1.40E-05
67-66-3	Chloroform	7.01E-06	3.77E-08
67-72-1	Hexachloroethane	9.80E-05	3.54E-08
69782-90-7	2,3,3’,4,4’,5’-Hexachlorobiphenyl (PCB 157)	5.26E-12	3.86E-13
70-30-4	Hexachlorophene	0.00E+00	0.00E+00
70362-50-4	3,4,4’,5-Tetrachlorobiphenyl (PCB 81)	2.54E-12	2.31E-13
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	4.37E-13	3.93E-14
71-36-3	n-Butyl alcohol	9.18E-06	7.00E-08
71-43-2	Benzene	4.71E-06	2.35E-08
71-55-6	1,1,1-Trichloroethane	8.23E-09	2.93E-11
72-43-5	Methoxychlor	0.00E+00	0.00E+00
72-55-9	4,4-DDE	5.82E-04	8.12E-07
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	6.84E-14	3.40E-16
74472-37-0	2,3,4,4’,5-Pentachlorobiphenyl (PCB 114)	1.82E-12	1.05E-13
74-83-9	Bromomethane	4.24E-06	4.16E-08
74-87-3	Chloromethane	3.04E-06	2.86E-08
74-88-4	Iodomethane	4.75E-06	3.83E-08
74-95-3	Methylene bromide	0.00E+00	0.00E+00
74-97-5	Bromochloromethane	0.00E+00	0.00E+00
75-00-3	Chloroethane	1.66E-08	1.19E-10
75-01-4	1-Chloroethene	1.69E-08	1.20E-10
75-02-5	Fluoroethene (vinyl fluoride)	8.68E-04	6.14E-06
75-05-8	Acetonitrile	3.47E-03	2.91E-04
75-07-0	Acetaldehyde	7.45E-04	1.08E-05
75-09-2	Dichloromethane (Methylene Chloride)	3.04E-04	2.97E-06

Table A-13 Process Emissions Model Results for PT Facility Emissions for the Baseline WTP Operating Configuration

CASRN	COPC	PT Facility PJV Emissions Rate	PT Facility PT Emissions Rate
75-15-0	Carbon disulfide	4.17E-07	1.82E-10
75-21-8	Ethylene oxide (Oxirane)	1.35E-06	1.50E-08
75-25-2	Bromoform	4.13E-09	3.49E-12
75-27-4	Bromodichloromethane	6.13E-03	9.15E-06
75-29-6	2-Chloropropane	0.00E+00	0.00E+00
75-34-3	1,1-Dichloroethane	6.65E-09	2.39E-11
75-35-4	1,1-Dichloroethene	1.05E-08	5.95E-11
75-44-5	Phosgene (hydrogen phosphide)	0.00E+00	0.00E+00
75-45-6	Chlorodifluoromethane	2.46E-08	1.74E-10
75-50-3	Trimethylamine	6.83E-04	8.72E-06
75-69-4	Trichlorofluoromethane	2.02E-08	1.43E-10
75-71-8	Dichlorodifluoromethane	2.06E-08	1.46E-10
76-01-7	Pentachloroethane	0.00E+00	0.00E+00
76-13-1	1,2,2-Trichlorotrifluoroethane	2.04E-08	7.21E-11
764-41-0	1,4-Dichloro-2-butene	0.00E+00	0.00E+00
76-44-8	Heptachlor	1.91E-08	6.77E-12
765-34-4	Glycidylaldehyde	0.00E+00	0.00E+00
77-47-4	Hexachlorocyclopentadiene	3.42E-06	1.50E-09
77-78-1	Dimethyl sulfate	0.00E+00	0.00E+00
78-83-1	2-Methylpropyl alcohol	5.64E-03	4.18E-05
78-87-5	1,2-Dichloropropane	6.64E-09	2.42E-11
78-93-3	2-Butanone	1.54E-04	5.45E-06
79-00-5	1,1,2-Trichloroethane	7.73E-09	1.20E-11
79-01-6	1,1,2-Trichloroethylene	2.67E-06	1.24E-08
79-10-7	2-Propenoic acid	8.16E-05	8.98E-08
79-34-5	1,1,2,2-Tetrachloroethane	7.60E-09	6.72E-12
79-46-9	2-Nitropropane	1.53E-06	3.69E-09
80-62-6	Methyl methacrylate	0.00E+00	0.00E+00
822-06-0	Hexamethylene-1,5-diisocyanate	0.00E+00	0.00E+00
823-40-5	Toluene-2,6-diamine	0.00E+00	0.00E+00
82-68-8	Pentachloronitrobenzene (PCNB)	1.51E-06	6.56E-10
832-69-9	1-Methylphenanthrene	0.00E+00	0.00E+00
83-32-9	Acenaphthene	2.25E-03	1.26E-06
84-66-2	Diethyl phthalate	6.08E-05	7.39E-08
84-74-2	Di-n-butylphthalate	2.55E-03	5.60E-06
85-01-8	Phenanthrene	3.88E-04	6.81E-07
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	0.00E+00	0.00E+00
85-68-7	Butylbenzylphthalate	6.36E-04	1.27E-06
86-73-7	Fluorene	4.67E-04	4.88E-07
87-61-6	1,2,3-Trichlorobenzene	0.00E+00	0.00E+00
87-68-3	Hexachlorobutadiene	4.22E-06	1.51E-09
87-86-5	Pentachlorophenol	2.89E-08	2.42E-12
88-06-2	2,4,6-Trichlorophenol	8.96E-04	1.76E-06
88-74-4	o-Nitroaniline (2-nitroaniline)	3.41E-06	1.05E-09
88-75-5	2-Nitrophenol	1.15E-03	2.62E-06
90-04-0	o-Anisidine	0.00E+00	0.00E+00
90-12-0	1-Methylnaphthalene	0.00E+00	0.00E+00
91-20-3	Naphthalene	3.70E-03	2.75E-06
91-22-5	Quinoline	0.00E+00	0.00E+00
91-57-6	2-Methylnaphthalene	5.57E-05	1.70E-07
91-58-7	2-Chloronaphthalene	5.95E-04	2.67E-07
91-94-1	3,3'-Dichlorobenzidine	7.58E-07	1.19E-11

Table A-13 Process Emissions Model Results for PT Facility Emissions for the Baseline WTP Operating Configuration

CASRN	COPC	PT Facility PJV Emissions Rate	PT Facility PT Emissions Rate
924-16-3	N-Nitroso-di-n-Buetylamine	0.00E+00	0.00E+00
92-52-4	1,1`-Biphenyl	1.51E-06	6.80E-10
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	0.00E+00	0.00E+00
94-75-7	2,4-D	0.00E+00	0.00E+00
95-48-7	o-Cresol	2.92E-04	5.62E-07
95-49-8	o-Chlorotoluene	0.00E+00	0.00E+00
95-50-1	1,2-Dichlorobenzene	6.59E-06	2.47E-09
95-53-4	o-Toluidine	0.00E+00	0.00E+00
95-57-8	2-Chlorophenol	2.25E-03	9.82E-07
95-63-6	1,2,4-Trimethyl benzene	0.00E+00	0.00E+00
95-94-3	1,2,4,5-Tetrachlorobenzene	0.00E+00	0.00E+00
95-95-4	2,4,5-Trichlorophenol	6.11E-04	1.33E-06
96-12-8	1,2-Dibromo-3-chloropropane	0.00E+00	0.00E+00
96-18-4	1,2,3-Trichloropropane	0.00E+00	0.00E+00
96-45-7	Ethylene thiourea	0.00E+00	0.00E+00
97-63-2	Ethyl methacrylate	0.00E+00	0.00E+00
98-01-1	Furfural	0.00E+00	0.00E+00
98-06-6	tert-Butyl benzene	0.00E+00	0.00E+00
98-07-7	Benzotrichloride	0.00E+00	0.00E+00
98-82-8	Cumene	5.02E-04	1.78E-07
98-83-9	Methyl styrene (mixed isomers)	0.00E+00	0.00E+00
98-86-2	Acetophenone	1.11E-06	2.91E-09
98-95-3	Nitrobenzene	6.22E-05	2.68E-07
99-35-4	1,3,5-Trinitrobenzene	0.00E+00	0.00E+00
99-65-0	1,3-Dinitrobenzene	0.00E+00	0.00E+00
99-87-6	p-Cymene	0.00E+00	0.00E+00
Inorganics		**g/s**	**g/s**
10028-15-6	Ozone	N/A	N/A
10102-44-0	Nitrogen dioxide	0.00E+00	1.29E-02
124-38-9	Carbon dioxide	5.85E+00	6.74E-01
14265-44-2	Phosphate	2.82E-08	1.12E-11
14265-44-2	Phosphate (ppt) - Note 7	0.00E+00	2.24E-11
14797-55-8	Nitrate	7.68E-07	1.07E-10
14797-65-0	Nitrite	1.79E-07	2.33E-11
14808-79-8	Sulfate	2.80E-08	4.15E-12
16887-00-6	Chloride	1.11E-08	1.30E-12
16984-48-8	Fluoride	1.64E-08	3.55E-12
16984-48-8	Fluoride (ppt) - Note 6	0.00E+00	2.24E-12
22967-92-6	Methylmercury	N/A	N/A
24959-67-9	Bromide	N/A	N/A
57-12-5	Cyanide	1.77E-12	2.60E-15
593-74-8	Dimethylmercury	3.77E-06	2.27E-08
630-08-0	Carbon monoxide	0.00E+00	0.00E+00
7429-90-5	Aluminum	3.22E-08	1.67E-11
7429-90-5	Aluminum (ppt) - Note 2	0.00E+00	5.38E-15
7439-89-6	Iron - Note 4	2.64E-10	3.36E-12
7439-92-1	Lead	1.02E-10	2.09E-13
7439-93-2	Lithium	3.71E-12	7.64E-14
7439-95-4	Magnesium	2.20E-11	7.70E-14
7439-96-5	Manganese	2.44E-11	4.68E-13
7439-97-6	Mercury (elemental)	0.00E+00	1.50E-06
7439-97-6	Mercury (Hg^{+2})	1.59E-11	4.02E-13

Table A-13 Process Emissions Model Results for PT Facility Emissions for the Baseline WTP Operating Configuration

CASRN	COPC	PT Facility PJV Emissions Rate	PT Facility PT Emissions Rate
7439-98-7	Molybdenum	4.62E-11	1.48E-14
7440-02-0	Nickel	1.64E-10	2.99E-13
7440-16-6	Rhodium	3.91E-12	2.21E-15
7440-22-4	Silver	4.77E-12	9.84E-15
7440-23-5	Sodium	4.82E-07	7.06E-11
7440-23-5	Sodium (ppt) - Note 5	0.00E+00	1.90E-11
7440-24-6	Strontium (total) - Note 11	7.92E-11	1.26E-13
7440-25-7	Tantalum	2.94E-12	5.24E-16
7440-28-0	Thallium	2.35E-11	2.08E-14
7440-31-5	Tin	N/A	N/A
7440-33-7	Tungsten	1.13E-11	9.60E-15
7440-36-0	Antimony	1.79E-11	8.15E-15
7440-38-2	Arsenic	1.79E-11	1.14E-14
7440-39-3	Barium	3.78E-12	2.33E-14
7440-41-7	Beryllium	8.80E-13	1.20E-15
7440-43-9	Cadmium	1.65E-11	2.20E-14
7440-47-3	Chromium - Note 3	2.62E-09	1.24E-12
7440-48-4	Cobalt	4.57E-12	3.74E-15
7440-50-8	Copper	6.11E-12	7.11E-15
7440-61-1	Uranium	1.17E-10	1.10E-12
7440-62-2	Vanadium	5.07E-12	6.31E-15
7440-65-5	Yttrium	1.91E-12	1.35E-15
7440-66-6	Zinc	6.89E-12	1.05E-13
7440-67-7	Zirconium	9.95E-11	1.16E-12
7446-09-5	Sulfur dioxide	0.00E+00	0.00E+00
7647-01-0	Hydrogen chloride	0.00E+00	0.00E+00
7664-39-3	Hydrogen fluoride	0.00E+00	0.00E+00
7664-41-7	Ammonia/Ammonium	1.30E-10	3.39E-11
7704-34-9	Total sulfur - Note 9	9.60E-09	1.43E-12
7723-14-0	Phosphorus - Note 8	9.20E-09	1.10E-11
7782-41-4	Fluorine gas	0.00E+00	0.00E+00
7782-49-2	Selenium	6.44E-11	9.38E-15
7782-50-5	Chlorine	0.00E+00	0.00E+00
PM	Particulate Matter - Note 10	0.00E+00	1.03E-10
Radionuclides		**Ci/s**	**Ci/s**
10028-17-8	Tritium	2.79E-09	2.61E-11
10045-97-3	Cesium-137	1.56E-10	5.27E-14
10098-91-6	Yttrium-90	N/A	N/A
10098-97-2	Strontium-90	3.72E-12	4.68E-14
10198-40-0	Cobalt-60	7.34E-17	8.42E-20
13966-29-5	Uranium-234	4.23E-17	3.40E-19
13967-48-1	Ruthenium-106	4.58E-25	3.85E-28
13967-70-9	Cesium-134	4.05E-19	1.31E-22
13968-55-3	Uranium-233	9.37E-17	1.20E-18
13981-15-2	Curium-244	8.41E-17	1.55E-19
13981-16-3	Plutonium-238	4.30E-16	4.20E-18
13981-37-8	Nickel-63	1.42E-13	1.45E-16
13982-10-0	Plutonium-242	4.29E-19	1.11E-21
13982-63-3	Radium-226	4.41E-12	5.32E-16
13982-70-2	Uranium-236	1.31E-18	9.46E-21
13994-20-2	Neptunium-237	2.41E-16	3.21E-19
14119-32-5	Plutonium-241	1.62E-15	1.65E-17

Table A-13 Process Emissions Model Results for PT Facility Emissions for the Baseline WTP Operating Configuration

CASRN	COPC	PT Facility PJV Emissions Rate	PT Facility PT Emissions Rate
14119-33-6	Plutonium-240	1.32E-15	1.41E-17
14133-76-7	Technetium-99	4.48E-13	6.03E-17
14158-29-3	Uranium-232	2.00E-18	1.44E-20
14234-35-6	Antimony-125	9.43E-18	2.96E-21
14331-85-2	Protactinium-231	2.73E-17	1.16E-20
14336-70-0	Nickel-59	2.40E-15	2.30E-18
14391-16-3	Europium-155	8.95E-17	4.70E-19
14596-10-2	Americium-241	5.44E-14	4.16E-16
14683-23-9	Europium-152	4.83E-16	7.35E-19
14762-75-5	Carbon-14	8.05E-15	1.12E-18
14952-40-0	Actinium-227	1.99E-17	1.20E-20
14993-75-0	Americium-243	2.43E-17	1.79E-19
15046-84-1	Iodine-129	3.45E-16	5.63E-20
15117-48-3	Plutonium-239	6.36E-15	6.74E-17
15117-96-1	Uranium-235	1.63E-18	1.28E-20
15262-20-1	Radium-228	2.47E-18	1.96E-20
15510-73-3	Curium-242	8.75E-17	1.38E-19
15585-10-1	Europium-154	1.50E-15	7.15E-18
15594-54-4	Thorium-229	1.22E-18	3.63E-21
15715-94-3	Samarium-151	2.39E-12	5.08E-15
15751-77-6	Zirconium-93	1.44E-14	4.75E-18
15757-87-6	Curium-243	6.84E-18	1.20E-20
15758-45-9	Selenium-79	1.00E-14	1.36E-18
15832-50-5	Tin-126	9.50E-15	2.34E-18
378253-40-8	Barium-137m	N/A	N/A
378253-44-2	Cadmium-113m	4.67E-15	1.17E-18
378782-82-2	Niobium-93m	1.54E-14	5.09E-18
7440-29-1	Thorium-232	1.98E-18	1.48E-20
7440-61-1R	Uranium-238	5.00E-17	3.68E-19

Notes:
1. The estimated PJV and PVP exhaust mass flowrates of total PCBs for the refined feed vector are 1.85E-04 g/s and 1.75E-06 g/s, respectively.
2. Aluminum (ppt) is aluminum ion precipitated as gibbsite.
3. Chromium includes Cr^{3+} and Cr^{6+} ions.
4. Iron includes Fe^{2+} and Fe^{3+} ions.
5. Sodium (ppt) is sodium ion precipitated as sodium fluoride phosphate, sodium phosphate, or sodium oxalate.
6. Fluoride (ppt) is fluoride ion precipitated as sodium fluoride phosphate.
7. Phosphate (ppt) is phosphate ion precipitated as sodium fluoride phosphate or sodium phosphate
8. Phosphorus includes portions of phosphate, phosphate (ppt), dihydrogen phosphate, hydrogen phosphate, phosphorus dioxide, and diphosphorus pentoxide(s).
9. Total sulfur includes portions of sulfate, hydrogen sulfite, hydrogen sulfate, sulfite, sulfur dioxide, and sulfur trioxide(s).
10. Particulate matter includes solid organics, solid cations, solid anions, solid radionuclides, sodium chloride(s), sodium cyanide(s), sodium fluoride(s), sodium iodide(s), diphosphorus pentoxide(s), and sulfur trioxide(s).
11. Strontium (total) includes strontium as an inorganic and radionuclide.

A.9.2 LAW Facility

The PEM results for the LAW Facility in baseline WTP operating configuration are provided in Table A-14 below. Note that units of g/s apply to organics and inorganics, and units of Ci/s apply to radionuclides.

Table A-14 Process Emissions Model Results for LAW Facility Emissions for the Baseline WTP Operating Configuration

CASRN	COPC	LAW Facility Emissions Rate
Organics		**g/s**
100-02-7	p-Nitrophenol	7.16E-05
100-21-0	Phthalic acid	3.50E-11
100-25-4	1,4-Dinitrobenzene	9.09E-10
100-40-3	4-Ethenylcyclohexene	3.41E-24
100-41-4	Ethyl benzene	1.00E-24
100-42-5	Styrene	2.36E-05
100-44-7	Benzyl chloride	0.00E+00
100-47-0	Benzonitrile	0.00E+00
100-51-6	Benzyl alcohol	0.00E+00
100-52-7	Benzaldehyde	0.00E+00
10061-01-5	cis-1,3-Dichloropropene	3.92E-22
10061-02-6	trans-1,3-Dichloropropene	1.17E-19
101-55-3	4-Bromophenylphenyl ether	1.43E-11
101-77-9	4,4-Methylenedianiline	0.00E+00
103-33-3	Azobenzene	0.00E+00
103-65-1	n-Propyl benzene (Isocumene)	0.00E+00
104-51-8	n-Butylbenzene	0.00E+00
104-76-7	2-Ethyl-1-hexanol	4.34E-10
105-67-9	2,4-Dimethylphenol	1.06E-05
10595-95-6	n-Nitrosomethylethylamine	2.78E-08
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	0.00E+00
106-44-5	p-Cresol (4-methyl phenol)	0.00E+00
106-46-7	1,4-Dichlorobenzene	2.58E-06
106-47-8	p-Chloroaniline	1.08E-05
106-49-0	p-Toluidine	0.00E+00
106-51-4	Quinone	0.00E+00
106-88-7	1,2-Epoxybutane	2.78E-12
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	0.00E+00
106-93-4	Ethylene dibromide	6.69E-20
106-99-0	1,3-Butadiene	0.00E+00
107-02-8	Acrolein	5.88E-15
107-05-1	3-Chloropropene	2.57E-25
107-06-2	1,2-Dichloroethane	2.36E-05
107-12-0	Propionitrile	8.21E-13
107-13-1	Acrylonitrile	2.36E-05
107-19-7	Propargyl alcohol	0.00E+00
107-21-1	Ethylene glycol (1,2-ethanediol)	0.00E+00
107-98-2	Propylene glycol monomethyl ether	0.00E+00
108-05-4	Acetic acid vinyl ester	4.65E-14
108-10-1	4-Methyl-2-pentanone	8.51E-16
108-39-4	m-Cresol	7.39E-08
108-60-1	bis (2-Chloroisopropyl)ether	0.00E+00
108-67-8	1,3,5-Trimethylbenzene	0.00E+00
108-86-1	Bromobenzene (Phenyl bromide)	0.00E+00
108-87-2	Methylcyclohexane	0.00E+00
108-88-3	Toluene	2.36E-05
108-90-7	Chlorobenzene	2.36E-05
108-94-1	Cyclohexanone	8.75E-11
108-95-2	Phenol	5.39E-06
109-74-0	n-Butanenitrile	1.08E-10
109-75-1	3-Butenenitrile	0.00E+00
109-77-3	Malononitrile	0.00E+00

Table A-14 Process Emissions Model Results for LAW Facility Emissions for the Baseline WTP Operating Configuration

CASRN	COPC	LAW Facility Emissions Rate
109-86-4	2-Methoxyethanol	0.00E+00
109-99-9	Tetrahydrofuran	1.93E-14
110-00-9	Furan	0.00E+00
110-54-3	n-Hexane	0.00E+00
110-59-8	Pentanenitrile	4.68E-11
110-80-5	2-Ethoxyethanol	3.31E-07
110-82-7	Cyclohexane	0.00E+00
110-83-8	Cyclohexene	0.00E+00
110-86-1	Pyridine	2.16E-11
111-15-9	Ethylene glycol monoethyl ether acetate	0.00E+00
111-44-4	bis(2-Chloroethyl)ether	2.20E-06
111-65-9	n-Octane	0.00E+00
111-76-2	2-Butoxyethanol	1.69E-08
111-84-2	n-Nonane	4.71E-22
111-91-1	bis(2-Chloroethoxy)methane	1.95E-06
1120-21-4	Undecane	0.00E+00
1120-71-4	1,3-Propane sultone	0.00E+00
112-30-1	1-Decanol	0.00E+00
112-31-2	Decanal	0.00E+00
112-40-3	Dodecane	0.00E+00
117-81-7	Bis(2-ethylhexyl) phthalate	2.60E-05
117-84-0	Di-n-octylphthalate	2.61E-10
118-74-1	Hexachlorobenzene	2.22E-06
119-90-4	3,3'-Dimethoxybenzidine	0.00E+00
120-12-7	Anthracene	1.73E-06
120-82-1	1,2,4-Trichlorobenzene	2.15E-19
120-83-2	2,4-Dichlorophenol	3.00E-17
121-14-2	2,4-Dinitrotoluene	2.85E-05
122-39-4	N,N-Diphenylamine	1.38E-11
122-66-7	1,2-Diphenylhydrazine	0.00E+00
123-33-1	Maleic hydrazide	0.00E+00
123-38-6	Propionaldehyde	5.71E-14
123-72-8	Butanal	1.27E-11
123-91-1	1,4-Dioxan	1.85E-12
124-18-5	Decane	0.00E+00
124-48-1	Chlorodibromomethane	2.36E-05
126-73-8	Tributyl phosphate	2.79E-08
126-98-7	2-Methyl-2-propenenitrile	3.08E-16
127-18-4	1,1,2,2-Tetrachloroethene	0.00E+00
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	1.38E-10
129-00-0	Pyrene	1.96E-06
131-11-3	Dimethyl Phthalate	1.40E-05
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	0.00E+00
132-64-9	Dibenzofuran	1.82E-05
1330-20-7	Xylenes (total)	2.36E-05
133-06-2	Captan	0.00E+00
1336-36-3	Polychlorinated biphenyls – Note 1	1.26E-12
134-32-7	alpha-Naphthylamine	2.49E-07
135-98-8	sec-Butylbenzene	0.00E+00
141-78-6	Acetic acid ethyl ester	2.98E-16
145-73-3	Endothall	0.00E+00
156-59-2	cis-1,2-Dichloroethene	0.00E+00
156-60-5	1,2-trans-Dichloroethene	5.36E-20

Table A-14 Process Emissions Model Results for LAW Facility Emissions for the Baseline WTP Operating Configuration

CASRN	COPC	LAW Facility Emissions Rate
1634-04-4	Methyl tert-butyl ether	1.99E-14
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1.50E-12
189-55-9	Dibenzo[a,i]pyrene	4.08E-07
189-64-0	Dibenzo[a,h]pyrene	4.08E-07
191-24-2	Benzo(g,h,i)perylene	3.68E-05
191-30-0	Dibenzo(a,l)pyrene	4.08E-07
192-65-4	Dibenzo[a,e]pyrene	4.08E-07
192-97-2	Benzo(e)pyrene	0.00E+00
193-39-5	Indeno(1,2,3-cd)pyrene	3.06E-05
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	1.69E-12
205-82-3	Benzo[j]fluoranthene	0.00E+00
205-99-2	Benzo(b)fluoranthene	3.57E-05
206-44-0	Fluoranthene	1.84E-06
207-08-9	Benzo(k)fluoranthene	4.18E-05
208-96-8	Acenaphthylene	1.39E-05
218-01-9	Chrysene	2.20E-06
224-42-0	Dibenz[a,j]acridine	8.38E-08
2245-38-7	2,3,5-Trimethylnaphthalene	0.00E+00
226-36-8	Dibenz[a,h]acridine	7.80E-08
23950-58-5	Pronamide	0.00E+00
27154-33-2	Trichlorofluoroethane	5.11E-20
31508-00-6	2,3’,4,4’,5-Pentachlorobiphenyl (PCB 118)	9.24E-10
319-84-6	alpha-BHC	8.95E-14
319-85-7	beta-BHC	6.19E-09
32598-13-3	3,3’,4,4’-Tetrachlorobiphenyl (PCB 77)	2.81E-10
32598-14-4	2,3,3’,4,4’-Pentachlorobiphenyl (PCB 105)	3.85E-10
3268-87-9	Octachlorodibenzo(p)dioxin	2.44E-11
32774-16-6	3,3’,4,4’,5,5’-Hexachlorobiphenyl (PCB 169)	1.83E-10
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	7.13E-12
3697-24-3	5-Methylchrysene	3.81E-09
38380-08-4	2,3,3’,4,4’,5-Hexachlorobiphenyl (PCB 156)	1.61E-10
39001-02-0	Octachlorodibenzofuran	3.89E-11
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	1.29E-12
39635-31-9	2,3,3’,4,4’,5,5’-Heptachlorobiphenyl (PCB 189)	3.62E-11
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	9.70E-13
4170-30-3	Crotonaldehyde (Propylene aldehyde)	3.39E-21
41851-50-7	Chlorocyclopentadiene	0.00E+00
460-19-5	Cyanogen (oxalonitrile)	0.00E+00
4786-20-3	2-Butenenitrile	0.00E+00
50-00-0	Formaldehyde	1.01E-07
50-32-8	Benzo(a)pyrene	1.92E-05
506-68-3	Cyanogen bromide (bromocyanide)	0.00E+00
506-77-4	Cyanogen chloride	0.00E+00
510-15-6	Chlorobenzilate	0.00E+00
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	7.91E-12
51-28-5	2,4-Dinitrophenol	2.52E-04
51-79-6	Ethyl carbamate (urethane)	0.00E+00
52663-72-6	2,3’,4,4’,5,5’-Hexachlorobiphenyl (PCB 167)	1.32E-10
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	0.00E+00
532-27-4	2-Chloroacetophenone	0.00E+00
534-52-1	4,6-Dinitro-o-cresol	2.20E-05
53-70-3	Dibenz[a,h]anthracene	3.22E-05
5385-75-1	Dibenzo(a,e)fluoranthene	0.00E+00

Table A-14 Process Emissions Model Results for LAW Facility Emissions for the Baseline WTP Operating Configuration

CASRN	COPC	LAW Facility Emissions Rate
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	2.36E-05
540-73-8	1,2-Dimethylhydrazine	0.00E+00
540-84-1	2,2,4-Trimethylpentane	0.00E+00
541-73-1	1,3-Dichlorobenzene	2.63E-21
542-75-6	1,3-Dichloropropene	0.00E+00
542-88-1	bis(Chloromethyl)ether	0.00E+00
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	1.80E-11
56-23-5	Carbon tetrachloride	2.36E-05
56-49-5	3-Methylcholanthrene	4.08E-09
56-55-3	Benzo(a)anthracene	2.22E-06
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	5.91E-12
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	7.91E-12
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	1.29E-11
57-24-9	Strychnine	0.00E+00
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	1.96E-10
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	1.21E-12
57-74-9	Chlordane	0.00E+00
581-42-0	2,6-Dimethylnaphthalene	0.00E+00
584-84-9	2,4-Toluene diisocyanate	0.00E+00
58-89-9	gamma-BHC (Lindane)	4.12E-13
58-90-2	2,3,4,6-Tetrachlorophenol	1.52E-08
589-38-8	3-Hexanone	8.97E-12
591-50-4	Benzene, iodo-	0.00E+00
591-78-6	2-Hexanone	3.76E-14
593-60-2	Bromoethene (Vinyl bromide)	0.00E+00
59-50-7	4-Chloro-3-methylphenol	3.23E-08
59-89-2	N-Nitrosomorpholine	1.10E-06
60-11-7	Dimethyl aminoazobenzene	0.00E+00
602-87-9	5-Nitroacenaphthene	3.23E-08
60-29-7	Ethyl ether	7.67E-19
60-35-5	Acetamide	9.86E-08
606-20-2	2,6-Dinitrotoluene	2.26E-05
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	5.49E-12
608-93-5	Pentachlorobenzene	0.00E+00
61626-71-9	Dichloropentadiene	0.00E+00
621-64-7	N-Nitroso-di-n-propylamine	3.41E-08
624-83-9	Methyl isocyanate	0.00E+00
62-50-0	Ethyl methanesulfonate	0.00E+00
62-53-3	Aniline	0.00E+00
62-75-9	N-Nitroso-N,N-dimethylamine	2.24E-10
628-73-9	Hexanenitrile	2.05E-11
630-20-6	1,1,1,2-Tetrachloroethane	8.89E-17
64-18-6	Formic acid (methanoic acid)	0.00E+00
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	8.99E-11
65-85-0	Benzoic acid	0.00E+00
67-56-1	Methyl alcohol	7.50E-09
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	4.38E-11
67-63-0	2-Propyl alcohol	2.78E-12
67-64-1	2-Propanone (Acetone)	7.45E-05
67-66-3	Chloroform	2.36E-05
67-72-1	Hexachloroethane	2.57E-19
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	1.62E-10
70-30-4	Hexachlorophene	0.00E+00

Table A-14 Process Emissions Model Results for LAW Facility Emissions for the Baseline WTP Operating Configuration

CASRN	COPC	LAW Facility Emissions Rate
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	4.86E-11
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	2.96E-11
71-36-3	n-Butyl alcohol	7.44E-11
71-43-2	Benzene	2.36E-05
71-55-6	1,1,1-Trichloroethane	0.00E+00
72-43-5	Methoxychlor	0.00E+00
72-55-9	4,4-DDE	1.02E-09
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	3.25E-12
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	7.74E-11
74-83-9	Bromomethane	1.99E-03
74-87-3	Chloromethane	9.68E-04
74-88-4	Iodomethane	1.70E-03
74-95-3	Methylene bromide	0.00E+00
74-97-5	Bromochloromethane	0.00E+00
75-00-3	Chloroethane	6.86E-25
75-01-4	1-Chloroethene	0.00E+00
75-02-5	Fluoroethene (vinyl fluoride)	3.06E-26
75-05-8	Acetonitrile	3.28E-04
75-07-0	Acetaldehyde	4.74E-11
75-09-2	Dichloromethane (Methylene Chloride)	8.35E-02
75-15-0	Carbon disulfide	2.36E-05
75-21-8	Ethylene oxide (Oxirane)	1.17E-14
75-25-2	Bromoform	2.36E-05
75-27-4	Bromodichloromethane	1.38E-15
75-29-6	2-Chloropropane	0.00E+00
75-34-3	1,1-Dichloroethane	2.78E-24
75-35-4	1,1-Dichloroethene	0.00E+00
75-44-5	Phosgene (hydrogen phosphide)	0.00E+00
75-45-6	Chlorodifluoromethane	0.00E+00
75-50-3	Trimethylamine	1.89E-11
75-69-4	Trichlorofluoromethane	0.00E+00
75-71-8	Dichlorodifluoromethane	0.00E+00
76-01-7	Pentachloroethane	0.00E+00
76-13-1	1,2,2-Trichlorotrifluoroethane	4.64E-22
764-41-0	1,4-Dichloro-2-butene	0.00E+00
76-44-8	Heptachlor	0.00E+00
765-34-4	Glycidylaldehyde	0.00E+00
77-47-4	Hexachlorocyclopentadiene	2.01E-04
77-78-1	Dimethyl sulfate	0.00E+00
78-83-1	2-Methylpropyl alcohol	3.78E-08
78-87-5	1,2-Dichloropropane	9.02E-23
78-93-3	2-Butanone	2.54E-05
79-00-5	1,1,2-Trichloroethane	2.88E-20
79-01-6	1,1,2-Trichloroethylene	2.36E-05
79-10-7	2-Propenoic acid	1.47E-07
79-34-5	1,1,2,2-Tetrachloroethane	2.66E-18
79-46-9	2-Nitropropane	2.74E-14
80-62-6	Methyl methacrylate	0.00E+00
822-06-0	Hexamethylene-1,5-diisocyanate	0.00E+00
823-40-5	Toluene-2,6-diamine	0.00E+00
82-68-8	Pentachloronitrobenzene (PCNB)	3.34E-16
832-69-9	1-Methylphenanthrene	0.00E+00
83-32-9	Acenaphthene	1.48E-05

Table A-14 Process Emissions Model Results for LAW Facility Emissions for the Baseline WTP Operating Configuration

CASRN	COPC	LAW Facility Emissions Rate
84-66-2	Diethyl phthalate	2.45E-05
84-74-2	Di-n-butylphthalate	1.34E-05
85-01-8	Phenanthrene	1.83E-06
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	0.00E+00
85-68-7	Butylbenzylphthalate	4.02E-06
86-73-7	Fluorene	1.74E-05
87-61-6	1,2,3-Trichlorobenzene	0.00E+00
87-68-3	Hexachlorobutadiene	2.68E-22
87-86-5	Pentachlorophenol	3.62E-09
88-06-2	2,4,6-Trichlorophenol	9.00E-09
88-74-4	o-Nitroaniline (2-nitroaniline)	1.92E-05
88-75-5	2-Nitrophenol	7.51E-06
90-04-0	o-Anisidine	0.00E+00
90-12-0	1-Methylnaphthalene	0.00E+00
91-20-3	Naphthalene	1.25E-05
91-22-5	Quinoline	0.00E+00
91-57-6	2-Methylnaphthalene	2.10E-06
91-58-7	2-Chloronaphthalene	2.91E-13
91-94-1	3,3'-Dichlorobenzidine	1.40E-05
924-16-3	N-Nitroso-di-n-Buetylamine	0.00E+00
92-52-4	1,1`-Biphenyl	7.98E-16
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	0.00E+00
94-75-7	2,4-D	0.00E+00
95-48-7	o-Cresol	7.49E-08
95-49-8	o-Chlorotoluene	0.00E+00
95-50-1	1,2-Dichlorobenzene	6.08E-19
95-53-4	o-Toluidine	0.00E+00
95-57-8	2-Chlorophenol	4.18E-13
95-63-6	1,2,4-Trimethyl benzene	0.00E+00
95-94-3	1,2,4,5-Tetrachlorobenzene	0.00E+00
95-95-4	2,4,5-Trichlorophenol	1.70E-08
96-12-8	1,2-Dibromo-3-chloropropane	0.00E+00
96-18-4	1,2,3-Trichloropropane	0.00E+00
96-45-7	Ethylene thiourea	0.00E+00
97-63-2	Ethyl methacrylate	0.00E+00
98-01-1	Furfural	0.00E+00
98-06-6	tert-Butyl benzene	0.00E+00
98-07-7	Benzotrichloride	0.00E+00
98-82-8	Cumene	0.00E+00
98-83-9	Methyl styrene (mixed isomers)	0.00E+00
98-86-2	Acetophenone	1.22E-11
98-95-3	Nitrobenzene	2.87E-06
99-35-4	1,3,5-Trinitrobenzene	0.00E+00
99-65-0	1,3-Dinitrobenzene	0.00E+00
99-87-6	p-Cymene	0.00E+00
Inorganics		**g/s**
10028-15-6	Ozone	N/A
10102-44-0	Nitrogen dioxide	9.21E-02
124-38-9	Carbon dioxide	5.99E+01
14265-44-2	Phosphate	2.72E-09
14265-44-2	Phosphate (ppt) - Note 7	6.62E-14
14797-55-8	Nitrate	3.95E-09
14797-65-0	Nitrite	9.18E-12

Table A-14 Process Emissions Model Results for LAW Facility Emissions for the Baseline WTP Operating Configuration

CASRN	COPC	LAW Facility Emissions Rate
14808-79-8	Sulfate	3.06E-11
16887-00-6	Chloride	1.15E-07
16984-48-8	Fluoride	4.16E-08
16984-48-8	Fluoride (ppt) - Note 6	6.62E-15
22967-92-6	Methylmercury	N/A
24959-67-9	Bromide	N/A
57-12-5	Cyanide	9.09E-17
593-74-8	Dimethylmercury	6.56E-08
630-08-0	Carbon monoxide	1.48E-02
7429-90-5	Aluminum	1.25E-10
7429-90-5	Aluminum (ppt) - Note 2	0.00E+00
7439-89-6	Iron - Note 4	6.24E-11
7439-92-1	Lead	2.18E-12
7439-93-2	Lithium	1.07E-10
7439-95-4	Magnesium	1.01E-10
7439-96-5	Manganese	5.86E-10
7439-97-6	Mercury (elemental)	1.08E-06
7439-97-6	Mercury (Hg^{+2})	1.70E-14
7439-98-7	Molybdenum	7.59E-11
7440-02-0	Nickel	2.53E-10
7440-16-6	Rhodium	5.93E-15
7440-22-4	Silver	7.87E-12
7440-23-5	Sodium	1.02E-06
7440-23-5	Sodium (ppt) - Note 5	6.41E-14
7440-24-6	Strontium (total) - Note 11	6.65E-11
7440-25-7	Tantalum	8.73E-14
7440-28-0	Thallium	1.23E-11
7440-31-5	Tin	N/A
7440-33-7	Tungsten	3.40E-13
7440-36-0	Antimony	4.57E-10
7440-38-2	Arsenic	4.55E-10
7440-39-3	Barium	3.16E-12
7440-41-7	Beryllium	2.61E-14
7440-43-9	Cadmium	1.46E-13
7440-47-3	Chromium - Note 3	6.71E-10
7440-48-4	Cobalt	3.83E-12
7440-50-8	Copper	5.34E-11
7440-61-1	Uranium	3.61E-12
7440-62-2	Vanadium	2.99E-10
7440-65-5	Yttrium	1.61E-12
7440-66-6	Zinc	8.54E-10
7440-67-7	Zirconium	1.55E-10
7446-09-5	Sulfur dioxide	3.84E-06
7647-01-0	Hydrogen chloride	1.70E-02
7664-39-3	Hydrogen fluoride	6.19E-03
7664-41-7	Ammonia/Ammonium	1.86E+00
7704-34-9	Total sulfur - Note 9	2.31E-06
7723-14-0	Phosphorus - Note 8	8.87E-10
7782-41-4	Fluorine gas	0.00E+00
7782-49-2	Selenium	2.62E-13
7782-50-5	Chlorine	0.00E+00
PM	Particulate Matter - Note 10	1.73E-04
Radionuclides		**Ci/s**

Table A-14 Process Emissions Model Results for LAW Facility Emissions for the Baseline WTP Operating Configuration

CASRN	COPC	LAW Facility Emissions Rate
10028-17-8	Tritium	1.86E-08
10045-97-3	Cesium-137	3.97E-15
10098-91-6	Yttrium-90	N/A
10098-97-2	Strontium-90	1.50E-13
10198-40-0	Cobalt-60	2.94E-18
13966-29-5	Uranium-234	5.01E-20
13967-48-1	Ruthenium-106	3.93E-27
13967-70-9	Cesium-134	1.04E-23
13968-55-3	Uranium-233	1.10E-19
13981-15-2	Curium-244	9.79E-20
13981-16-3	Plutonium-238	5.05E-19
13981-37-8	Nickel-63	1.42E-15
13982-10-0	Plutonium-242	4.97E-22
13982-63-3	Radium-226	1.93E-13
13982-70-2	Uranium-236	1.55E-21
13994-20-2	Neptunium-237	2.83E-19
14119-32-5	Plutonium-241	1.92E-18
14119-33-6	Plutonium-240	1.55E-18
14133-76-7	Technetium-99	2.11E-13
14158-29-3	Uranium-232	2.35E-21
14234-35-6	Antimony-125	1.50E-17
14331-85-2	Protactinium-231	3.17E-20
14336-70-0	Nickel-59	2.39E-17
14391-16-3	Europium-155	1.06E-19
14596-10-2	Americium-241	1.25E-16
14683-23-9	Europium-152	5.68E-19
14762-75-5	Carbon-14	5.74E-07
14952-40-0	Actinium-227	2.31E-20
14993-75-0	Americium-243	5.58E-20
15046-84-1	Iodine-129	1.82E-10
15117-48-3	Plutonium-239	7.47E-18
15117-96-1	Uranium-235	1.93E-21
15262-20-1	Radium-228	1.11E-19
15510-73-3	Curium-242	1.02E-19
15585-10-1	Europium-154	1.78E-18
15594-54-4	Thorium-229	1.43E-21
15715-94-3	Samarium-151	2.80E-15
15751-77-6	Zirconium-93	3.86E-17
15757-87-6	Curium-243	7.96E-21
15758-45-9	Selenium-79	4.96E-17
15832-50-5	Tin-126	1.10E-17
378253-40-8	Barium-137m	N/A
378253-44-2	Cadmium-113m	2.85E-17
378782-82-2	Niobium-93m	1.80E-17
7440-29-1	Thorium-232	2.33E-21
7440-61-1R	Uranium-238	5.92E-20

Notes:
1. The estimated LAW Facility exhaust mass flowrate of total PCBs for the refined feed vector is 7.58E-13 g/s.
2. Aluminum (ppt) is aluminum ion precipitated as gibbsite.
3. Chromium includes Cr^{3+} and Cr^{6+} ions.
4. Iron includes Fe^{2+} and Fe^{3+} ions.
5. Sodium (ppt) is sodium ion precipitated as sodium fluoride phosphate, sodium phosphate, or sodium oxalate.
6. Fluoride (ppt) is fluoride ion precipitated as sodium fluoride phosphate.
7. Phosphate (ppt) is phosphate ion precipitated as sodium fluoride phosphate or sodium phosphate

Table A-14 Process Emissions Model Results for LAW Facility Emissions for the Baseline WTP Operating Configuration

CASRN	COPC	LAW Facility Emissions Rate

8. Phosphorus includes portions of phosphate, phosphate (ppt), dihydrogen phosphate, hydrogen phosphate, phosphorus dioxide, and diphosphorus pentoxide(s).
9. Total sulfur includes portions of sulfate, hydrogen sulfite, hydrogen sulfate, sulfite, sulfur dioxide, and sulfur trioxide(s).
10. Particulate matter includes solid organics, solid cations, solid anions, solid radionuclides, sodium chloride(s), sodium cyanide(s), sodium fluoride(s), sodium iodide(s), diphosphorus pentoxide(s), and sulfur trioxide(s).
11. Strontium (total) includes strontium as an inorganic and radionuclide.

A.9.3 HLW Facility

The PEM results for the HLW Facility in baseline WTP operating configuration are provided in Table A-15 below. The table presents the PEM results for the two main HLW Facility flues, the PJV flue, and the HLW melter offgas treatment process system (HOP) flue. Note that units of g/s apply to organics and inorganics, and units of Ci/s apply to radionuclides.

Table A-15 Process Emissions Model Results for HLW Facility Emissions for the Baseline WTP Operating Configuration

CASRN	COPC	HLW Facility PJV Emissions Rate	HLW Facility HOP Emissions Rate
Organics		**g/s**	**g/s**
100-02-7	p-Nitrophenol	2.00E-08	1.07E-07
100-21-0	Phthalic acid	2.23E-11	4.14E-12
100-25-4	1,4-Dinitrobenzene	3.06E-08	6.11E-10
100-40-3	4-Ethenylcyclohexene	1.67E-06	2.66E-08
100-41-4	Ethyl benzene	1.86E-10	7.27E-13
100-42-5	Styrene	1.61E-10	3.48E-13
100-44-7	Benzyl chloride	0.00E+00	0.00E+00
100-47-0	Benzonitrile	0.00E+00	0.00E+00
100-51-6	Benzyl alcohol	0.00E+00	0.00E+00
100-52-7	Benzaldehyde	0.00E+00	0.00E+00
10061-01-5	cis-1,3-Dichloropropene	5.94E-10	1.29E-12
10061-02-6	trans-1,3-Dichloropropene	8.94E-10	1.34E-12
101-55-3	4-Bromophenylphenyl ether	3.47E-05	4.10E-08
101-77-9	4,4-Methylenedianiline	0.00E+00	0.00E+00
103-33-3	Azobenzene	0.00E+00	0.00E+00
103-65-1	n-Propyl benzene (Isocumene)	0.00E+00	0.00E+00
104-51-8	n-Butylbenzene	0.00E+00	0.00E+00
104-76-7	2-Ethyl-1-hexanol	2.55E-05	3.32E-08
105-67-9	2,4-Dimethylphenol	8.03E-06	6.01E-08
10595-95-6	n-Nitrosomethylethylamine	1.99E-05	1.13E-07
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	0.00E+00	0.00E+00
106-44-5	p-Cresol (4-methyl phenol)	0.00E+00	0.00E+00
106-46-7	1,4-Dichlorobenzene	3.91E-06	1.49E-08
106-47-8	p-Chloroaniline	5.34E-06	6.13E-08
106-49-0	p-Toluidine	0.00E+00	0.00E+00
106-51-4	Quinone	0.00E+00	0.00E+00
106-88-7	1,2-Epoxybutane	2.95E-05	3.56E-08
106-89-8	Epichlorohydrin (1-chloro-2,3 epoxypropane)	0.00E+00	0.00E+00
106-93-4	Ethylene dibromide	2.40E-10	3.49E-13
106-99-0	1,3-Butadiene	4.62E-10	1.17E-11
107-02-8	Acrolein	1.60E-08	1.90E-11

Table A-15 Process Emissions Model Results for HLW Facility Emissions for the Baseline WTP Operating Configuration

CASRN	COPC	HLW Facility PJV Emissions Rate	HLW Facility HOP Emissions Rate
107-05-1	3-Chloropropene	2.53E-10	1.29E-12
107-06-2	1,2-Dichloroethane	2.64E-10	4.07E-13
107-12-0	Propionitrile	9.71E-08	1.20E-10
107-13-1	Acrylonitrile	1.80E-07	1.40E-06
107-19-7	Propargyl alcohol	0.00E+00	0.00E+00
107-21-1	Ethylene glycol (1,2-ethanediol)	0.00E+00	0.00E+00
107-98-2	Propylene glycol monomethyl ether	0.00E+00	0.00E+00
108-05-4	Acetic acid vinyl ester	3.13E-05	4.25E-08
108-10-1	4-Methyl-2-pentanone	3.82E-09	4.54E-12
108-39-4	m-Cresol	2.30E-05	2.01E-07
108-60-1	bis (2-Chloroisopropyl)ether	0.00E+00	0.00E+00
108-67-8	1,3,5-Trimethylbenzene	0.00E+00	0.00E+00
108-86-1	Bromobenzene (Phenyl bromide)	0.00E+00	0.00E+00
108-87-2	Methylcyclohexane	1.05E-11	1.48E-12
108-88-3	Toluene	4.07E-08	1.40E-06
108-90-7	Chlorobenzene	5.60E-08	1.40E-06
108-94-1	Cyclohexanone	8.53E-07	1.54E-09
108-95-2	Phenol	6.18E-07	3.58E-08
109-74-0	n-Butanenitrile	2.87E-05	3.44E-08
109-75-1	3-Butenenitrile	0.00E+00	0.00E+00
109-77-3	Malononitrile	0.00E+00	0.00E+00
109-86-4	2-Methoxyethanol	0.00E+00	0.00E+00
109-99-9	Tetrahydrofuran	1.19E-08	1.41E-11
110-00-9	Furan	0.00E+00	0.00E+00
110-54-3	n-Hexane	1.16E-10	6.78E-11
110-59-8	Pentanenitrile	2.79E-05	3.29E-08
110-80-5	2-Ethoxyethanol	3.76E-05	5.69E-07
110-82-7	Cyclohexane	2.56E-11	1.29E-12
110-83-8	Cyclohexene	7.95E-11	1.29E-12
110-86-1	Pyridine	2.05E-07	3.74E-10
111-15-9	Ethylene glycol monoethyl ether acetate	0.00E+00	0.00E+00
111-44-4	bis(2-Chloroethyl)ether	4.76E-06	1.22E-08
111-65-9	n-Octane	1.48E-11	1.55E-11
111-76-2	2-Butoxyethanol	1.42E-05	7.41E-08
111-84-2	n-Nonane	9.39E-12	1.04E-11
111-91-1	bis(2-Chloroethoxy)methane	2.29E-06	1.10E-08
1120-21-4	Undecane	0.00E+00	0.00E+00
1120-71-4	1,3-Propane sultone	0.00E+00	0.00E+00
112-30-1	1-Decanol	0.00E+00	0.00E+00
112-31-2	Decanal	0.00E+00	0.00E+00
112-40-3	Dodecane	0.00E+00	0.00E+00
117-81-7	Bis(2-ethylhexyl) phthalate	2.26E-06	1.96E-07
117-84-0	Di-n-octylphthalate	1.20E-04	1.41E-07
118-74-1	Hexachlorobenzene	4.11E-06	1.29E-08
119-90-4	3,3'-Dimethoxybenzidine	0.00E+00	0.00E+00
120-12-7	Anthracene	2.57E-05	3.51E-08
120-82-1	1,2,4-Trichlorobenzene	1.51E-08	2.58E-11
120-83-2	2,4-Dichlorophenol	2.60E-05	5.35E-08
121-14-2	2,4-Dinitrotoluene	4.92E-06	3.65E-07
122-39-4	N,N-Diphenylamine	1.87E-08	6.65E-11
122-66-7	1,2-Diphenylhydrazine	0.00E+00	0.00E+00
123-33-1	Maleic hydrazide	0.00E+00	0.00E+00

Table A-15 Process Emissions Model Results for HLW Facility Emissions for the Baseline WTP Operating Configuration

CASRN	COPC	HLW Facility PJV Emissions Rate	HLW Facility HOP Emissions Rate
123-38-6	Propionaldehyde	3.65E-08	4.31E-11
123-72-8	Butanal	3.02E-05	3.57E-08
123-91-1	1,4-Dioxan	7.57E-09	1.87E-11
124-18-5	Decane	0.00E+00	0.00E+00
124-48-1	Chlorodibromomethane	7.13E-16	0.00E+00
126-73-8	Tributyl phosphate	1.26E-05	7.32E-08
126-98-7	2-Methyl-2-propenenitrile	1.04E-08	1.29E-11
127-18-4	1,1,2,2-Tetrachloroethene	5.87E-11	4.23E-13
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	1.82E-12	9.57E-10
129-00-0	Pyrene	9.02E-05	1.56E-07
131-11-3	Dimethyl Phthalate	9.12E-08	9.82E-09
131-89-5	2-Cycloyhexyl-4,6-dinitrophenol	0.00E+00	0.00E+00
132-64-9	Dibenzofuran	5.62E-06	1.29E-08
1330-20-7	Xylenes (total)	8.79E-08	1.40E-06
133-06-2	Captan	0.00E+00	0.00E+00
1336-36-3	Polychlorinated biphenyls – Note 1	4.68E-05	5.67E-08
134-32-7	alpha-Naphthylamine	1.16E-06	6.96E-08
135-98-8	sec-Butylbenzene	0.00E+00	0.00E+00
141-78-6	Acetic acid ethyl ester	1.16E-09	1.38E-12
145-73-3	Endothall	0.00E+00	0.00E+00
156-59-2	cis-1,2-Dichloroethene	0.00E+00	0.00E+00
156-60-5	1,2-trans-Dichloroethene	2.17E-05	9.55E-08
1634-04-4	Methyl tert-butyl ether	2.50E-05	3.48E-08
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	2.23E-14	1.12E-13
189-55-9	Dibenzo[a,i]pyrene	1.35E-07	6.30E-08
189-64-0	Dibenzo[a,h]pyrene	1.35E-07	6.30E-08
191-24-2	Benzo(g,h,i)perylene	3.87E-06	9.26E-08
191-30-0	Dibenzo(a,l)pyrene	1.35E-07	6.30E-08
192-65-4	Dibenzo[a,e]pyrene	1.35E-07	6.30E-08
192-97-2	Benzo(e)pyrene	0.00E+00	0.00E+00
193-39-5	Indeno(1,2,3-cd)pyrene	1.14E-05	6.84E-08
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	2.44E-13	3.82E-14
205-82-3	Benzo[j]fluoranthene	0.00E+00	0.00E+00
205-99-2	Benzo(b)fluoranthene	8.53E-06	2.51E-08
206-44-0	Fluoranthene	9.49E-05	1.44E-07
207-08-9	Benzo(k)fluoranthene	1.93E-06	2.94E-08
208-96-8	Acenaphthylene	2.57E-05	3.49E-08
218-01-9	Chrysene	5.58E-06	1.22E-08
224-42-0	Dibenz[a,j]acridine	2.07E-08	1.07E-08
2245-38-7	2,3,5-Trimethylnaphthalene	0.00E+00	0.00E+00
226-36-8	Dibenz[a,h]acridine	1.94E-08	1.00E-08
23950-58-5	Pronamide	0.00E+00	0.00E+00
27154-33-2	Trichlorofluoroethane	3.17E-05	1.49E-07
31508-00-6	2,3’,4,4’,5-Pentachlorobiphenyl (PCB 118)	2.33E-12	9.17E-12
319-84-6	alpha-BHC	1.01E-09	1.69E-12
319-85-7	beta-BHC	2.37E-08	2.30E-09
32598-13-3	3,3’,4,4’-Tetrachlorobiphenyl (PCB 77)	7.76E-13	8.88E-13
32598-14-4	2,3,3’,4,4’-Pentachlorobiphenyl (PCB 105)	8.69E-13	4.01E-12
3268-87-9	Octachlorodibenzo(p)dioxin	2.78E-18	7.74E-13
32774-16-6	3,3’,4,4’,5,5’-Hexachlorobiphenyl (PCB 169)	5.81E-14	2.62E-13
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	3.95E-13	1.91E-13
3697-24-3	5-Methylchrysene	1.53E-05	3.50E-08

Table A-15 Process Emissions Model Results for HLW Facility Emissions for the Baseline WTP Operating Configuration

CASRN	COPC	HLW Facility PJV Emissions Rate	HLW Facility HOP Emissions Rate
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	2.58E-13	1.04E-12
39001-02-0	Octachlorodibenzofuran	1.81E-19	1.24E-12
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	1.56E-13	2.77E-14
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	4.91E-14	3.17E-13
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	6.58E-14	4.04E-14
4170-30-3	Crotonaldehyde (Propylene aldehyde)	1.07E-08	1.76E-11
41851-50-7	Chlorocyclopentadiene	0.00E+00	0.00E+00
460-19-5	Cyanogen (oxalonitrile)	0.00E+00	0.00E+00
4786-20-3	2-Butenenitrile	0.00E+00	0.00E+00
50-00-0	Formaldehyde	6.68E-06	1.38E-07
50-32-8	Benzo(a)pyrene	2.61E-06	1.36E-08
506-68-3	Cyanogen bromide (bromocyanide)	0.00E+00	0.00E+00
506-77-4	Cyanogen chloride	0.00E+00	0.00E+00
510-15-6	Chlorobenzilate	0.00E+00	0.00E+00
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	3.16E-13	1.40E-13
51-28-5	2,4-Dinitrophenol	6.59E-06	4.70E-07
51-79-6	Ethyl carbamate (urethane)	0.00E+00	0.00E+00
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	8.82E-14	4.03E-13
528-29-0	1,2-Dinitrobenzene (o-Dinitrobenzene)	0.00E+00	0.00E+00
532-27-4	2-Chloroacetophenone	0.00E+00	0.00E+00
534-52-1	4,6-Dinitro-o-cresol	8.71E-06	8.57E-08
53-70-3	Dibenz[a,h]anthracene	3.15E-08	2.31E-08
5385-75-1	Dibenzo(a,e)fluoranthene	0.00E+00	0.00E+00
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	1.71E-19	0.00E+00
540-73-8	1,2-Dimethylhydrazine	0.00E+00	0.00E+00
540-84-1	2,2,4-Trimethylpentane	0.00E+00	0.00E+00
541-73-1	1,3-Dichlorobenzene	7.35E-09	1.69E-11
542-75-6	1,3-Dichloropropene	0.00E+00	0.00E+00
542-88-1	bis(Chloromethyl)ether	0.00E+00	0.00E+00
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	2.64E-14	4.59E-13
56-23-5	Carbon tetrachloride	1.26E-08	1.40E-06
56-49-5	3-Methylcholanthrene	1.52E-05	3.56E-08
56-55-3	Benzo(a)anthracene	2.48E-06	1.29E-08
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	2.18E-14	1.83E-13
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	4.22E-14	2.09E-13
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	2.08E-14	3.02E-13
57-24-9	Strychnine	0.00E+00	0.00E+00
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	5.65E-14	4.42E-13
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	1.16E-13	3.82E-14
57-74-9	Chlordane	0.00E+00	0.00E+00
581-42-0	2,6-Dimethylnaphthalene	0.00E+00	0.00E+00
584-84-9	2,4-Toluene diisocyanate	0.00E+00	0.00E+00
58-89-9	gamma-BHC (Lindane)	1.31E-09	3.22E-12
58-90-2	2,3,4,6-Tetrachlorophenol	4.35E-05	1.13E-07
589-38-8	3-Hexanone	2.79E-05	3.30E-08
591-50-4	Benzene, iodo-	0.00E+00	0.00E+00
591-78-6	2-Hexanone	4.74E-08	5.58E-11
593-60-2	Bromoethene (Vinyl bromide)	0.00E+00	0.00E+00
59-50-7	4-Chloro-3-methylphenol	5.17E-05	1.97E-07
59-89-2	N-Nitrosomorpholine	2.43E-06	6.55E-07
60-11-7	Dimethyl aminoazobenzene	0.00E+00	0.00E+00
602-87-9	5-Nitroacenaphthene	9.49E-06	6.68E-08

Table A-15 Process Emissions Model Results for HLW Facility Emissions for the Baseline WTP Operating Configuration

CASRN	COPC	HLW Facility PJV Emissions Rate	HLW Facility HOP Emissions Rate
60-29-7	Ethyl ether	2.95E-08	4.83E-11
60-35-5	Acetamide	9.32E-08	4.79E-08
606-20-2	2,6-Dinitrotoluene	9.50E-07	1.59E-08
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	1.15E-14	1.13E-13
608-93-5	Pentachlorobenzene	0.00E+00	0.00E+00
61626-71-9	Dichloropentadiene	0.00E+00	0.00E+00
621-64-7	N-Nitroso-di-n-propylamine	4.81E-05	1.94E-07
624-83-9	Methyl isocyanate	0.00E+00	0.00E+00
62-50-0	Ethyl methanesulfonate	0.00E+00	0.00E+00
62-53-3	Aniline	0.00E+00	0.00E+00
62-75-9	N-Nitroso-N,N-dimethylamine	2.28E-07	1.07E-09
628-73-9	Hexanenitrile	2.72E-05	3.20E-08
630-20-6	1,1,1,2-Tetrachloroethane	8.01E-05	1.65E-07
64-18-6	Formic acid (methanoic acid)	0.00E+00	0.00E+00
65510-44-3	2’,3,4,4’,5-Pentachlorobiphenyl (PCB 123)	6.41E-14	2.26E-13
65-85-0	Benzoic acid	0.00E+00	0.00E+00
67-56-1	Methyl alcohol	3.30E-05	8.21E-08
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	7.93E-14	9.38E-13
67-63-0	2-Propyl alcohol	2.37E-08	4.49E-11
67-64-1	2-Propanone (Acetone)	8.82E-07	3.81E-05
67-66-3	Chloroform	5.60E-08	1.40E-06
67-72-1	Hexachloroethane	2.00E-06	5.14E-09
69782-90-7	2,3,3’,4,4’,5’-Hexachlorobiphenyl (PCB 157)	2.57E-13	1.04E-12
70-30-4	Hexachlorophene	0.00E+00	0.00E+00
70362-50-4	3,4,4’,5-Tetrachlorobiphenyl (PCB 81)	1.37E-13	2.84E-13
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	1.91E-13	6.47E-13
71-36-3	n-Butyl alcohol	7.02E-07	1.28E-09
71-43-2	Benzene	8.00E-08	1.40E-06
71-55-6	1,1,1-Trichloroethane	6.25E-11	4.30E-13
72-43-5	Methoxychlor	0.00E+00	0.00E+00
72-55-9	4,4-DDE	3.46E-05	4.73E-08
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	4.93E-15	5.88E-14
74472-37-0	2,3,4,4’,5-Pentachlorobiphenyl (PCB 114)	1.56E-13	3.23E-13
74-83-9	Bromomethane	4.19E-08	1.40E-06
74-87-3	Chloromethane	3.37E-08	1.47E-06
74-88-4	Iodomethane	4.61E-08	1.40E-06
74-95-3	Methylene bromide	0.00E+00	0.00E+00
74-97-5	Bromochloromethane	0.00E+00	0.00E+00
75-00-3	Chloroethane	2.07E-10	8.69E-13
75-01-4	1-Chloroethene	8.69E-11	8.82E-13
75-02-5	Fluoroethene (vinyl fluoride)	1.14E-06	4.54E-08
75-05-8	Acetonitrile	2.06E-06	4.02E-06
75-07-0	Acetaldehyde	3.70E-05	4.36E-08
75-09-2	Dichloromethane (Methylene Chloride)	2.00E-07	1.42E-06
75-15-0	Carbon disulfide	1.26E-08	1.40E-06
75-21-8	Ethylene oxide (Oxirane)	6.30E-08	7.51E-11
75-25-2	Bromoform	0.00E+00	0.00E+00
75-27-4	Bromodichloromethane	1.82E-04	3.23E-07
75-29-6	2-Chloropropane	0.00E+00	0.00E+00
75-34-3	1,1-Dichloroethane	1.11E-10	3.48E-13
75-35-4	1,1-Dichloroethene	5.57E-11	5.48E-13
75-44-5	Phosgene (hydrogen phosphide)	0.00E+00	0.00E+00

Table A-15 Process Emissions Model Results for HLW Facility Emissions for the Baseline WTP Operating Configuration

CASRN	COPC	HLW Facility PJV Emissions Rate	HLW Facility HOP Emissions Rate
75-45-6	Chlorodifluoromethane	8.82E-11	1.29E-12
75-50-3	Trimethylamine	3.31E-05	3.90E-08
75-69-4	Trichlorofluoromethane	3.21E-11	1.06E-12
75-71-8	Dichlorodifluoromethane	9.55E-12	1.08E-12
76-01-7	Pentachloroethane	0.00E+00	0.00E+00
76-13-1	1,2,2-Trichlorotrifluoroethane	6.18E-12	1.06E-12
764-41-0	1,4-Dichloro-2-butene	0.00E+00	0.00E+00
76-44-8	Heptachlor	2.05E-12	1.00E-12
765-34-4	Glycidylaldehyde	0.00E+00	0.00E+00
77-47-4	Hexachlorocyclopentadiene	7.40E-06	1.41E-07
77-78-1	Dimethyl sulfate	0.00E+00	0.00E+00
78-83-1	2-Methylpropyl alcohol	4.16E-04	7.27E-07
78-87-5	1,2-Dichloropropane	1.59E-10	3.48E-13
78-93-3	2-Butanone	2.36E-07	1.40E-06
79-00-5	1,1,2-Trichloroethane	2.69E-10	4.08E-13
79-01-6	1,1,2-Trichloroethylene	3.26E-08	1.79E-06
79-10-7	2-Propenoic acid	1.13E-05	2.15E-07
79-34-5	1,1,2,2-Tetrachloroethane	3.19E-10	4.09E-13
79-46-9	2-Nitropropane	7.30E-08	8.63E-11
80-62-6	Methyl methacrylate	0.00E+00	0.00E+00
822-06-0	Hexamethylene-1,5-diisocyanate	0.00E+00	0.00E+00
823-40-5	Toluene-2,6-diamine	0.00E+00	0.00E+00
82-68-8	Pentachloronitrobenzene (PCNB)	6.26E-08	8.13E-11
832-69-9	1-Methylphenanthrene	0.00E+00	0.00E+00
83-32-9	Acenaphthene	1.08E-04	1.34E-07
84-66-2	Diethyl phthalate	6.20E-06	1.06E-07
84-74-2	Di-n-butylphthalate	9.09E-06	1.46E-06
85-01-8	Phenanthrene	2.39E-05	3.67E-08
85-44-9	Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	0.00E+00	0.00E+00
85-68-7	Butylbenzylphthalate	7.87E-05	4.93E-07
86-73-7	Fluorene	2.70E-05	3.76E-08
87-61-6	1,2,3-Trichlorobenzene	0.00E+00	0.00E+00
87-68-3	Hexachlorobutadiene	5.56E-08	2.21E-10
87-86-5	Pentachlorophenol	2.14E-09	5.93E-10
88-06-2	2,4,6-Trichlorophenol	7.17E-05	1.38E-07
88-74-4	o-Nitroaniline (2-nitroaniline)	1.30E-07	1.35E-08
88-75-5	2-Nitrophenol	8.45E-05	5.05E-07
90-04-0	o-Anisidine	0.00E+00	0.00E+00
90-12-0	1-Methylnaphthalene	0.00E+00	0.00E+00
91-20-3	Naphthalene	3.73E-04	2.71E-07
91-22-5	Quinoline	0.00E+00	0.00E+00
91-57-6	2-Methylnaphthalene	5.21E-06	1.16E-08
91-58-7	2-Chloronaphthalene	2.53E-05	3.21E-08
91-94-1	3,3'-Dichlorobenzidine	2.87E-08	7.97E-08
924-16-3	N-Nitroso-di-n-Buetylamine	0.00E+00	0.00E+00
92-52-4	1,1`-Biphenyl	6.42E-08	8.14E-11
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	0.00E+00	0.00E+00
94-75-7	2,4-D	0.00E+00	0.00E+00
95-48-7	o-Cresol	3.99E-05	2.63E-07
95-49-8	o-Chlorotoluene	0.00E+00	0.00E+00
95-50-1	1,2-Dichlorobenzene	1.79E-07	3.36E-10
95-53-4	o-Toluidine	0.00E+00	0.00E+00

Table A-15 Process Emissions Model Results for HLW Facility Emissions for the Baseline WTP Operating Configuration

CASRN	COPC	HLW Facility PJV Emissions Rate	HLW Facility HOP Emissions Rate
95-57-8	2-Chlorophenol	8.97E-05	1.17E-07
95-63-6	1,2,4-Trimethyl benzene	0.00E+00	0.00E+00
95-94-3	1,2,4,5-Tetrachlorobenzene	0.00E+00	0.00E+00
95-95-4	2,4,5-Trichlorophenol	6.05E-05	1.59E-07
96-12-8	1,2-Dibromo-3-chloropropane	0.00E+00	0.00E+00
96-18-4	1,2,3-Trichloropropane	0.00E+00	0.00E+00
96-45-7	Ethylene thiourea	0.00E+00	0.00E+00
97-63-2	Ethyl methacrylate	0.00E+00	0.00E+00
98-01-1	Furfural	0.00E+00	0.00E+00
98-06-6	tert-Butyl benzene	0.00E+00	0.00E+00
98-07-7	Benzotrichloride	0.00E+00	0.00E+00
98-82-8	Cumene	6.70E-08	2.62E-08
98-83-9	Methyl styrene (mixed isomers)	0.00E+00	0.00E+00
98-86-2	Acetophenone	6.96E-08	1.28E-10
98-95-3	Nitrobenzene	5.01E-06	1.19E-08
99-35-4	1,3,5-Trinitrobenzene	0.00E+00	0.00E+00
99-65-0	1,3-Dinitrobenzene	0.00E+00	0.00E+00
99-87-6	p-Cymene	0.00E+00	0.00E+00
Inorganics		**g/s**	**g/s**
10028-15-6	Ozone	N/A	N/A
10102-44-0	Nitrogen dioxide	0.00E+00	3.09E-02
124-38-9	Carbon dioxide	5.22E-01	1.25E+01
14265-44-2	Phosphate	3.36E-10	2.26E-10
14265-44-2	Phosphate (ppt) - Note 7	0.00E+00	0.00E+00
14797-55-8	Nitrate	1.76E-08	7.75E-11
14797-65-0	Nitrite	1.93E-09	1.57E-11
14808-79-8	Sulfate	9.22E-10	5.34E-11
16887-00-6	Chloride	1.98E-10	1.10E-12
16984-48-8	Fluoride	3.72E-09	2.11E-11
16984-48-8	Fluoride (ppt) - Note 6	0.00E+00	0.00E+00
22967-92-6	Methylmercury	N/A	N/A
24959-67-9	Bromide	N/A	N/A
57-12-5	Cyanide	3.73E-17	2.40E-15
593-74-8	Dimethylmercury	3.02E-08	1.25E-12
630-08-0	Carbon monoxide	0.00E+00	6.81E-03
7429-90-5	Aluminum	2.69E-11	2.17E-11
7429-90-5	Aluminum (ppt) - Note 2	0.00E+00	3.66E-15
7439-89-6	Iron - Note 4	2.87E-13	9.75E-12
7439-92-1	Lead	1.86E-13	1.67E-12
7439-93-2	Lithium	6.64E-14	1.14E-11
7439-95-4	Magnesium	7.15E-12	5.40E-13
7439-96-5	Manganese	1.29E-14	9.76E-13
7439-97-6	Mercury (elemental)	0.00E+00	2.06E-11
7439-97-6	Mercury (Hg^{+2})	1.05E-11	1.02E-16
7439-98-7	Molybdenum	8.20E-14	1.25E-14
7440-02-0	Nickel	1.50E-13	5.88E-13
7440-16-6	Rhodium	5.42E-15	1.44E-14
7440-22-4	Silver	4.17E-15	1.03E-14
7440-23-5	Sodium	3.21E-08	3.35E-11
7440-23-5	Sodium (ppt) - Note 5	0.00E+00	0.00E+00
7440-24-6	Strontium (total) - Note 11	9.42E-14	3.39E-13
7440-25-7	Tantalum	4.07E-15	2.43E-16

Table A-15 Process Emissions Model Results for HLW Facility Emissions for the Baseline WTP Operating Configuration

CASRN	COPC	HLW Facility PJV Emissions Rate	HLW Facility HOP Emissions Rate
7440-28-0	Thallium	6.23E-13	2.60E-14
7440-31-5	Tin	N/A	N/A
7440-33-7	Tungsten	1.58E-14	8.59E-15
7440-36-0	Antimony	7.13E-15	2.91E-14
7440-38-2	Arsenic	3.44E-14	1.09E-13
7440-39-3	Barium	3.83E-15	6.66E-14
7440-41-7	Beryllium	1.22E-15	1.13E-15
7440-43-9	Cadmium	1.38E-14	4.77E-14
7440-47-3	Chromium - Note 3	3.62E-12	2.05E-11
7440-48-4	Cobalt	6.34E-15	3.83E-15
7440-50-8	Copper	5.16E-15	7.48E-14
7440-61-1	Uranium	1.68E-13	1.10E-12
7440-62-2	Vanadium	1.07E-14	7.27E-15
7440-65-5	Yttrium	3.02E-16	1.18E-15
7440-66-6	Zinc	6.91E-15	3.93E-12
7440-67-7	Zirconium	6.68E-14	3.70E-12
7446-09-5	Sulfur dioxide	0.00E+00	3.20E-04
7647-01-0	Hydrogen chloride	0.00E+00	1.77E-02
7664-39-3	Hydrogen fluoride	0.00E+00	9.81E-08
7664-41-7	Ammonia/Ammonium	1.54E-10	2.35E-01
7704-34-9	Total sulfur - Note 9	6.62E-10	1.92E-04
7723-14-0	Phosphorus - Note 8	1.09E-10	7.38E-11
7782-41-4	Fluorine gas	0.00E+00	0.00E+00
7782-49-2	Selenium	3.38E-12	3.65E-14
7782-50-5	Chlorine	0.00E+00	0.00E+00
PM	Particulate Matter - Note 10	0.00E+00	8.12E-05
Radionuclides		**Ci/s**	**Ci/s**
10028-17-8	Tritium	1.50E-10	2.25E-08
10045-97-3	Cesium-137	3.50E-12	6.91E-13
10098-91-6	Yttrium-90	N/A	N/A
10098-97-2	Strontium-90	4.77E-15	1.33E-13
10198-40-0	Cobalt-60	1.03E-19	8.91E-20
13966-29-5	Uranium-234	6.17E-20	3.40E-19
13967-48-1	Ruthenium-106	3.86E-24	2.63E-25
13967-70-9	Cesium-134	9.15E-21	1.62E-21
13968-55-3	Uranium-233	1.39E-19	1.20E-18
13981-15-2	Curium-244	1.17E-19	1.48E-19
13981-16-3	Plutonium-238	6.26E-19	4.20E-18
13981-37-8	Nickel-63	1.31E-16	2.73E-16
13982-10-0	Plutonium-242	5.39E-22	1.07E-21
13982-63-3	Radium-226	1.13E-13	1.07E-15
13982-70-2	Uranium-236	1.87E-21	9.42E-21
13994-20-2	Neptunium-237	3.38E-19	3.01E-19
14119-32-5	Plutonium-241	2.38E-18	1.65E-17
14119-33-6	Plutonium-240	1.93E-18	1.42E-17
14133-76-7	Technetium-99	2.48E-14	8.70E-15
14158-29-3	Uranium-232	2.90E-21	1.44E-20
14234-35-6	Antimony-125	3.66E-21	9.34E-21
14331-85-2	Protactinium-231	3.77E-20	9.09E-21
14336-70-0	Nickel-59	2.21E-18	4.30E-18
14391-16-3	Europium-155	1.29E-19	4.66E-19
14596-10-2	Americium-241	1.20E-16	4.19E-16

Table A-15 Process Emissions Model Results for HLW Facility Emissions for the Baseline WTP Operating Configuration

CASRN	COPC	HLW Facility PJV Emissions Rate	HLW Facility HOP Emissions Rate
14683-23-9	Europium-152	6.79E-19	6.96E-19
14762-75-5	Carbon-14	7.88E-15	9.23E-08
14952-40-0	Actinium-227	2.74E-20	1.02E-20
14993-75-0	Americium-243	5.28E-20	1.80E-19
15046-84-1	Iodine-129	5.34E-16	6.55E-10
15117-48-3	Plutonium-239	9.30E-18	6.75E-17
15117-96-1	Uranium-235	2.37E-21	1.27E-20
15262-20-1	Radium-228	6.52E-20	2.71E-20
15510-73-3	Curium-242	1.22E-19	1.31E-19
15585-10-1	Europium-154	2.16E-18	7.08E-18
15594-54-4	Thorium-229	1.75E-21	2.11E-21
15715-94-3	Samarium-151	3.35E-15	3.58E-15
15751-77-6	Zirconium-93	9.39E-18	4.65E-18
15757-87-6	Curium-243	9.60E-21	1.15E-20
15758-45-9	Selenium-79	5.18E-16	4.71E-18
15832-50-5	Tin-126	1.31E-17	1.44E-18
378253-40-8	Barium-137m	N/A	N/A
378253-44-2	Cadmium-113m	3.86E-17	1.01E-17
378782-82-2	Niobium-93m	2.12E-17	3.64E-18
7440-29-1	Thorium-232	2.90E-21	1.47E-20
7440-61-1R	Uranium-238	7.28E-20	3.67E-19

Notes:
1. The estimated PJV and HOP exhaust mass flowrates for the refined feed vector are 1.16E-05 g/s and 1.41E-08 g/s, respectively.
2. Aluminum (ppt) is aluminum ion precipitated as gibbsite.
3. Chromium includes Cr^{3+} and Cr^{6+} ions.
4. Iron includes Fe^{2+} and Fe^{3+} ions.
5. Sodium (ppt) is sodium ion precipitated as sodium fluoride phosphate, sodium phosphate, or sodium oxalate.
6. Fluoride (ppt) is fluoride ion precipitated as sodium fluoride phosphate.
7. Phosphate (ppt) is phosphate ion precipitated as sodium fluoride phosphate or sodium phosphate
8. Phosphorus includes portions of phosphate, phosphate (ppt), dihydrogen phosphate, hydrogen phosphate, phosphorus dioxide, and diphosphorus pentoxide(s).
9. Total sulfur includes portions of sulfate, hydrogen sulfite, hydrogen sulfate, sulfite, sulfur dioxide, and sulfur trioxide(s).
10. Particulate matter includes solid organics, solid cations, solid anions, solid radionuclides, sodium chloride(s), sodium cyanide(s), sodium fluoride(s), sodium iodide(s), diphosphorus pentoxide(s), and sulfur trioxide(s).
11. Strontium (total) includes strontium as an inorganic and radionuclide.

A.10 Management of Nondetect COPCs, Baseline WTP Operating Configuration

Per the RAWP, Section 5.2.2, if during the EPDT, a COPC is not detected, it is assumed present at one-half the detection limit, and if a COPC is a risk driver and not found, it is assumed present at the detection limit. Given the uncertainty in emissions modeling, for simplicity, COPCs melter emissions that were estimated below detection limits were adjusted (increased) to equal projected MDLs for the conditions modeled in PEM. The MDLs used were taken from CCN 283075, and for analytes for which no MDL was provided, an RL was used in lieu of an MDL. The MDLs were converted to emission units by dividing the MDL, as mass collected by sampling, by the volume of gas sampled, and multiplying by the estimated stack emissions flowrate derived from the PEM. Table A-16 provides the projected MDL-based flowrates. These rates were applied only for emissions estimates for melter flues in cases where estimated emissions, before applying upset factors, were below these values (e.g., less than detectable), where available.

Table A-16 MDL-based Emission Rates

CASRN	COPC	MDL-based LAW Facility Emissions Rate	MDL-based HLW Facility HOP Emissions Rate
Organics		**g/s**	**g/s**
100-02-7	p-Nitrophenol	8.64E-06	4.16E-06
100-41-4	Ethyl benzene	1.73E-07	8.32E-08
100-42-5	Styrene	2.16E-07	1.04E-07
100-51-6	Benzyl alcohol	2.69E-06	1.29E-06
100-52-7	Benzaldehyde	1.44E-05	6.93E-06
10061-01-5	cis-1,3-Dichloropropene	2.88E-07	1.39E-07
10061-02-6	trans-1,3-Dichloropropene	2.12E-07	1.02E-07
101-55-3	4-Bromophenylphenyl ether	1.87E-06	9.01E-07
103-33-3	Azobenzene	1.68E-06	8.09E-07
103-65-1	n-Propyl benzene (Isocumene)	2.16E-07	1.04E-07
104-51-8	n-Butylbenzene	1.71E-07	8.23E-08
105-67-9	2,4-Dimethylphenol	7.15E-06	3.44E-06
10595-95-6	n-Nitrosomethylethylamine	1.82E-06	8.78E-07
106-43-4	4-Chlorotoluene (p-Tolyl chloride)	2.38E-07	1.14E-07
106-44-5	p-Cresol (4-methyl phenol)	2.64E-06	1.27E-06
106-46-7	1,4-Dichlorobenzene	1.51E-06	7.28E-07
106-47-8	p-Chloroaniline	3.50E-06	1.69E-06
106-93-4	Ethylene dibromide	2.70E-07	1.30E-07
106-99-0	1,3-Butadiene	2.95E-07	1.42E-07
107-06-2	1,2-Dichloroethane	3.89E-07	1.87E-07
107-13-1	Acrylonitrile	4.90E-06	2.36E-06
108-05-4	Acetic acid vinyl ester	1.09E-05	5.24E-06
108-10-1	4-Methyl-2-pentanone	1.53E-05	7.38E-06
108-39-4	m-Cresol	2.64E-06	1.27E-06
108-60-1	bis (2-Chloroisopropyl)ether	1.63E-06	7.86E-07
108-67-8	1,3,5-Trimethylbenzene	3.31E-07	1.59E-07
108-86-1	Bromobenzene (Phenyl bromide)	3.24E-07	1.56E-07
108-88-3	Toluene	1.78E-07	8.58E-08
108-90-7	Chlorobenzene	1.73E-07	8.32E-08
108-95-2	Phenol	1.48E-06	7.12E-07
109-99-9	Tetrahydrofuran	2.18E-05	1.05E-05
110-54-3	n-Hexane	3.60E-07	1.73E-07
110-86-1	Pyridine	4.13E-06	1.99E-06
111-44-4	bis(2-Chloroethyl)ether	1.55E-06	7.46E-07
111-91-1	bis(2-Chloroethoxy)methane	1.22E-06	5.89E-07
117-81-7	Bis(2-ethylhexyl) phthalate	5.14E-06	2.47E-06
117-84-0	Di-n-octylphthalate	2.21E-06	1.06E-06
118-74-1	Hexachlorobenzene	1.58E-06	7.63E-07
120-12-7	Anthracene	1.83E-09	8.80E-10
120-82-1	1,2,4-Trichlorobenzene	1.58E-06	7.63E-07
120-83-2	2,4-Dichlorophenol	1.43E-06	6.89E-07
121-14-2	2,4-Dinitrotoluene	3.12E-06	1.50E-06
122-39-4	N,N-Diphenylamine	9.93E-09	4.78E-09
122-66-7	1,2-Diphenylhydrazine	1.33E-06	6.38E-07
124-48-1	Chlorodibromomethane	3.67E-07	1.77E-07
127-18-4	1,1,2,2-Tetrachloroethene	1.94E-07	9.36E-08
129-00-0	Pyrene	1.72E-08	8.30E-09
131-11-3	Dimethyl Phthalate	1.40E-06	6.75E-07
132-64-9	Dibenzofuran	1.33E-06	6.38E-07
1330-20-7	Xylenes (total)	4.32E-07	2.08E-07
1336-36-3	Polychlorinated biphenyls	5.04E-09	2.43E-09
134-32-7	alpha-Naphthylamine	2.78E-06	1.34E-06

Table A-16 MDL-based Emission Rates

CASRN	COPC	MDL-based LAW Facility Emissions Rate	MDL-based HLW Facility HOP Emissions Rate
135-98-8	sec-Butylbenzene	1.69E-07	8.15E-08
156-59-2	cis-1,2-Dichloroethene	1.84E-07	8.84E-08
156-60-5	1,2-trans-Dichloroethene	3.13E-07	1.51E-07
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1.17E-11	5.64E-12
191-24-2	Benzo(g,h,i)perylene	2.45E-09	1.18E-09
192-97-2	Benzo(e)pyrene	2.69E-09	1.29E-09
193-39-5	Indeno(1,2,3-cd)pyrene	1.27E-09	6.10E-10
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	4.22E-12	2.03E-12
205-82-3	Benzo[j]fluoranthene	1.44E-08	6.93E-09
205-99-2	Benzo(b)fluoranthene	1.45E-08	6.96E-09
206-44-0	Fluoranthene	3.07E-09	1.48E-09
207-08-9	Benzo(k)fluoranthene	2.06E-08	9.90E-09
208-96-8	Acenaphthylene	1.15E-09	5.55E-10
218-01-9	Chrysene	1.20E-09	5.75E-10
2245-38-7	2,3,5-Trimethylnaphthalene	1.86E-09	8.94E-10
23950-58-5	Pronamide	2.88E-05	1.39E-05
31508-00-6	2,3’,4,4’,5-Pentachlorobiphenyl (PCB 118)	2.24E-11	1.08E-11
32598-13-3	3,3’,4,4’-Tetrachlorobiphenyl (PCB 77)	2.42E-11	1.16E-11
32598-14-4	2,3,3’,4,4’-Pentachlorobiphenyl (PCB 105)	2.33E-11	1.12E-11
3268-87-9	Octachlorodibenzo(p)dioxin	4.75E-12	2.29E-12
32774-16-6	3,3’,4,4’,5,5’-Hexachlorobiphenyl (PCB 169)	2.26E-11	1.09E-11
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	4.22E-12	2.03E-12
38380-08-4	2,3,3’,4,4’,5-Hexachlorobiphenyl (PCB 156)	3.79E-11	1.83E-11
39001-02-0	Octachlorodibenzofuran	7.39E-12	3.56E-12
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	5.47E-12	2.63E-12
39635-31-9	2,3,3’,4,4’,5,5’-Heptachlorobiphenyl (PCB 189)	1.76E-11	8.48E-12
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	6.77E-12	3.26E-12
50-32-8	Benzo(a)pyrene	1.37E-09	6.59E-10
510-15-6	Chlorobenzilate	1.44E-05	6.93E-06
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	4.56E-12	2.20E-12
51-28-5	2,4-Dinitrophenol	2.07E-05	9.96E-06
52663-72-6	2,3’,4,4’,5,5’-Hexachlorobiphenyl (PCB 167)	2.26E-11	1.09E-11
534-52-1	4,6-Dinitro-o-cresol	6.58E-06	3.17E-06
53-70-3	Dibenz[a,h]anthracene	1.86E-09	8.97E-10
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	3.28E-07	1.58E-07
541-73-1	1,3-Dichlorobenzene	1.59E-06	7.65E-07
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	4.85E-12	2.33E-12
56-23-5	Carbon tetrachloride	2.12E-07	1.02E-07
56-49-5	3-Methylcholanthrene	1.39E-06	6.70E-07
56-55-3	Benzo(a)anthracene	1.80E-09	8.67E-10
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	2.78E-12	1.34E-12
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	2.59E-12	1.25E-12
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	2.78E-12	1.34E-12
57465-28-8	3,3’,4,4’,5-Pentachlorobiphenyl (PCB 126)	1.40E-10	6.72E-11
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	5.47E-12	2.63E-12
581-42-0	2,6-Dimethylnaphthalene	6.96E-09	3.35E-09
58-90-2	2,3,4,6-Tetrachlorophenol	4.99E-06	2.40E-06
591-78-6	2-Hexanone	1.23E-06	5.93E-07
593-60-2	Bromoethene (Vinyl bromide)	4.41E-05	2.12E-05
59-50-7	4-Chloro-3-methylphenol	3.98E-06	1.92E-06
59-89-2	N-Nitrosomorpholine	1.49E-06	7.16E-07
60-11-7	Dimethyl aminoazobenzene	1.15E-06	5.52E-07
606-20-2	2,6-Dinitrotoluene	3.17E-06	1.53E-06

Table A-16 MDL-based Emission Rates

CASRN	COPC	MDL-based LAW Facility Emissions Rate	MDL-based HLW Facility HOP Emissions Rate
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	6.63E-12	3.19E-12
608-93-5	Pentachlorobenzene	1.51E-06	7.28E-07
621-64-7	N-Nitroso-di-n-propylamine	1.52E-06	7.30E-07
62-50-0	Ethyl methanesulfonate	1.18E-06	5.68E-07
62-53-3	Aniline	4.13E-06	1.99E-06
62-75-9	N-Nitroso-N,N-dimethylamine	1.52E-06	7.33E-07
630-20-6	1,1,1,2-Tetrachloroethane	1.98E-07	9.53E-08
65510-44-3	2’,3,4,4’,5-Pentachlorobiphenyl (PCB 123)	1.24E-10	5.96E-11
65-85-0	Benzoic acid	2.83E-05	1.36E-05
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	5.47E-12	2.63E-12
67-63-0	2-Propyl alcohol	3.96E-04	1.91E-04
67-64-1	2-Propanone (Acetone)	5.76E-06	2.77E-06
67-66-3	Chloroform	1.84E-07	8.84E-08
67-72-1	Hexachloroethane	1.43E-06	6.86E-07
69782-90-7	2,3,3’,4,4’,5’-Hexachlorobiphenyl (PCB 157)	3.79E-11	1.83E-11
70362-50-4	3,4,4’,5-Tetrachlorobiphenyl (PCB 81)	2.40E-11	1.16E-11
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	2.74E-12	1.32E-12
71-43-2	Benzene	5.22E-07	2.51E-07
71-55-6	1,1,1-Trichloroethane	1.94E-07	9.36E-08
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	6.63E-12	3.19E-12
74472-37-0	2,3,4,4’,5-Pentachlorobiphenyl (PCB 114)	2.23E-11	1.07E-11
74-83-9	Bromomethane	9.51E-07	4.58E-07
74-87-3	Chloromethane	6.48E-07	3.12E-07
74-88-4	Iodomethane	9.07E-07	4.37E-07
74-95-3	Methylene bromide	3.74E-07	1.80E-07
74-97-5	Bromochloromethane	4.74E-07	2.28E-07
75-00-3	Chloroethane	9.87E-07	4.75E-07
75-01-4	1-Chloroethene	5.91E-07	2.84E-07
75-05-8	Acetonitrile	1.51E-04	7.28E-05
75-09-2	Dichloromethane (Methylene Chloride)	3.67E-07	1.77E-07
75-15-0	Carbon disulfide	3.02E-07	1.46E-07
75-25-2	Bromoform	1.80E-06	8.67E-07
75-27-4	Bromodichloromethane	2.34E-07	1.13E-07
75-29-6	2-Chloropropane	1.49E-06	7.16E-07
75-34-3	1,1-Dichloroethane	1.69E-07	8.15E-08
75-35-4	1,1-Dichloroethene	2.63E-07	1.27E-07
75-69-4	Trichlorofluoromethane	3.89E-07	1.87E-07
75-71-8	Dichlorodifluoromethane	6.88E-07	3.31E-07
76-01-7	Pentachloroethane	1.26E-06	6.05E-07
76-13-1	1,2,2-Trichlorotrifluoroethane	1.09E-05	5.24E-06
764-41-0	1,4-Dichloro-2-butene	7.92E-06	3.81E-06
77-47-4	Hexachlorocyclopentadiene	1.15E-05	5.55E-06
78-87-5	1,2-Dichloropropane	2.79E-07	1.34E-07
78-93-3	2-Butanone	1.53E-05	7.38E-06
79-00-5	1,1,2-Trichloroethane	1.50E-06	7.21E-07
79-01-6	1,1,2-Trichloroethylene	3.56E-07	1.72E-07
79-34-5	1,1,2,2-Tetrachloroethane	3.52E-06	1.69E-06
82-68-8	Pentachloronitrobenzene (PCNB)	7.54E-06	3.63E-06
832-69-9	1-Methylphenanthrene	2.06E-09	9.94E-10
83-32-9	Acenaphthene	2.33E-09	1.12E-09
84-66-2	Diethyl phthalate	1.56E-06	7.51E-07
84-74-2	Di-n-butylphthalate	2.26E-06	1.09E-06
85-01-8	Phenanthrene	1.14E-08	5.50E-09

Table A-16 MDL-based Emission Rates

CASRN	COPC	MDL-based LAW Facility Emissions Rate	MDL-based HLW Facility HOP Emissions Rate
85-68-7	Butylbenzylphthalate	2.16E-06	1.04E-06
86-73-7	Fluorene	1.95E-09	9.38E-10
87-61-6	1,2,3-Trichlorobenzene	2.45E-07	1.18E-07
87-68-3	Hexachlorobutadiene	1.32E-06	6.35E-07
87-86-5	Pentachlorophenol	8.26E-06	3.97E-06
88-06-2	2,4,6-Trichlorophenol	1.38E-06	6.63E-07
88-74-4	o-Nitroaniline (2-nitroaniline)	1.97E-06	9.47E-07
88-75-5	2-Nitrophenol	1.97E-06	9.47E-07
90-12-0	1-Methylnaphthalene	5.09E-09	2.45E-09
91-20-3	Naphthalene	1.20E-07	5.77E-08
91-57-6	2-Methylnaphthalene	9.89E-09	4.76E-09
91-58-7	2-Chloronaphthalene	1.49E-06	7.16E-07
91-94-1	3,3'-Dichlorobenzidine	3.99E-06	1.92E-06
924-16-3	N-Nitroso-di-n-Buetylamine	2.21E-06	1.06E-06
92-52-4	1,1`-Biphenyl	1.28E-08	6.15E-09
94-59-7	Safrole (5-(2-Propenyl)-1,3-benzodioxole)	1.63E-06	7.86E-07
95-48-7	o-Cresol	1.27E-06	6.10E-07
95-49-8	o-Chlorotoluene	2.09E-07	1.01E-07
95-50-1	1,2-Dichlorobenzene	1.63E-06	7.86E-07
95-53-4	o-Toluidine	1.34E-06	6.47E-07
95-57-8	2-Chlorophenol	1.46E-06	7.02E-07
95-63-6	1,2,4-Trimethyl benzene	2.38E-07	1.14E-07
95-94-3	1,2,4,5-Tetrachlorobenzene	1.32E-06	6.33E-07
95-95-4	2,4,5-Trichlorophenol	1.32E-06	6.33E-07
96-12-8	1,2-Dibromo-3-chloropropane	2.12E-06	1.02E-06
96-18-4	1,2,3-Trichloropropane	3.73E-06	1.80E-06
98-06-6	tert-Butyl benzene	1.84E-07	8.84E-08
98-82-8	Cumene	1.69E-07	8.15E-08
98-86-2	Acetophenone	1.22E-06	5.87E-07
98-95-3	Nitrobenzene	1.37E-06	6.59E-07
99-35-4	1,3,5-Trinitrobenzene	7.20E-05	3.47E-05
99-65-0	1,3-Dinitrobenzene	7.83E-06	3.77E-06
99-87-6	p-Cymene	1.69E-07	8.15E-08
Inorganics		**g/s**	**g/s**
7429-90-5	Aluminum	5.23E-06	2.52E-06
7439-89-6	Iron	5.95E-06	2.87E-06
7439-92-1	Lead	3.84E-07	1.85E-07
7439-93-2	Lithium	2.78E-07	1.34E-07
7439-95-4	Magnesium	3.26E-06	1.57E-06
7439-96-5	Manganese	9.84E-08	4.74E-08
7439-97-6	Mercury	1.92E-08	9.24E-09
7439-98-7	Molybdenum	3.98E-07	1.92E-07
7440-02-0	Nickel	8.31E-08	4.00E-08
7440-22-4	Silver	2.64E-07	1.27E-07
7440-23-5	Sodium	2.50E-04	1.20E-04
7440-24-6	Strontium (total)	8.45E-08	4.07E-08
7440-28-0	Thallium	3.36E-07	1.62E-07
7440-31-5	Tin	1.50E-05	7.20E-06
7440-36-0	Antimony	3.26E-07	1.57E-07
7440-38-2	Arsenic	2.98E-07	1.43E-07
7440-39-3	Barium	4.51E-07	2.17E-07
7440-41-7	Beryllium	1.44E-08	6.93E-09
7440-43-9	Cadmium	2.02E-08	9.71E-09

Table A-16 MDL-based Emission Rates

CASRN	COPC	MDL-based LAW Facility Emissions Rate	MDL-based HLW Facility HOP Emissions Rate
7440-47-3	Chromium	2.21E-07	1.06E-07
7440-48-4	Cobalt	6.10E-08	2.93E-08
7440-50-8	Copper	2.06E-07	9.94E-08
7440-62-2	Vanadium	8.64E-08	4.16E-08
7440-66-6	Zinc	4.13E-07	1.99E-07
7647-01-0	Hydrogen chloride	2.02E-05	9.71E-06
7664-39-3	Hydrogen fluoride	2.40E-04	1.16E-04
7723-14-0	Phosphorus	4.22E-07	2.03E-07
7782-49-2	Selenium	3.36E-07	1.62E-07
7782-50-5	Chlorine	2.02E-05	9.71E-06

A.11 Process Upsets

Process upset conditions include periods of startup, shutdown, process malfunction (e.g., the unit is operating outside the permitted operating conditions), or equipment failure. Periods when process equipment is being maintained or in an idle condition are also included. Process upset conditions are generally assumed to result in greater than normal stack emissions during the short period of the upset. However, EPA has indicated that upsets are not generally expected to significantly increase stack emissions over the lifetime of a facility (EPA530-R-05-006).

The potential for increased emissions during upset events were addressed through the application of upset factors. The default upset factors are 2.8 for organic chemicals and 1.45 for metals (RAWP Section 5.3). These upset factors were applied to the estimated vapor-phase emissions that were environmentally modeled. These upset factors are based on the amount of time the facility is expected to operate in an upset condition and the estimated magnitude of stack emissions during upset relative to routine operating conditions. Refer to Section 5.3 of the RAWP for more details on process upsets and their calculations.

A.12 Other Emissions Sources, Baseline WTP Operating Configuration

A.12.1 Analytical Laboratory

Lab emission for the baseline WTP configuration are less than 1% of the total risk and are not included in this report.

A.12.2 Cell Emissions Estimate

Ecology has agreed (CCN 023430) that fugitive emissions are not applicable to the WTP. Fugitive emissions, as defined in WAC-173-400-030(39), *Definitions*, “means emissions that could not reasonably pass through a stack, chimney, vent, or other functionally equivalent opening.” Conversely, for WTP, the cell emissions are those vapor emissions that leak from valves, connectors, etc. within the facility that are incidental to waste processing and considered uncontrolled, with the exception of HEPA filtration control of the particulate phase. Such constituents are primarily volatile organics, but dimethylmercury, tritium, and ammonia are also considered due to their ability to exist in the vapor phase under standard conditions. The estimated release of organic material from ancillary equipment is calculated using EPA-453/R-95-017, and from the composition of representative process streams as provided in the emissions estimate. Refer to 24590-WTP-RPT-ENV-17-008, *Cell Emissions Estimate* (Supplement 3 of the RAWP) for a

detailed description. Table A-17 provides the total process cell emissions, summed for each of the PT, LAW, and HLW Facilities as provided in 24590-WTP-RPT-ENV-17-008.

Table A-17 Cell Emission Rates for the Baseline WTP Operating Configuration

CASRN	COPC	PT Facility Cell Emissions Rate (g/s)	LAW Facility Cell Emissions Rate (g/s)	HLW Facility Cell Emissions Rate (g/s)
100-02-7	p-Nitrophenol	8.94E-06	1.43E-05	8.71E-07
100-21-0	Phthalic acid	3.57E-06	5.36E-06	3.63E-07
100-25-4	1,4-Dinitrobenzene	1.05E-08	4.79E-09	1.54E-09
100-40-3	4-Ethenylcyclohexene	4.25E-07	2.44E-24	5.00E-08
100-41-4	Ethyl benzene	1.16E-11	2.21E-24	1.36E-12
100-42-5	Styrene	5.58E-12	1.71E-10	6.53E-13
10061-01-5	cis-1,3-Dichloropropene	2.05E-11	1.36E-21	2.41E-12
10061-02-6	trans-1,3-Dichloropropene	2.14E-11	5.20E-19	2.52E-12
101-55-3	4-Bromophenylphenyl ether	6.61E-07	7.18E-11	7.82E-08
104-76-7	2-Ethyl-1-hexanol	5.93E-07	2.23E-09	6.71E-08
105-67-9	2,4-Dimethylphenol	8.95E-07	7.30E-07	2.11E-07
10595-95-6	n-Nitrosomethylethylamine	1.95E-06	1.46E-07	2.85E-07
106-46-7	1,4-Dichlorobenzene	3.52E-09	6.87E-11	4.15E-10
106-47-8	p-Chloroaniline	1.12E-06	1.12E-06	2.45E-07
106-88-7	1,2-Epoxybutane	5.70E-07	1.39E-11	6.73E-08
106-93-4	Ethylene dibromide	5.56E-12	3.03E-19	6.54E-13
106-99-0	1,3-Butadiene	1.86E-10	4.75E-29	2.19E-11
107-02-8	Acrolein	3.05E-10	2.96E-14	3.61E-11
107-05-1	3-Chloropropene	2.05E-11	4.61E-25	2.41E-12
107-06-2	1,2-Dichloroethane	7.52E-12	4.70E-10	7.65E-13
107-12-0	Propionitrile	2.07E-09	4.20E-12	2.38E-10
107-13-1	Acrylonitrile	2.19E-09	6.77E-09	8.71E-11
108-05-4	Acetic acid vinyl ester	6.77E-07	2.19E-13	7.97E-08
108-10-1	4-Methyl-2-pentanone	7.29E-11	4.27E-15	8.62E-12
108-39-4	m-Cresol	3.49E-06	3.89E-07	5.21E-07
108-87-2	Methylcyclohexane	2.36E-11	0.00E+00	2.78E-12
108-88-3	Toluene	2.90E-11	6.98E-11	3.41E-12
108-90-7	Chlorobenzene	6.69E-12	1.24E-10	7.95E-13
108-94-1	Cyclohexanone	2.90E-08	4.53E-10	3.34E-09
108-95-2	Phenol	3.93E-07	5.39E-07	7.10E-08
109-74-0	n-Butanenitrile	5.75E-07	5.52E-10	6.72E-08
109-99-9	Tetrahydrofuran	2.31E-10	9.82E-14	2.72E-11
110-54-3	n-Hexane	1.08E-09	0.00E+00	1.27E-10
110-59-8	Pentanenitrile	5.40E-07	2.38E-10	6.36E-08
110-80-5	2-Ethoxyethanol	1.03E-05	1.75E-06	1.51E-06
110-82-7	Cyclohexane	2.05E-11	0.00E+00	2.41E-12
110-83-8	Cyclohexene	2.05E-11	1.04E-28	2.41E-12
110-86-1	Pyridine	7.02E-09	1.12E-10	8.10E-10
111-44-4	bis(2-Chloroethyl)ether	2.09E-08	1.48E-08	4.77E-09
111-65-9	n-Octane	2.47E-10	0.00E+00	2.91E-11
111-76-2	2-Butoxyethanol	1.28E-06	8.84E-08	1.86E-07
111-84-2	n-Nonane	1.66E-10	2.42E-24	1.95E-11
111-91-1	bis(2-Chloroethoxy)methane	1.12E-07	7.45E-08	2.76E-08
117-81-7	Bis(2-ethylhexyl) phthalate	4.10E-06	6.93E-06	4.64E-07
117-84-0	Di-n-octylphthalate	2.33E-06	1.33E-09	2.73E-07
118-74-1	Hexachlorobenzene	1.18E-11	1.11E-10	5.67E-12
120-12-7	Anthracene	4.18E-07	2.65E-09	4.94E-08
120-82-1	1,2,4-Trichlorobenzene	4.11E-10	8.80E-19	4.84E-11
120-83-2	2,4-Dichlorophenol	8.54E-07	1.08E-16	1.00E-07

Table A-17 Cell Emission Rates for the Baseline WTP Operating Configuration

CASRN	COPC	PT Facility Cell Emissions Rate (g/s)	LAW Facility Cell Emissions Rate (g/s)	HLW Facility Cell Emissions Rate (g/s)
121-14-2	2,4-Dinitrotoluene	8.48E-06	8.33E-06	9.73E-07
122-39-4	N,N-Diphenylamine	1.19E-09	7.24E-11	1.60E-10
123-38-6	Propionaldehyde	7.06E-10	2.90E-13	8.31E-11
123-72-8	Butanal	5.74E-07	6.38E-11	6.79E-08
123-91-1	1,4-Dioxan	3.41E-10	9.62E-12	4.28E-11
124-48-1	Chlorodibromomethane	2.36E-12	5.90E-10	1.67E-15
126-73-8	Tributyl phosphate	1.30E-06	1.47E-07	1.85E-07
126-98-7	2-Methyl-2-propenenitrile	2.06E-10	1.51E-15	2.43E-11
127-18-4	1,1,2,2-Tetrachloroethene	6.76E-12	1.04E-26	7.94E-13
128-37-0	2,6-Bis(tert-butyl)-4-methylphenol	1.72E-08	7.19E-10	2.21E-09
129-00-0	Pyrene	2.75E-06	7.77E-08	3.16E-07
131-11-3	Dimethyl Phthalate	1.95E-07	5.52E-07	2.21E-08
132-64-9	Dibenzofuran	6.35E-11	7.35E-10	1.09E-10
1330-20-7	Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations)	1.98E-09	8.88E-11	2.33E-10
1336-36-3	Polychlorinated biphenyls	2.80E-07	3.77E-12	2.66E-08
134-32-7	alpha-Naphthylamine	1.71E-06	1.31E-06	1.89E-07
141-78-6	Acetic acid ethyl ester	2.21E-11	1.50E-15	2.62E-12
156-60-5	1,2-trans-Dichloroethene	1.52E-06	1.07E-19	1.79E-07
1634-04-4	Methyl tert-butyl ether	5.54E-07	9.24E-14	6.52E-08
1746-01-6	2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	2.45E-17	2.57E-17	6.62E-18
189-55-9	Dibenzo[a,i]pyrene	1.72E-06	2.15E-06	1.72E-07
189-64-0	Dibenzo[a,h]pyrene	1.72E-06	2.15E-06	1.72E-07
191-24-2	Benzo(g,h,i)perylene	1.89E-06	2.44E-06	2.33E-07
191-30-0	Dibenzo(a,l)pyrene	1.72E-06	2.15E-06	1.72E-07
192-65-4	Dibenzo[a,e]pyrene	1.72E-06	2.15E-06	1.72E-07
193-39-5	Indeno(1,2,3-cd)pyrene	1.22E-06	5.99E-07	1.86E-07
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	6.03E-18	1.06E-17	4.01E-17
205-99-2	Benzo(b)fluoranthene	8.88E-08	6.92E-08	2.01E-08
206-44-0	Fluoranthene	2.51E-06	3.88E-08	2.83E-07
207-08-9	Benzo(k)fluoranthene	5.52E-07	1.05E-06	8.88E-08
208-96-8	Acenaphthylene	4.04E-07	1.22E-09	4.80E-08
218-01-9	Chrysene	7.34E-10	2.25E-09	3.33E-10
224-42-0	Dibenz[a,j]acridine	1.99E-06	2.73E-06	1.95E-07
226-36-8	Dibenz[a,h]acridine	1.92E-06	2.54E-06	1.83E-07
27154-33-2	Trichlorofluoroethane	2.38E-06	9.70E-20	2.80E-07
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	1.89E-17	4.09E-16	2.91E-17
319-84-6	alpha-BHC	3.18E-11	4.63E-13	3.59E-12
319-85-7	beta-BHC	2.09E-08	3.27E-08	5.79E-09
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	6.74E-14	1.98E-14	1.68E-14
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	1.73E-19	4.82E-17	2.01E-18
3268-87-9	Octachlorodibenzo(p)dioxin	6.06E-15	4.70E-15	1.66E-15
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	1.23E-16	2.52E-16	1.05E-17
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	6.44E-16	3.93E-16	3.25E-16
3697-24-3	5-Methylchrysene	6.50E-07	1.98E-08	7.91E-08
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	2.46E-17	1.39E-16	8.96E-18
39001-02-0	Octachlorodibenzofuran	2.44E-15	2.98E-15	5.31E-16
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	1.53E-16	7.13E-17	1.22E-16
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	1.01E-16	1.52E-16	1.23E-17
40321-76-4	1,2,3,7,8-Pentachlorodibenzo(p)dioxin	8.81E-16	4.94E-16	3.47E-16
4170-30-3	Crotonaldehyde (Propylene aldehyde)	2.80E-10	1.76E-20	4.03E-11
50-00-0	Formaldehyde	2.59E-06	5.32E-07	3.69E-07

Table A-17 Cell Emission Rates for the Baseline WTP Operating Configuration

CASRN	COPC	PT Facility Cell Emissions Rate (g/s)	LAW Facility Cell Emissions Rate (g/s)	HLW Facility Cell Emissions Rate (g/s)
50-32-8	Benzo(a)pyrene	1.56E-07	1.54E-07	3.43E-08
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	4.42E-16	2.89E-16	2.13E-16
51-28-5	2,4-Dinitrophenol	3.67E-06	7.18E-06	5.61E-07
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	2.73E-15	2.45E-15	2.22E-16
534-52-1	4,6-Dinitro-o-cresol	1.47E-06	1.82E-06	2.99E-07
53-70-3	Dibenz[a,h]anthracene	3.16E-07	1.81E-06	1.99E-08
540-59-0	1,2-Dichloroethene (total) (1,2-Dichloroethylene)	4.14E-15	1.13E-10	1.95E-19
541-73-1	1,3-Dichlorobenzene	2.69E-10	8.70E-21	3.17E-11
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	8.53E-17	6.05E-17	2.59E-17
56-23-5	Carbon tetrachloride	1.06E-11	1.54E-11	1.25E-12
56-49-5	3-Methylcholanthrene	6.59E-07	2.12E-08	8.09E-08
56-55-3	Benzo(a)anthracene	1.47E-07	1.46E-07	3.23E-08
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	6.50E-16	5.61E-16	1.52E-16
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	4.89E-16	3.85E-16	1.47E-16
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	2.31E-16	1.57E-16	6.29E-17
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	3.18E-15	2.24E-15	6.22E-16
57653-85-7	1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	1.33E-16	8.29E-17	7.56E-17
58-89-9	gamma-BHC (Lindane)	5.34E-11	2.14E-12	7.09E-12
58-90-2	2,3,4,6-Tetrachlorophenol	2.08E-06	7.92E-08	2.61E-07
589-38-8	3-Hexanone	5.31E-07	4.51E-11	6.28E-08
591-78-6	2-Hexanone	9.05E-10	1.90E-13	1.07E-10
59-50-7	4-Chloro-3-methylphenol	3.44E-06	1.69E-07	4.78E-07
59-89-2	N-Nitrosomorpholine	1.39E-05	5.82E-06	1.78E-06
602-87-9	5-Nitroacenaphthene	1.22E-06	1.70E-07	1.71E-07
60-29-7	Ethyl ether	7.70E-10	3.22E-18	9.06E-11
60-35-5	Acetamide	3.02E-06	1.33E-06	3.79E-07
606-20-2	2,6-Dinitrotoluene	3.16E-07	5.05E-07	5.55E-08
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	8.05E-17	5.61E-17	2.08E-17
621-64-7	N-Nitroso-di-n-propylamine	3.39E-06	1.78E-07	4.75E-07
62-75-9	N-Nitroso-N,N-dimethylamine	1.87E-08	1.17E-09	2.68E-09
628-73-9	Hexanenitrile	5.19E-07	1.03E-10	6.13E-08
630-20-6	1,1,1,2-Tetrachloroethane	2.64E-06	3.19E-16	3.10E-07
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	2.89E-13	7.89E-14	3.68E-14
67-56-1	Methyl alcohol	1.64E-06	3.91E-08	1.93E-07
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	2.66E-16	1.89E-16	7.67E-17
67-63-0	2-Propyl alcohol	8.46E-10	1.44E-11	9.82E-11
67-64-1	2-Propanone (Acetone)	4.30E-08	3.74E-08	4.04E-09
67-66-3	Chloroform	6.95E-12	1.24E-10	8.25E-13
67-72-1	Hexachloroethane	8.20E-08	7.82E-19	9.64E-09
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	3.03E-16	4.58E-16	4.98E-17
70362-50-4	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	6.14E-16	5.26E-16	1.17E-16
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	1.93E-16	1.07E-16	1.19E-16
71-36-3	n-Butyl alcohol	2.41E-08	3.85E-10	2.78E-09
71-43-2	Benzene	1.75E-11	8.22E-11	2.07E-12
71-55-6	1,1,1-Trichloroethane	6.87E-12	1.49E-26	8.07E-13
72-55-9	4,4-DDE	8.62E-07	5.23E-09	9.68E-08
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	4.82E-17	3.41E-17	1.13E-17
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	3.16E-17	9.25E-17	9.93E-18
74-83-9	Bromomethane	1.39E-11	7.39E-11	1.63E-12
74-87-3	Chloromethane	2.76E-11	5.23E-11	3.25E-12
74-88-4	Iodomethane	1.49E-15	8.34E-11	3.59E-15
75-00-3	Chloroethane	1.39E-11	1.42E-24	1.63E-12

Table A-17 Cell Emission Rates for the Baseline WTP Operating Configuration

CASRN	COPC	PT Facility Cell Emissions Rate (g/s)	LAW Facility Cell Emissions Rate (g/s)	HLW Facility Cell Emissions Rate (g/s)
75-01-4	1-Chloroethene	1.41E-11	1.85E-27	1.65E-12
75-02-5	Fluoroethene (vinyl fluoride)	7.24E-07	9.78E-27	8.51E-08
75-05-8	Acetonitrile	4.10E-07	4.26E-07	3.93E-08
75-07-0	Acetaldehyde	7.12E-07	2.40E-10	8.40E-08
75-09-2	Dichloromethane (Methylene Chloride)	4.11E-09	5.45E-09	4.83E-10
75-15-0	Carbon disulfide	3.66E-18	1.55E-11	3.26E-17
75-21-8	Ethylene oxide (Oxirane)	1.20E-09	5.84E-14	1.42E-10
75-25-2	Bromoform	3.40E-25	7.05E-14	0.00E+00
75-27-4	Bromodichloromethane	5.15E-06	5.50E-15	6.06E-07
75-34-3	1,1-Dichloroethane	5.56E-12	7.25E-24	6.53E-13
75-35-4	1,1-Dichloroethene	8.74E-12	1.45E-27	1.03E-12
75-45-6	Chlorodifluoromethane	2.05E-11	2.11E-28	2.41E-12
75-50-3	Trimethylamine	6.30E-07	9.54E-11	7.44E-08
75-69-4	Trichlorofluoromethane	1.69E-11	0.00E+00	1.98E-12
75-71-8	Dichlorodifluoromethane	1.72E-11	0.00E+00	2.02E-12
76-13-1	1,2,2-Trichlorotrifluoroethane	1.70E-11	0.00E+00	2.00E-12
76-44-8	Heptachlor	1.60E-11	0.00E+00	1.88E-12
77-47-4	Hexachlorocyclopentadiene	1.80E-17	5.87E-11	2.38E-14
78-83-1	2-Methylpropyl alcohol	1.37E-05	1.96E-07	1.56E-06
78-87-5	1,2-Dichloropropane	5.56E-12	3.09E-22	6.53E-13
78-93-3	2-Butanone	9.60E-09	1.17E-08	7.17E-10
79-00-5	1,1,2-Trichloroethane	6.51E-12	1.27E-19	7.66E-13
79-01-6	1,1,2-Trichloroethylene	7.40E-12	4.61E-11	8.70E-13
79-10-7	2-Propenoic acid	3.95E-06	7.77E-07	5.72E-07
79-34-5	1,1,2,2-Tetrachloroethane	6.52E-12	1.29E-17	7.69E-13
79-46-9	2-Nitropropane	1.39E-09	1.38E-13	1.64E-10
82-68-8	Pentachloronitrobenzene (PCNB)	1.30E-09	1.60E-15	1.53E-10
83-32-9	Acenaphthene	1.98E-06	9.05E-10	2.34E-07
84-66-2	Diethyl phthalate	2.07E-06	1.24E-06	2.86E-07
84-74-2	Di-n-butylphthalate	2.60E-05	3.46E-06	3.70E-06
85-01-8	Phenanthrene	4.87E-07	1.27E-08	5.62E-08
85-68-7	Butylbenzylphthalate	8.88E-06	1.39E-06	1.27E-06
86-73-7	Fluorene	4.20E-07	3.33E-09	4.98E-08
87-68-3	Hexachlorobutadiene	3.52E-09	5.81E-22	4.14E-10
87-86-5	Pentachlorophenol	1.57E-08	1.91E-08	1.60E-09
88-06-2	2,4,6-Trichlorophenol	2.58E-06	4.67E-08	3.02E-07
88-74-4	o-Nitroaniline (2-nitroaniline)	2.69E-07	7.56E-07	3.06E-08
88-75-5	2-Nitrophenol	2.63E-06	1.13E-07	3.17E-07
91-20-3	Naphthalene	1.84E-06	3.44E-08	2.18E-07
91-57-6	2-Methylnaphthalene	4.84E-10	3.48E-09	6.12E-10
91-58-7	2-Chloronaphthalene	5.12E-07	1.42E-12	6.04E-08
91-94-1	3,3'-Dichlorobenzidine	1.48E-06	5.03E-06	1.41E-07
92-52-4	1,1`-Biphenyl	1.30E-09	3.88E-15	1.53E-10
95-48-7	o-Cresol	4.54E-06	3.93E-07	6.72E-07
95-50-1	1,2-Dichlorobenzene	5.36E-09	2.33E-18	6.31E-10
95-57-8	2-Chlorophenol	1.86E-06	2.00E-12	2.20E-07
95-95-4	2,4,5-Trichlorophenol	2.87E-06	8.85E-08	3.66E-07
98-82-8	Cumene	4.19E-07	0.00E+00	4.92E-08
98-86-2	Acetophenone	2.02E-09	6.32E-11	2.51E-10
98-95-3	Nitrobenzene	1.78E-08	1.02E-08	3.42E-09
593-74-8	Dimethyl Mercury	2.87E-11	3.46E-10	1.83E-13
7664-41-7	Ammonia/Ammonium	1.14E-05	4.96E-06	3.88E-06

Table A-17 Cell Emission Rates for the Baseline WTP Operating Configuration

CASRN	COPC	PT Facility Cell Emissions Rate (g/s)	LAW Facility Cell Emissions Rate (g/s)	HLW Facility Cell Emissions Rate (g/s)
10028-17-8	Tritium	3.01E-10	3.97E-11	2.31E-11

A.13 Emissions Consolidation, Baseline WTP Operating Configuration

The data provided in Table A-18 indicate the final estimated emissions rates used to evaluate the baseline WTP operating configuration in the PRA. The final rates include the estimated emissions from process modeling, the impact of upset factors, then application of MDLs where appropriate, and the addition of process cell emissions. For example, the total PCB (1336-36-3) emissions estimated for the LAW melter were 1.26E-12 g/s (Table A-14). After applying an upset factor of 2.8 (refer to Section A.5), this value is further increased to 3.54E-12 g/s. However, the emission rate based on the MDL for this constituent is forecasted to be 5.04E-09 g/s (Table A-16), so the constituent is presumed present at the MDL[8]. When LAW cell emissions of 6.28E-12 g/s (Table A-17) are added, the total corresponding emission rate evaluated in the risk assessment is 5.04E-12 g/s (Table A-19). The process for non-organics is similar, only an upset factor of 1.45 is used.

A.13.1 PT Facility

The PT Facility emissions include the contribution of the PJV12 and PVP13, plus related PT Facility cell emissions. Since the PT Facility is not a thermal treatment unit, upset factors are not applied. Note that units of g/s apply to organics and inorganics, and units of Ci/s apply to radionuclides. The PRA emission rates for the PT Facility in the baseline WTP operating configuration are presented in Table A-18.

Table A-18 PT Facility Emission Rates for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

COPC	CASRN	PT Facility Emissions Rate
Organics		**g/s**
p-Nitrophenol	100-02-7	9.25E-06
Phthalic acid	100-21-0	3.57E-06
1,4-Dinitrobenzene	100-25-4	1.80E-07
4-Ethenylcyclohexene	100-40-3	5.11E-04
Ethyl benzene	100-41-4	1.39E-08
Styrene	100-42-5	9.50E-06
Benzyl chloride	100-44-7	0.00E+00
Benzonitrile	100-47-0	0.00E+00
Benzyl alcohol	100-51-6	0.00E+00
Benzaldehyde	100-52-7	0.00E+00
cis-1,3-Dichloropropene	10061-01-5	2.46E-08
trans-1,3-Dichloropropene	10061-02-6	2.54E-08
4-Bromophenylphenyl ether	101-55-3	7.27E-04
4,4-Methylenedianiline	101-77-9	0.00E+00
Azobenzene	103-33-3	0.00E+00
n-Propyl benzene (Isocumene)	103-65-1	0.00E+00

[8] If a COPC is not detected, and is a potential risk driver (e.g., PCB or PAH), it is presumed present at the MDL, otherwise, it is presumed present at one-half the MDL (refer to Section 5.2.2 of the RAWP).

Table A-18 PT Facility Emission Rates for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

COPC	CASRN	PT Facility Emissions Rate
n-Butylbenzene	104-51-8	0.00E+00
2-Ethyl-1-hexanol	104-76-7	4.50E-04
2,4-Dimethylphenol	105-67-9	1.61E-04
n-Nitrosomethylethylamine	10595-95-6	1.52E-04
4-Chlorotoluene (p-Tolyl chloride)	106-43-4	0.00E+00
p-Cresol (4-methyl phenol)	106-44-5	0.00E+00
1,4-Dichlorobenzene	106-46-7	8.01E-06
p-Chloroaniline	106-47-8	1.15E-04
p-Toluidine	106-49-0	0.00E+00
Quinone	106-51-4	0.00E+00
1,2-Epoxybutane	106-88-7	6.50E-04
Epichlorohydrin (1-chloro-2,3 epoxypropane)	106-89-8	0.00E+00
Ethylene dibromide	106-93-4	6.58E-09
1,3-Butadiene	106-99-0	2.25E-07
Acrolein	107-02-8	3.38E-07
3-Chloropropene	107-05-1	2.47E-08
1,2-Dichloroethane	107-06-2	2.41E-05
Propionitrile	107-12-0	1.82E-06
Acrylonitrile	107-13-1	1.48E-04
Propargyl alcohol	107-19-7	0.00E+00
Ethylene glycol (1,2-ethanediol)	107-21-1	0.00E+00
Propylene glycol monomethyl ether	107-98-2	0.00E+00
Acetic acid vinyl ester	108-05-4	8.00E-04
4-Methyl-2-pentanone	108-10-1	8.16E-08
m-Cresol	108-39-4	1.68E-04
bis (2-Chloroisopropyl)ether	108-60-1	0.00E+00
1,3,5-Trimethylbenzene	108-67-8	0.00E+00
Bromobenzene (Phenyl bromide)	108-86-1	0.00E+00
Methylcyclohexane	108-87-2	2.84E-08
Toluene	108-88-3	4.04E-06
Chlorobenzene	108-90-7	7.03E-06
Cyclohexanone	108-94-1	1.13E-05
Phenol	108-95-2	1.45E-05
n-Butanenitrile	109-74-0	5.56E-04
3-Butenenitrile	109-75-1	0.00E+00
Malononitrile	109-77-3	0.00E+00
2-Methoxyethanol	109-86-4	0.00E+00
Tetrahydrofuran	109-99-9	2.40E-07
Furan	110-00-9	0.00E+00
n-Hexane	110-54-3	1.30E-06
Pentanenitrile	110-59-8	5.58E-04
2-Ethoxyethanol	110-80-5	2.79E-04
Cyclohexane	110-82-7	2.47E-08
Cyclohexene	110-83-8	2.47E-08
Pyridine	110-86-1	2.71E-06
Ethylene glycol monoethyl ether acetate	111-15-9	0.00E+00
Bis(2-chloroethyl)ether	111-44-4	6.19E-05
n-Octane	111-65-9	2.97E-07
2-Butoxyethanol	111-76-2	1.10E-04
n-Nonane	111-84-2	1.99E-07
Bis(2-chloroethoxy)methane	111-91-1	4.16E-05
Undecane	1120-21-4	0.00E+00

Table A-18 PT Facility Emission Rates for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

COPC	CASRN	PT Facility Emissions Rate
1,3-Propane sultone	1120-71-4	0.00E+00
1-Decanol	112-30-1	0.00E+00
Decanal	112-31-2	0.00E+00
Dodecane	112-40-3	0.00E+00
Bis(2-ethylhexyl) phthalate	117-81-7	4.16E-05
Di-n-octylphthalate	117-84-0	2.37E-03
Hexachlorobenzene	118-74-1	5.89E-06
3,3'-Dimethoxybenzidine	119-90-4	0.00E+00
Anthracene	120-12-7	4.57E-04
1,2,4-Trichlorobenzene	120-82-1	4.90E-07
2,4-Dichlorophenol	120-83-2	1.02E-03
2,4-Dinitrotoluene	121-14-2	6.36E-05
N,N-Diphenylamine	122-39-4	1.65E-07
1,2-Diphenylhydrazine	122-66-7	0.00E+00
Maleic hydrazide	123-33-1	0.00E+00
Propionaldehyde	123-38-6	7.38E-07
Butanal	123-72-8	6.34E-04
1,4-Dioxan	123-91-1	7.99E-08
Decane	124-18-5	0.00E+00
Chlorodibromomethane	124-48-1	2.90E-05
Tributyl phosphate	126-73-8	9.95E-05
2-Methyl-2-propenenitrile	126-98-7	2.38E-07
1,1,2,2-Tetrachloroethene	127-18-4	8.11E-09
2,6-Bis(tert-butyl)-4-methylphenol	128-37-0	3.49E-06
Pyrene	129-00-0	1.30E-03
Dimethyl Phthalate	131-11-3	2.59E-06
2-Cycloyhexyl-4,6-dinitrophenol	131-89-5	0.00E+00
Dibenzofuran	132-64-9	2.49E-05
Xylenes (mixed isomers)	1330-20-7	7.44E-06
Captan	133-06-2	0.00E+00
Polychlorinated biphenyls – Note 1	1336-36-3	1.04E-03
alpha-Naphthylamine	134-32-7	1.44E-05
sec-Butylbenzene	135-98-8	0.00E+00
Acetic acid ethyl ester	141-78-6	2.48E-08
Endothall	145-73-3	0.00E+00
cis-1,2-Dichloroethene	156-59-2	0.00E+00
1,2-trans-Dichloroethene	156-60-5	1.83E-03
Methyl tert-butyl ether	1634-04-4	6.56E-04
2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1746-01-6	1.97E-13
Dibenzo[a,i]pyrene	189-55-9	3.52E-06
Dibenzo[a,h]pyrene	189-64-0	3.52E-06
Benzo(g,h,i)perylene	191-24-2	5.02E-05
Dibenzo(a,l)pyrene	191-30-0	3.52E-06
Dibenzo[a,e]pyrene	192-65-4	3.52E-06
Benzo(e)pyrene	192-97-2	0.00E+00
Indeno(1,2,3-cd)pyrene	193-39-5	1.30E-04
1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	19408-74-3	2.15E-13
Benzo[j]fluoranthene	205-82-3	0.00E+00
Benzo(b)fluoranthene	205-99-2	1.29E-04
Fluoranthene	206-44-0	1.49E-03
Benzo(k)fluoranthene	207-08-9	4.72E-05
Acenaphthylene	208-96-8	4.71E-04

Table A-18 PT Facility Emission Rates for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

COPC	CASRN	PT Facility Emissions Rate
Chrysene	218-01-9	4.53E-05
Dibenz[a,j]acridine	224-42-0	2.29E-06
2,3,5-Trimethylnaphthalene	2245-38-7	0.00E+00
Dibenz[a,h]acridine	226-36-8	2.21E-06
Pronamide	23950-58-5	0.00E+00
Trichlorofluoroethane	27154-33-2	2.87E-03
2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	31508-00-6	1.60E-11
alpha-BHC	319-84-6	1.43E-08
beta-BHC	319-85-7	5.69E-07
3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	32598-13-3	1.14E-11
2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	32598-14-4	2.44E-12
Octachlorodibenzo(p)dioxin	3268-87-9	4.56E-12
3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	32774-16-6	3.82E-12
1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	35822-46-9	1.20E-12
5-Methylchrysene	3697-24-3	1.78E-04
2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	38380-08-4	3.88E-12
Octachlorodibenzofuran	39001-02-0	4.37E-13
1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	39227-28-6	2.56E-13
2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	39635-31-9	1.87E-12
1,2,3,7,8-Pentachlorodibenzo(p)dioxin	40321-76-4	2.30E-13
Crotonaldehyde (Propylene aldehyde)	4170-30-3	3.91E-07
Chlorocyclopentadiene	41851-50-7	0.00E+00
Cyanogen (oxalonitrile)	460-19-5	0.00E+00
2-Butenenitrile	4786-20-3	0.00E+00
Formaldehyde	50-00-0	5.26E-05
Benzo(a)pyrene	50-32-8	5.16E-05
Cyanogen bromide (bromocyanide)	506-68-3	0.00E+00
Cyanogen chloride	506-77-4	0.00E+00
Chlorobenzilate	510-15-6	0.00E+00
2,3,7,8-Tetrachlorodibenzofuran	51207-31-9	9.83E-13
2,4-Dinitrophenol	51-28-5	1.68E-04
Ethyl carbamate (urethane)	51-79-6	0.00E+00
2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	52663-72-6	4.03E-12
1,2-Dinitrobenzene (o-Dinitrobenzene)	528-29-0	0.00E+00
2-Chloroacetophenone	532-27-4	0.00E+00
4,6-Dinitro-o-cresol	534-52-1	1.93E-04
Dibenz[a,h]anthracene	53-70-3	1.17E-06
Dibenzo(a,e)fluoranthene	5385-75-1	0.00E+00
1,2-Dichloroethene (total) (1,2-Dichloroethylene)	540-59-0	6.41E-06
1,2-Dimethylhydrazine	540-73-8	0.00E+00
2,2,4-Trimethylpentane	540-84-1	0.00E+00
1,3-Dichlorobenzene	541-73-1	3.22E-07
1,3-Dichloropropene	542-75-6	0.00E+00
Bis(chloromethyl)ether	542-88-1	0.00E+00
1,2,3,4,7,8,9-Heptachlorodibenzofuran	55673-89-7	1.92E-13
Carbon tetrachloride	56-23-5	9.09E-07
3-Methylcholanthrene	56-49-5	1.72E-04
Benzo(a)anthracene	56-55-3	4.89E-05
2,3,4,7,8-Pentachlorodibenzofuran	57117-31-4	3.34E-13
1,2,3,7,8-Pentachlorodibenzofuran	57117-41-6	2.55E-13
1,2,3,6,7,8-Hexachlorodibenzofuran	57117-44-9	2.05E-13
Strychnine	57-24-9	0.00E+00

Table A-18 PT Facility Emission Rates for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

COPC	CASRN	PT Facility Emissions Rate
3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	57465-28-8	3.52E-12
1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	57653-85-7	3.16E-13
Chlordane	57-74-9	0.00E+00
2,6-Dimethylnaphthalene	581-42-0	0.00E+00
2,4-Toluene diisocyanate	584-84-9	0.00E+00
gamma-BHC (Lindane)	58-89-9	1.34E-08
2,3,4,6-Tetrachlorophenol	58-90-2	4.48E-04
3-Hexanone	589-38-8	5.89E-04
Benzene, iodo-	591-50-4	0.00E+00
2-Hexanone	591-78-6	9.73E-07
Bromoethene (Vinyl bromide)	593-60-2	0.00E+00
4-Chloro-3-methylphenol	59-50-7	4.38E-04
N-Nitrosomorpholine	59-89-2	3.43E-05
Dimethyl aminoazobenzene	60-11-7	2.52E-19
5-Nitroacenaphthene	602-87-9	7.74E-05
Ethyl ether	60-29-7	9.22E-07
Acetamide	60-35-5	3.80E-06
2,6-Dinitrotoluene	606-20-2	2.29E-05
2,3,4,6,7,8-Hexachlorodibenzofuran	60851-34-5	1.26E-13
Pentachlorobenzene	608-93-5	0.00E+00
Dichloropentadiene	61626-71-9	0.00E+00
N-Nitroso-di-n-propylamine	621-64-7	3.99E-04
Methyl isocyanate	624-83-9	0.00E+00
Ethyl methanesulfonate	62-50-0	0.00E+00
Aniline	62-53-3	0.00E+00
N-Nitroso-N,N-dimethylamine	62-75-9	1.81E-06
Hexanenitrile	628-73-9	5.58E-04
1,1,1,2-Tetrachloroethane	630-20-6	3.15E-03
Formic acid (methanoic acid)	64-18-6	0.00E+00
2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	65510-44-3	5.50E-10
Benzoic acid	65-85-0	0.00E+00
Methyl alcohol	67-56-1	3.79E-04
1,2,3,4,6,7,8-Heptachlorodibenzofuran	67562-39-4	6.01E-13
2-Propyl alcohol	67-63-0	3.09E-07
2-Propanone (Acetone)	67-64-1	3.66E-04
Chloroform	67-66-3	7.05E-06
Hexachloroethane	67-72-1	9.81E-05
2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	69782-90-7	5.65E-12
Hexachlorophene	70-30-4	0.00E+00
3,4,4',5-Tetrachlorobiphenyl (PCB 81)	70362-50-4	2.78E-12
1,2,3,4,7,8-Hexachlorodibenzofuran	70648-26-9	4.77E-13
n-Butyl alcohol	71-36-3	9.27E-06
Benzene	71-43-2	4.74E-06
1,1,1-Trichloroethane	71-55-6	8.26E-09
Methoxychlor	72-43-5	0.00E+00
4,4-DDE	72-55-9	5.84E-04
1,2,3,7,8,9-Hexachlorodibenzofuran	72918-21-9	6.88E-14
2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	74472-37-0	1.92E-12
Bromomethane	74-83-9	4.28E-06
Chloromethane	74-87-3	3.07E-06
Iodomethane	74-88-4	4.79E-06
Methylene bromide	74-95-3	0.00E+00

Table A-18 PT Facility Emission Rates for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

COPC	CASRN	PT Facility Emissions Rate
Bromochloromethane	74-97-5	0.00E+00
Chloroethane	75-00-3	1.67E-08
1-Chloroethene	75-01-4	1.70E-08
Fluoroethene (vinyl fluoride)	75-02-5	8.74E-04
Acetonitrile	75-05-8	3.76E-03
Acetaldehyde	75-07-0	7.56E-04
Dichloromethane (Methylene Chloride)	75-09-2	3.07E-04
Carbon disulfide	75-15-0	4.17E-07
Ethylene oxide (Oxirane)	75-21-8	1.37E-06
Bromoform	75-25-2	4.13E-09
Bromodichloromethane	75-27-4	6.15E-03
2-Chloropropane	75-29-6	0.00E+00
1,1-Dichloroethane	75-34-3	6.68E-09
1,1-Dichloroethene	75-35-4	1.05E-08
Phosgene (hydrogen phosphide)	75-44-5	0.00E+00
Chlorodifluoromethane	75-45-6	2.48E-08
Trimethylamine	75-50-3	6.93E-04
Trichlorofluoromethane	75-69-4	2.04E-08
Dichlorodifluoromethane	75-71-8	2.08E-08
Pentachloroethane	76-01-7	0.00E+00
1,2,2-Trichlorotrifluoroethane	76-13-1	2.05E-08
1,4-Dichloro-2-butene	764-41-0	0.00E+00
Heptachlor	76-44-8	1.92E-08
Glycidylaldehyde	765-34-4	0.00E+00
Hexachlorocyclopentadiene	77-47-4	3.42E-06
Dimethyl sulfate	77-78-1	0.00E+00
2-Methylpropyl alcohol	78-83-1	5.70E-03
1,2-Dichloropropane	78-87-5	6.67E-09
2-Butanone	78-93-3	1.59E-04
1,1,2-Trichloroethane	79-00-5	7.74E-09
1,1,2-Trichloroethylene	79-01-6	2.68E-06
2-Propenoic acid	79-10-7	8.56E-05
1,1,2,2-Tetrachloroethane	79-34-5	7.61E-09
2-Nitropropane	79-46-9	1.53E-06
Methyl methacrylate	80-62-6	0.00E+00
Hexamethylene-1,5-diisocyanate	822-06-0	0.00E+00
Toluene-2,6-diamine	823-40-5	0.00E+00
Pentachloronitrobenzene (PCNB)	82-68-8	1.52E-06
1-Methylphenanthrene	832-69-9	0.00E+00
Acenaphthene	83-32-9	2.26E-03
Diethyl phthalate	84-66-2	6.29E-05
Di-n-butylphthalate	84-74-2	2.58E-03
Phenanthrene	85-01-8	3.89E-04
Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	85-44-9	0.00E+00
Butylbenzylphthalate	85-68-7	6.46E-04
Fluorene	86-73-7	4.68E-04
1,2,3-Trichlorobenzene	87-61-6	0.00E+00
Hexachlorobutadiene	87-68-3	4.22E-06
Pentachlorophenol	87-86-5	4.46E-08
2,4,6-Trichlorophenol	88-06-2	9.00E-04
o-Nitroaniline (2-nitroaniline)	88-74-4	3.68E-06
2-Nitrophenol	88-75-5	1.16E-03

Table A-18 PT Facility Emission Rates for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

COPC	CASRN	PT Facility Emissions Rate
o-Anisidine	90-04-0	0.00E+00
1-Methylnaphthalene	90-12-0	0.00E+00
Naphthalene	91-20-3	3.70E-03
Quinoline	91-22-5	0.00E+00
2-Methylnaphthalene	91-57-6	5.58E-05
2-Chloronaphthalene	91-58-7	5.96E-04
3,3'-Dichlorobenzidine	91-94-1	2.23E-06
N-Nitroso-di-n-Buetylamine	924-16-3	0.00E+00
1,1`-Biphenyl	92-52-4	1.51E-06
Safrole (5-(2-Propenyl)-1,3-benzodioxole)	94-59-7	0.00E+00
2,4-D	94-75-7	0.00E+00
o-Cresol	95-48-7	2.97E-04
o-Chlorotoluene	95-49-8	0.00E+00
1,2-Dichlorobenzene	95-50-1	6.40E-06
o-Toluidine	95-53-4	0.00E+00
2-Chlorophenol	95-57-8	2.18E-03
1,2,4-Trimethyl benzene	95-63-6	0.00E+00
1,2,4,5-Tetrachlorobenzene	95-94-3	0.00E+00
2,4,5-Trichlorophenol	95-95-4	6.11E-04
1,2-Dibromo-3-chloropropane	96-12-8	0.00E+00
1,2,3-Trichloropropane	96-18-4	0.00E+00
Ethylene thiourea	96-45-7	0.00E+00
Ethyl methacrylate	97-63-2	0.00E+00
Furfural	98-01-1	0.00E+00
tert-Butyl benzene	98-06-6	0.00E+00
Benzotrichloride	98-07-7	0.00E+00
Cumene	98-82-8	5.03E-04
Methyl styrene (mixed isomers)	98-83-9	0.00E+00
Acetophenone	98-86-2	1.11E-06
Nitrobenzene	98-95-3	6.25E-05
1,3,5-Trinitrobenzene	99-35-4	0.00E+00
1,3-Dinitrobenzene	99-65-0	0.00E+00
p-Cymene	99-87-6	0.00E+00
Inorganics		**g/s**
Ozone	10028-15-6	0.00E+00
Nitrogen dioxide	10102-44-0	1.29E-02
Carbon dioxide	124-38-9	6.52E+00
Phosphate	14265-44-2	2.82E-08
Nitrate	14797-55-8	7.68E-07
Nitrite	14797-65-0	1.79E-07
Sulfate	14808-79-8	2.80E-08
Chloride	16887-00-6	1.11E-08
Fluoride	16984-48-8	1.64E-08
Methyl mercury	22967-92-6	0.00E+00
Bromide	24959-67-9	0.00E+00
Cyanide	57-12-5	1.78E-12
Dimethyl Mercury	593-74-8	3.47E-06
Carbon monoxide	630-08-0	0.00E+00
Aluminum	7429-90-5	3.22E-08
Iron	7439-89-6	2.67E-10
Lead	7439-92-1	1.02E-10
Lithium	7439-93-2	3.79E-12

Table A-18 PT Facility Emission Rates for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

COPC	CASRN	PT Facility Emissions Rate
Magnesium	7439-95-4	2.21E-11
Manganese	7439-96-5	2.49E-11
Mercury	7439-97-6	1.18E-06
Molybdenum	7439-98-7	4.62E-11
Nickel	7440-02-0	1.64E-10
Rhodium	7440-16-6	3.91E-12
Silver	7440-22-4	4.78E-12
Sodium	7440-23-5	4.82E-07
Strontium (total)	7440-24-6	7.93E-11
Tantalum	7440-25-7	2.94E-12
Thallium	7440-28-0	2.35E-11
Tin	7440-31-5	0.00E+00
Tungsten	7440-33-7	1.13E-11
Antimony	7440-36-0	1.79E-11
Arsenic	7440-38-2	1.79E-11
Barium	7440-39-3	3.80E-12
Beryllium	7440-41-7	8.81E-13
Cadmium	7440-43-9	1.65E-11
Chromium	7440-47-3	2.62E-09
Cobalt	7440-48-4	4.58E-12
Copper	7440-50-8	6.11E-12
Uranium	7440-61-1	1.18E-10
Vanadium	7440-62-2	5.08E-12
Yttrium	7440-65-5	1.92E-12
Zinc	7440-66-6	6.99E-12
Zirconium	7440-67-7	1.01E-10
Sulfur dioxide	7446-09-5	0.00E+00
Hydrogen chloride	7647-01-0	0.00E+00
Hydrogen fluoride	7664-39-3	0.00E+00
Ammonia/Ammonium	7664-41-7	1.14E-05
Total sulfur	7704-34-9	9.60E-09
Phosphorus	7723-14-0	9.21E-09
Fluorine gas	7782-41-4	0.00E+00
Selenium	7782-49-2	6.44E-11
Chlorine	7782-50-5	0.00E+00
Radionuclides		**Ci/s**
Tritium	10028-17-8	3.12E-09
Cesium-137	10045-97-3	1.56E-10
Yttrium-90 – Note 2	10098-91-6	3.77E-12
Strontium-90	10098-97-2	3.77E-12
Cobalt-60	10198-40-0	7.35E-17
Uranium-234	13966-29-5	4.26E-17
Ruthenium-106	13967-48-1	4.58E-25
Cesium-134	13967-70-9	4.05E-19
Uranium-233	13968-55-3	9.49E-17
Curium-244	13981-15-2	8.42E-17
Plutonium-238	13981-16-3	4.34E-16
Nickel-63	13981-37-8	1.42E-13
Plutonium-242	13982-10-0	4.30E-19
Radium-226	13982-63-3	4.41E-12
Uranium-236	13982-70-2	1.32E-18
Neptunium-237	13994-20-2	2.41E-16

Table A-18 PT Facility Emission Rates for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

COPC	CASRN	PT Facility Emissions Rate
Plutonium-241	14119-32-5	1.63E-15
Plutonium-240	14119-33-6	1.33E-15
Technetium-99	14133-76-7	4.48E-13
Uranium-232	14158-29-3	2.01E-18
Antimony-125	14234-35-6	9.43E-18
Protactinium-231	14331-85-2	2.73E-17
Nickel-59	14336-70-0	2.40E-15
Europium-155	14391-16-3	9.00E-17
Americium-241	14596-10-2	5.48E-14
Europium-152	14683-23-9	4.84E-16
Carbon-14	14762-75-5	8.05E-15
Actinium-227	14952-40-0	1.99E-17
Americium-243	14993-75-0	2.45E-17
Iodine-129	15046-84-1	3.45E-16
Plutonium-239	15117-48-3	6.43E-15
Uranium-235	15117-96-1	1.65E-18
Radium-228	15262-20-1	2.49E-18
Curium-242	15510-73-3	8.76E-17
Europium-154	15585-10-1	1.51E-15
Thorium-229	15594-54-4	1.23E-18
Samarium-151	15715-94-3	2.40E-12
Zirconium-93	15751-77-6	1.44E-14
Curium-243	15757-87-6	6.86E-18
Selenium-79	15758-45-9	1.00E-14
Tin-126	15832-50-5	9.50E-15
Barium-137m – Note 3	378253-40-8	1.48E-10
Cadmium-113m	378253-44-2	4.67E-15
Niobium-93m	378782-82-2	1.54E-14
Thorium-232	7440-29-1	2.00E-18
Uranium-238	7440-61-1R	5.04E-17

Notes:
1. The estimated PT Facility emissions mass flowrate of total PCBs for the refined feed vector is 1.87E-04 g/s.
2. ^{90}Y is assumed to be present in secular equilibrium with ^{90}Sr (Cember 1983).
3. The activity of ^{137}mBa is in secular equilibrium with ^{137}Cs (at 94.6% of the activity of ^{137}Cs) (24590-WTP-3DG-W12W-00002).

A.13.2 LAW Facility

The LAW Facility emissions include the contribution of the melter flue, with an upset factor applied, and then with MDLs applied for constituents estimated below the forecasted MDL, plus related LAW Facility cell emissions. Note that units of g/s apply to organics and inorganics, and units of Ci/s apply to radionuclides. The PRA emission rates for the LAW Facility in the baseline WTP operating configuration are presented in Table A-19.

Table A-19 LAW Facility Emission Rates for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

COPC	CASRN	LAW Facility Emissions Rate
Organics		**g/s**
p-Nitrophenol	100-02-7	2.15E-04
Phthalic acid	100-21-0	5.36E-06
1,4-Dinitrobenzene	100-25-4	7.34E-09
4-Ethenylcyclohexene	100-40-3	1.20E-23
Ethyl benzene	100-41-4	8.64E-08
Styrene	100-42-5	6.61E-05
Benzyl chloride	100-44-7	0.00E+00
Benzonitrile	100-47-0	0.00E+00
Benzyl alcohol	100-51-6	1.34E-06
Benzaldehyde	100-52-7	7.20E-06
cis-1,3-Dichloropropene	10061-01-5	1.44E-07
trans-1,3-Dichloropropene	10061-02-6	1.06E-07
4-Bromophenylphenyl ether	101-55-3	9.36E-07
4,4-Methylenedianiline	101-77-9	0.00E+00
Azobenzene	103-33-3	8.40E-07
n-Propyl benzene (Isocumene)	103-65-1	1.08E-07
n-Butylbenzene	104-51-8	8.55E-08
2-Ethyl-1-hexanol	104-76-7	3.44E-09
2,4-Dimethylphenol	105-67-9	3.03E-05
n-Nitrosomethylethylamine	10595-95-6	1.06E-06
4-Chlorotoluene (p-Tolyl chloride)	106-43-4	1.19E-07
p-Cresol (4-methyl phenol)	106-44-5	1.32E-06
1,4-Dichlorobenzene	106-46-7	7.22E-06
p-Chloroaniline	106-47-8	3.14E-05
p-Toluidine	106-49-0	0.00E+00
Quinone	106-51-4	0.00E+00
1,2-Epoxybutane	106-88-7	2.17E-11
Epichlorohydrin (1-chloro-2,3 epoxypropane)	106-89-8	0.00E+00
Ethylene dibromide	106-93-4	1.35E-07
1,3-Butadiene	106-99-0	1.48E-07
Acrolein	107-02-8	4.61E-14
3-Chloropropene	107-05-1	1.18E-24
1,2-Dichloroethane	107-06-2	6.61E-05
Propionitrile	107-12-0	6.50E-12
Acrylonitrile	107-13-1	6.61E-05
Propargyl alcohol	107-19-7	0.00E+00
Ethylene glycol (1,2-ethanediol)	107-21-1	0.00E+00
Propylene glycol monomethyl ether	107-98-2	0.00E+00
Acetic acid vinyl ester	108-05-4	5.45E-06
4-Methyl-2-pentanone	108-10-1	7.67E-06
m-Cresol	108-39-4	1.71E-06
bis (2-Chloroisopropyl)ether	108-60-1	8.16E-07
1,3,5-Trimethylbenzene	108-67-8	1.66E-07
Bromobenzene (Phenyl bromide)	108-86-1	1.62E-07
Methylcyclohexane	108-87-2	0.00E+00
Toluene	108-88-3	6.61E-05
Chlorobenzene	108-90-7	6.61E-05
Cyclohexanone	108-94-1	6.98E-10
Phenol	108-95-2	1.56E-05
n-Butanenitrile	109-74-0	8.56E-10

Table A-19 LAW Facility Emission Rates for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

COPC	CASRN	LAW Facility Emissions Rate
3-Butenenitrile	109-75-1	0.00E+00
Malononitrile	109-77-3	0.00E+00
2-Methoxyethanol	109-86-4	0.00E+00
Tetrahydrofuran	109-99-9	1.09E-05
Furan	110-00-9	0.00E+00
n-Hexane	110-54-3	1.80E-07
Pentanenitrile	110-59-8	3.69E-10
2-Ethoxyethanol	110-80-5	2.67E-06
Cyclohexane	110-82-7	0.00E+00
Cyclohexene	110-83-8	1.04E-28
Pyridine	110-86-1	2.06E-06
Ethylene glycol monoethyl ether acetate	111-15-9	0.00E+00
Bis(2-chloroethyl)ether	111-44-4	6.17E-06
n-Octane	111-65-9	0.00E+00
2-Butoxyethanol	111-76-2	1.36E-07
n-Nonane	111-84-2	1.32E-21
Bis(2-chloroethoxy)methane	111-91-1	5.53E-06
Undecane	1120-21-4	0.00E+00
1,3-Propane sultone	1120-71-4	0.00E+00
1-Decanol	112-30-1	0.00E+00
Decanal	112-31-2	0.00E+00
Dodecane	112-40-3	0.00E+00
Bis(2-ethylhexyl) phthalate	117-81-7	7.98E-05
Di-n-octylphthalate	117-84-0	1.11E-06
Hexachlorobenzene	118-74-1	6.22E-06
3,3'-Dimethoxybenzidine	119-90-4	0.00E+00
Anthracene	120-12-7	4.86E-06
1,2,4-Trichlorobenzene	120-82-1	7.92E-07
2,4-Dichlorophenol	120-83-2	7.15E-07
2,4-Dinitrotoluene	121-14-2	8.80E-05
N,N-Diphenylamine	122-39-4	5.04E-09
1,2-Diphenylhydrazine	122-66-7	6.63E-07
Maleic hydrazide	123-33-1	0.00E+00
Propionaldehyde	123-38-6	4.50E-13
Butanal	123-72-8	9.93E-11
1,4-Dioxan	123-91-1	1.48E-11
Decane	124-18-5	0.00E+00
Chlorodibromomethane	124-48-1	6.61E-05
Tributyl phosphate	126-73-8	2.25E-07
2-Methyl-2-propenenitrile	126-98-7	2.37E-15
1,1,2,2-Tetrachloroethene	127-18-4	9.72E-08
2,6-Bis(tert-butyl)-4-methylphenol	128-37-0	1.11E-09
Pyrene	129-00-0	5.56E-06
Dimethyl Phthalate	131-11-3	3.96E-05
2-Cycloyhexyl-4,6-dinitrophenol	131-89-5	0.00E+00
Dibenzofuran	132-64-9	5.11E-05
Xylenes (mixed isomers)	1330-20-7	6.60E-05
Captan	133-06-2	0.00E+00
Polychlorinated biphenyls – Note 1	1336-36-3	5.04E-09
alpha-Naphthylamine	134-32-7	2.70E-06
sec-Butylbenzene	135-98-8	8.46E-08

Table A-19 LAW Facility Emission Rates for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

COPC	CASRN	LAW Facility Emissions Rate
Acetic acid ethyl ester	141-78-6	2.33E-15
Endothall	145-73-3	0.00E+00
cis-1,2-Dichloroethene	156-59-2	9.18E-08
1,2-trans-Dichloroethene	156-60-5	1.57E-07
Methyl tert-butyl ether	1634-04-4	1.48E-13
2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1746-01-6	5.86E-12
Dibenzo[a,i]pyrene	189-55-9	3.30E-06
Dibenzo[a,h]pyrene	189-64-0	3.30E-06
Benzo(g,h,i)perylene	191-24-2	1.05E-04
Dibenzo(a,l)pyrene	191-30-0	3.30E-06
Dibenzo[a,e]pyrene	192-65-4	3.30E-06
Benzo(e)pyrene	192-97-2	2.69E-09
Indeno(1,2,3-cd)pyrene	193-39-5	8.63E-05
1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	19408-74-3	4.75E-12
Benzo[j]fluoranthene	205-82-3	7.20E-09
Benzo(b)fluoranthene	205-99-2	9.99E-05
Fluoranthene	206-44-0	5.19E-06
Benzo(k)fluoranthene	207-08-9	1.18E-04
Acenaphthylene	208-96-8	3.89E-05
Chrysene	218-01-9	6.16E-06
Dibenz[a,j]acridine	224-42-0	2.73E-06
2,3,5-Trimethylnaphthalene	2245-38-7	1.86E-09
Dibenz[a,h]acridine	226-36-8	2.76E-06
Pronamide	23950-58-5	1.44E-05
Trichlorofluoroethane	27154-33-2	2.40E-19
2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	31508-00-6	2.59E-09
alpha-BHC	319-84-6	7.14E-13
beta-BHC	319-85-7	5.00E-08
3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	32598-13-3	7.88E-10
2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	32598-14-4	1.08E-09
Octachlorodibenzo(p)dioxin	3268-87-9	6.82E-11
3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	32774-16-6	5.14E-10
1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	35822-46-9	2.00E-11
5-Methylchrysene	3697-24-3	3.05E-08
2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	38380-08-4	4.52E-10
Octachlorodibenzofuran	39001-02-0	1.09E-10
1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	39227-28-6	2.74E-12
2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	39635-31-9	1.01E-10
1,2,3,7,8-Pentachlorodibenzo(p)dioxin	40321-76-4	3.39E-12
Crotonaldehyde (Propylene aldehyde)	4170-30-3	2.71E-20
Chlorocyclopentadiene	41851-50-7	0.00E+00
Cyanogen (oxalonitrile)	460-19-5	0.00E+00
2-Butenenitrile	4786-20-3	0.00E+00
Formaldehyde	50-00-0	8.14E-07
Benzo(a)pyrene	50-32-8	5.40E-05
Cyanogen bromide (bromocyanide)	506-68-3	0.00E+00
Cyanogen chloride	506-77-4	0.00E+00
Chlorobenzilate	510-15-6	7.20E-06
2,3,7,8-Tetrachlorodibenzofuran	51207-31-9	2.21E-11
2,4-Dinitrophenol	51-28-5	7.12E-04
Ethyl carbamate (urethane)	51-79-6	0.00E+00

Table A-19 LAW Facility Emission Rates for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

COPC	CASRN	LAW Facility Emissions Rate
2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	52663-72-6	3.70E-10
1,2-Dinitrobenzene (o-Dinitrobenzene)	528-29-0	0.00E+00
2-Chloroacetophenone	532-27-4	0.00E+00
4,6-Dinitro-o-cresol	534-52-1	6.34E-05
Dibenz[a,h]anthracene	53-70-3	9.20E-05
Dibenzo(a,e)fluoranthene	5385-75-1	0.00E+00
1,2-Dichloroethene (total) (1,2-Dichloroethylene)	540-59-0	6.61E-05
1,2-Dimethylhydrazine	540-73-8	0.00E+00
2,2,4-Trimethylpentane	540-84-1	0.00E+00
1,3-Dichlorobenzene	541-73-1	7.95E-07
1,3-Dichloropropene	542-75-6	0.00E+00
Bis(chloromethyl)ether	542-88-1	0.00E+00
1,2,3,4,7,8,9-Heptachlorodibenzofuran	55673-89-7	5.04E-11
Carbon tetrachloride	56-23-5	6.61E-05
3-Methylcholanthrene	56-49-5	7.17E-07
Benzo(a)anthracene	56-55-3	6.36E-06
2,3,4,7,8-Pentachlorodibenzofuran	57117-31-4	1.65E-11
1,2,3,7,8-Pentachlorodibenzofuran	57117-41-6	2.21E-11
1,2,3,6,7,8-Hexachlorodibenzofuran	57117-44-9	3.60E-11
Strychnine	57-24-9	0.00E+00
3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	57465-28-8	5.48E-10
1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	57653-85-7	2.74E-12
Chlordane	57-74-9	0.00E+00
2,6-Dimethylnaphthalene	581-42-0	6.96E-09
2,4-Toluene diisocyanate	584-84-9	0.00E+00
gamma-BHC (Lindane)	58-89-9	3.30E-12
2,3,4,6-Tetrachlorophenol	58-90-2	2.58E-06
3-Hexanone	589-38-8	7.02E-11
Benzene, iodo-	591-50-4	0.00E+00
2-Hexanone	591-78-6	6.16E-07
Bromoethene (Vinyl bromide)	593-60-2	2.21E-05
4-Chloro-3-methylphenol	59-50-7	2.16E-06
N-Nitrosomorpholine	59-89-2	8.91E-06
Dimethyl aminoazobenzene	60-11-7	5.74E-07
5-Nitroacenaphthene	602-87-9	2.60E-07
Ethyl ether	60-29-7	5.37E-18
Acetamide	60-35-5	1.61E-06
2,6-Dinitrotoluene	606-20-2	6.39E-05
2,3,4,6,7,8-Hexachlorodibenzofuran	60851-34-5	1.54E-11
Pentachlorobenzene	608-93-5	7.56E-07
Dichloropentadiene	61626-71-9	0.00E+00
N-Nitroso-di-n-propylamine	621-64-7	9.37E-07
Methyl isocyanate	624-83-9	0.00E+00
Ethyl methanesulfonate	62-50-0	5.91E-07
Aniline	62-53-3	2.06E-06
N-Nitroso-N,N-dimethylamine	62-75-9	7.62E-07
Hexanenitrile	628-73-9	1.61E-10
1,1,1,2-Tetrachloroethane	630-20-6	9.90E-08
Formic acid (methanoic acid)	64-18-6	0.00E+00
2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	65510-44-3	2.52E-10
Benzoic acid	65-85-0	1.42E-05

Table A-19 LAW Facility Emission Rates for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

COPC	CASRN	LAW Facility Emissions Rate
Methyl alcohol	67-56-1	6.01E-08
1,2,3,4,6,7,8-Heptachlorodibenzofuran	67562-39-4	1.23E-10
2-Propyl alcohol	67-63-0	1.98E-04
2-Propanone (Acetone)	67-64-1	2.09E-04
Chloroform	67-66-3	6.61E-05
Hexachloroethane	67-72-1	7.13E-07
2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	69782-90-7	4.53E-10
Hexachlorophene	70-30-4	0.00E+00
3,4,4',5-Tetrachlorobiphenyl (PCB 81)	70362-50-4	1.36E-10
1,2,3,4,7,8-Hexachlorodibenzofuran	70648-26-9	8.29E-11
n-Butyl alcohol	71-36-3	5.93E-10
Benzene	71-43-2	6.61E-05
1,1,1-Trichloroethane	71-55-6	9.72E-08
Methoxychlor	72-43-5	0.00E+00
4,4-DDE	72-55-9	8.07E-09
1,2,3,7,8,9-Hexachlorodibenzofuran	72918-21-9	9.09E-12
2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	74472-37-0	2.17E-10
Bromomethane	74-83-9	5.58E-03
Chloromethane	74-87-3	2.71E-03
Iodomethane	74-88-4	4.75E-03
Methylene bromide	74-95-3	1.87E-07
Bromochloromethane	74-97-5	2.37E-07
Chloroethane	75-00-3	4.93E-07
1-Chloroethene	75-01-4	2.95E-07
Fluoroethene (vinyl fluoride)	75-02-5	9.54E-26
Acetonitrile	75-05-8	9.20E-04
Acetaldehyde	75-07-0	3.73E-10
Dichloromethane (Methylene Chloride)	75-09-2	2.34E-01
Carbon disulfide	75-15-0	6.60E-05
Ethylene oxide (Oxirane)	75-21-8	9.10E-14
Bromoform	75-25-2	6.61E-05
Bromodichloromethane	75-27-4	1.17E-07
2-Chloropropane	75-29-6	7.44E-07
1,1-Dichloroethane	75-34-3	8.46E-08
1,1-Dichloroethene	75-35-4	1.31E-07
Phosgene (hydrogen phosphide)	75-44-5	0.00E+00
Chlorodifluoromethane	75-45-6	2.11E-28
Trimethylamine	75-50-3	1.48E-10
Trichlorofluoromethane	75-69-4	1.94E-07
Dichlorodifluoromethane	75-71-8	3.44E-07
Pentachloroethane	76-01-7	6.29E-07
1,2,2-Trichlorotrifluoroethane	76-13-1	5.45E-06
1,4-Dichloro-2-butene	764-41-0	3.96E-06
Heptachlor	76-44-8	0.00E+00
Glycidylaldehyde	765-34-4	0.00E+00
Hexachlorocyclopentadiene	77-47-4	5.63E-04
Dimethyl sulfate	77-78-1	0.00E+00
2-Methylpropyl alcohol	78-83-1	3.02E-07
1,2-Dichloropropane	78-87-5	1.40E-07
2-Butanone	78-93-3	7.12E-05
1,1,2-Trichloroethane	79-00-5	7.49E-07

Table A-19 LAW Facility Emission Rates for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

COPC	CASRN	LAW Facility Emissions Rate
1,1,2-Trichloroethylene	79-01-6	6.61E-05
2-Propenoic acid	79-10-7	1.19E-06
1,1,2,2-Tetrachloroethane	79-34-5	1.76E-06
2-Nitropropane	79-46-9	2.14E-13
Methyl methacrylate	80-62-6	0.00E+00
Hexamethylene-1,5-diisocyanate	822-06-0	0.00E+00
Toluene-2,6-diamine	823-40-5	0.00E+00
Pentachloronitrobenzene (PCNB)	82-68-8	3.77E-06
1-Methylphenanthrene	832-69-9	2.06E-09
Acenaphthene	83-32-9	4.16E-05
Diethyl phthalate	84-66-2	7.00E-05
Di-n-butylphthalate	84-74-2	4.10E-05
Phenanthrene	85-01-8	5.15E-06
Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	85-44-9	0.00E+00
Butylbenzylphthalate	85-68-7	1.26E-05
Fluorene	86-73-7	4.88E-05
1,2,3-Trichlorobenzene	87-61-6	1.22E-07
Hexachlorobutadiene	87-68-3	6.60E-07
Pentachlorophenol	87-86-5	4.15E-06
2,4,6-Trichlorophenol	88-06-2	7.36E-07
o-Nitroaniline (2-nitroaniline)	88-74-4	5.46E-05
2-Nitrophenol	88-75-5	2.11E-05
o-Anisidine	90-04-0	0.00E+00
1-Methylnaphthalene	90-12-0	5.09E-09
Naphthalene	91-20-3	3.50E-05
Quinoline	91-22-5	0.00E+00
2-Methylnaphthalene	91-57-6	5.87E-06
2-Chloronaphthalene	91-58-7	7.44E-07
3,3'-Dichlorobenzidine	91-94-1	4.43E-05
N-Nitroso-di-n-Buetylamine	924-16-3	1.10E-06
1,1`-Biphenyl	92-52-4	6.39E-09
Safrole (5-(2-Propenyl)-1,3-benzodioxole)	94-59-7	8.16E-07
2,4-D	94-75-7	0.00E+00
o-Cresol	95-48-7	1.03E-06
o-Chlorotoluene	95-49-8	1.04E-07
1,2-Dichlorobenzene	95-50-1	8.16E-07
o-Toluidine	95-53-4	6.72E-07
2-Chlorophenol	95-57-8	7.30E-07
1,2,4-Trimethyl benzene	95-63-6	1.19E-07
1,2,4,5-Tetrachlorobenzene	95-94-3	6.58E-07
2,4,5-Trichlorophenol	95-95-4	7.46E-07
1,2-Dibromo-3-chloropropane	96-12-8	1.06E-06
1,2,3-Trichloropropane	96-18-4	1.87E-06
Ethylene thiourea	96-45-7	0.00E+00
Ethyl methacrylate	97-63-2	0.00E+00
Furfural	98-01-1	0.00E+00
tert-Butyl benzene	98-06-6	9.18E-08
Benzotrichloride	98-07-7	0.00E+00
Cumene	98-82-8	8.46E-08
Methyl styrene (mixed isomers)	98-83-9	0.00E+00
Acetophenone	98-86-2	6.10E-07

Table A-19 LAW Facility Emission Rates for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

COPC	CASRN	LAW Facility Emissions Rate
Nitrobenzene	98-95-3	8.04E-06
1,3,5-Trinitrobenzene	99-35-4	3.60E-05
1,3-Dinitrobenzene	99-65-0	3.91E-06
p-Cymene	99-87-6	8.46E-08
Inorganics		**g/s**
Ozone	10028-15-6	0.00E+00
Nitrogen dioxide	10102-44-0	1.33E-01
Carbon dioxide	124-38-9	8.69E+01
Phosphate	14265-44-2	3.94E-09
Nitrate	14797-55-8	5.73E-09
Nitrite	14797-65-0	1.33E-11
Sulfate	14808-79-8	4.44E-11
Chloride	16887-00-6	1.67E-07
Fluoride	16984-48-8	6.03E-08
Methyl mercury	22967-92-6	0.00E+00
Bromide	24959-67-9	0.00E+00
Cyanide	57-12-5	1.32E-16
Dimethyl Mercury	593-74-8	4.66E-08
Carbon monoxide	630-08-0	2.14E-02
Aluminum	7429-90-5	2.62E-06
Iron	7439-89-6	2.98E-06
Lead	7439-92-1	1.92E-07
Lithium	7439-93-2	1.39E-07
Magnesium	7439-95-4	1.63E-06
Manganese	7439-96-5	4.92E-08
Mercury	7439-97-6	7.64E-07
Molybdenum	7439-98-7	1.99E-07
Nickel	7440-02-0	4.15E-08
Rhodium	7440-16-6	8.59E-15
Silver	7440-22-4	1.32E-07
Sodium	7440-23-5	1.25E-04
Strontium (total)	7440-24-6	4.22E-08
Tantalum	7440-25-7	1.27E-13
Thallium	7440-28-0	1.68E-07
Tin	7440-31-5	7.48E-06
Tungsten	7440-33-7	4.93E-13
Antimony	7440-36-0	1.63E-07
Arsenic	7440-38-2	1.49E-07
Barium	7440-39-3	2.26E-07
Beryllium	7440-41-7	7.20E-09
Cadmium	7440-43-9	1.01E-08
Chromium	7440-47-3	1.10E-07
Cobalt	7440-48-4	3.05E-08
Copper	7440-50-8	1.03E-07
Uranium	7440-61-1	5.23E-12
Vanadium	7440-62-2	4.32E-08
Yttrium	7440-65-5	2.33E-12
Zinc	7440-66-6	2.06E-07
Zirconium	7440-67-7	2.25E-10
Sulfur dioxide	7446-09-5	5.57E-06
Hydrogen chloride	7647-01-0	2.47E-02

Table A-19 LAW Facility Emission Rates for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

COPC	CASRN	LAW Facility Emissions Rate
Hydrogen fluoride	7664-39-3	8.98E-03
Ammonia/Ammonium	7664-41-7	2.70E+00
Total sulfur	7704-34-9	3.35E-06
Phosphorus	7723-14-0	2.11E-07
Fluorine gas	7782-41-4	0.00E+00
Selenium	7782-49-2	1.68E-07
Chlorine	7782-50-5	1.01E-05
Radionuclides		**Ci/s**
Tritium	10028-17-8	2.69E-08
Cesium-137	10045-97-3	5.76E-15
Yttrium-90 – Note 2	10098-91-6	2.17E-13
Strontium-90	10098-97-2	2.17E-13
Cobalt-60	10198-40-0	4.27E-18
Uranium-234	13966-29-5	7.26E-20
Ruthenium-106	13967-48-1	5.70E-27
Cesium-134	13967-70-9	1.51E-23
Uranium-233	13968-55-3	1.60E-19
Curium-244	13981-15-2	1.42E-19
Plutonium-238	13981-16-3	7.32E-19
Nickel-63	13981-37-8	2.05E-15
Plutonium-242	13982-10-0	7.20E-22
Radium-226	13982-63-3	2.79E-13
Uranium-236	13982-70-2	2.25E-21
Neptunium-237	13994-20-2	4.10E-19
Plutonium-241	14119-32-5	2.79E-18
Plutonium-240	14119-33-6	2.25E-18
Technetium-99	14133-76-7	3.05E-13
Uranium-232	14158-29-3	3.41E-21
Antimony-125	14234-35-6	2.17E-17
Protactinium-231	14331-85-2	4.59E-20
Nickel-59	14336-70-0	3.47E-17
Europium-155	14391-16-3	1.54E-19
Americium-241	14596-10-2	1.81E-16
Europium-152	14683-23-9	8.23E-19
Carbon-14	14762-75-5	8.32E-07
Actinium-227	14952-40-0	3.34E-20
Americium-243	14993-75-0	8.09E-20
Iodine-129	15046-84-1	2.63E-10
Plutonium-239	15117-48-3	1.08E-17
Uranium-235	15117-96-1	2.80E-21
Radium-228	15262-20-1	1.61E-19
Curium-242	15510-73-3	1.48E-19
Europium-154	15585-10-1	2.58E-18
Thorium-229	15594-54-4	2.08E-21
Samarium-151	15715-94-3	4.06E-15
Zirconium-93	15751-77-6	5.60E-17
Curium-243	15757-87-6	1.15E-20
Selenium-79	15758-45-9	7.19E-17
Tin-126	15832-50-5	1.60E-17
Barium-137m – Note 3	378253-40-8	5.45E-15
Cadmium-113m	378253-44-2	4.14E-17

Table A-19 LAW Facility Emission Rates for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

COPC	CASRN	LAW Facility Emissions Rate
Niobium-93m	378782-82-2	2.60E-17
Thorium-232	7440-29-1	3.38E-21
Uranium-238	7440-61-1R	8.59E-20

Notes:
1. The estimated LAW Facility emissions mass flowrate of total PCBs for the refined feed vector is 5.04E-09 g/s.
2. ^{90}Y is assumed to be present in secular equilibrium with ^{90}Sr (Cember 1983).
3. The activity of ^{137}mBa is in secular equilibrium with ^{137}Cs (at 94.6% of the activity of ^{137}Cs) (24590-WTP-3DG-W12W-00002).

A.13.3 HLW Facility

The HLW Facility emissions include the contribution of the HOP31 melter flue, with an upset factor applied, and then with MDLs applied for constituents estimated below the forecasted MDL, plus related HLW Facility cell emissions. Note that units of g/s apply to organics and inorganics, and units of Ci/s apply to radionuclides. The PRA emission rates for the HLW Facility in the baseline WTP operating configuration are presented in Table A-20.

Table A-20 HLW Facility Emission Rates for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

COPC	CASRN	HLW Facility Emissions Rate
Organics		**g/s**
p-Nitrophenol	100-02-7	5.05E-06
Phthalic acid	100-21-0	3.63E-07
1,4-Dinitrobenzene	100-25-4	3.38E-08
4-Ethenylcyclohexene	100-40-3	1.80E-06
Ethyl benzene	100-41-4	8.34E-08
Styrene	100-42-5	1.04E-07
Benzyl chloride	100-44-7	0.00E+00
Benzonitrile	100-47-0	0.00E+00
Benzyl alcohol	100-51-6	1.29E-06
Benzaldehyde	100-52-7	6.93E-06
cis-1,3-Dichloropropene	10061-01-5	1.39E-07
trans-1,3-Dichloropropene	10061-02-6	1.03E-07
4-Bromophenylphenyl ether	101-55-3	3.57E-05
4,4-Methylenedianiline	101-77-9	0.00E+00
Azobenzene	103-33-3	8.09E-07
n-Propyl benzene (Isocumene)	103-65-1	1.04E-07
n-Butylbenzene	104-51-8	8.23E-08
2-Ethyl-1-hexanol	104-76-7	2.57E-05
2,4-Dimethylphenol	105-67-9	1.17E-05
n-Nitrosomethylethylamine	10595-95-6	2.10E-05
4-Chlorotoluene (p-Tolyl chloride)	106-43-4	1.14E-07
p-Cresol (4-methyl phenol)	106-44-5	1.27E-06
1,4-Dichlorobenzene	106-46-7	4.64E-06
p-Chloroaniline	106-47-8	7.27E-06
p-Toluidine	106-49-0	0.00E+00
Quinone	106-51-4	0.00E+00
1,2-Epoxybutane	106-88-7	2.97E-05

Table A-20 HLW Facility Emission Rates for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

COPC	CASRN	HLW Facility Emissions Rate
Epichlorohydrin (1-chloro-2,3 epoxypropane)	106-89-8	0.00E+00
Ethylene dibromide	106-93-4	1.30E-07
1,3-Butadiene	106-99-0	1.43E-07
Acrolein	107-02-8	1.61E-08
3-Chloropropene	107-05-1	2.59E-10
1,2-Dichloroethane	107-06-2	1.87E-07
Propionitrile	107-12-0	9.76E-08
Acrylonitrile	107-13-1	2.54E-06
Propargyl alcohol	107-19-7	0.00E+00
Ethylene glycol (1,2-ethanediol)	107-21-1	0.00E+00
Propylene glycol monomethyl ether	107-98-2	0.00E+00
Acetic acid vinyl ester	108-05-4	3.66E-05
4-Methyl-2-pentanone	108-10-1	7.39E-06
m-Cresol	108-39-4	2.48E-05
bis (2-Chloroisopropyl)ether	108-60-1	7.86E-07
1,3,5-Trimethylbenzene	108-67-8	1.59E-07
Bromobenzene (Phenyl bromide)	108-86-1	1.56E-07
Methylcyclohexane	108-87-2	1.74E-11
Toluene	108-88-3	3.95E-06
Chlorobenzene	108-90-7	3.97E-06
Cyclohexanone	108-94-1	8.60E-07
Phenol	108-95-2	1.40E-06
n-Butanenitrile	109-74-0	2.89E-05
3-Butenenitrile	109-75-1	0.00E+00
Malononitrile	109-77-3	0.00E+00
2-Methoxyethanol	109-86-4	0.00E+00
Tetrahydrofuran	109-99-9	1.05E-05
Furan	110-00-9	0.00E+00
n-Hexane	110-54-3	1.74E-07
Pentanenitrile	110-59-8	2.81E-05
2-Ethoxyethanol	110-80-5	4.07E-05
Cyclohexane	110-82-7	3.17E-11
Cyclohexene	110-83-8	8.55E-11
Pyridine	110-86-1	2.19E-06
Ethylene glycol monoethyl ether acetate	111-15-9	0.00E+00
Bis(2-chloroethyl)ether	111-44-4	5.51E-06
n-Octane	111-65-9	8.73E-11
2-Butoxyethanol	111-76-2	1.46E-05
n-Nonane	111-84-2	5.80E-11
Bis(2-chloroethoxy)methane	111-91-1	2.91E-06
Undecane	1120-21-4	0.00E+00
1,3-Propane sultone	1120-71-4	0.00E+00
1-Decanol	112-30-1	0.00E+00
Decanal	112-31-2	0.00E+00
Dodecane	112-40-3	0.00E+00
Bis(2-ethylhexyl) phthalate	117-81-7	5.20E-06
Di-n-octylphthalate	117-84-0	1.21E-04
Hexachlorobenzene	118-74-1	4.88E-06
3,3'-Dimethoxybenzidine	119-90-4	0.00E+00
Anthracene	120-12-7	2.59E-05
1,2,4-Trichlorobenzene	120-82-1	7.78E-07

Table A-20 HLW Facility Emission Rates for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

COPC	CASRN	HLW Facility Emissions Rate
2,4-Dichlorophenol	120-83-2	2.68E-05
2,4-Dinitrotoluene	121-14-2	7.40E-06
N,N-Diphenylamine	122-39-4	2.36E-08
1,2-Diphenylhydrazine	122-66-7	6.38E-07
Maleic hydrazide	123-33-1	0.00E+00
Propionaldehyde	123-38-6	3.67E-08
Butanal	123-72-8	3.04E-05
1,4-Dioxan	123-91-1	7.66E-09
Decane	124-18-5	0.00E+00
Chlorodibromomethane	124-48-1	1.77E-07
Tributyl phosphate	126-73-8	1.30E-05
2-Methyl-2-propenenitrile	126-98-7	1.05E-08
1,1,2,2-Tetrachloroethene	127-18-4	9.36E-08
2,6-Bis(tert-butyl)-4-methylphenol	128-37-0	4.89E-09
Pyrene	129-00-0	9.10E-05
Dimethyl Phthalate	131-11-3	7.88E-07
2-Cycloyhexyl-4,6-dinitrophenol	131-89-5	0.00E+00
Dibenzofuran	132-64-9	6.26E-06
Xylenes (mixed isomers)	1330-20-7	4.00E-06
Captan	133-06-2	0.00E+00
Polychlorinated biphenyls – Note 1	1336-36-3	4.70E-05
alpha-Naphthylamine	134-32-7	2.68E-06
sec-Butylbenzene	135-98-8	8.15E-08
Acetic acid ethyl ester	141-78-6	1.17E-09
Endothall	145-73-3	0.00E+00
cis-1,2-Dichloroethene	156-59-2	8.84E-08
1,2-trans-Dichloroethene	156-60-5	2.20E-05
Methyl tert-butyl ether	1634-04-4	2.52E-05
2,3,7,8-Tetrachlorodibenzo(p)dioxin (TCDD)	1746-01-6	5.66E-12
Dibenzo[a,i]pyrene	189-55-9	4.83E-07
Dibenzo[a,h]pyrene	189-64-0	4.83E-07
Benzo(g,h,i)perylene	191-24-2	4.37E-06
Dibenzo(a,l)pyrene	191-30-0	4.83E-07
Dibenzo[a,e]pyrene	192-65-4	4.83E-07
Benzo(e)pyrene	192-97-2	2.59E-09
Indeno(1,2,3-cd)pyrene	193-39-5	1.18E-05
1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	19408-74-3	2.17E-12
Benzo[j]fluoranthene	205-82-3	6.93E-09
Benzo(b)fluoranthene	205-99-2	8.62E-06
Fluoranthene	206-44-0	9.56E-05
Benzo(k)fluoranthene	207-08-9	2.10E-06
Acenaphthylene	208-96-8	2.58E-05
Chrysene	218-01-9	5.62E-06
Dibenz[a,j]acridine	224-42-0	2.16E-07
2,3,5-Trimethylnaphthalene	2245-38-7	1.79E-09
Dibenz[a,h]acridine	226-36-8	2.30E-07
Pronamide	23950-58-5	1.39E-05
Trichlorofluoroethane	27154-33-2	3.24E-05
2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	31508-00-6	2.80E-11
alpha-BHC	319-84-6	1.02E-09
beta-BHC	319-85-7	3.59E-08

Table A-20 HLW Facility Emission Rates for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

COPC	CASRN	HLW Facility Emissions Rate
3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	32598-13-3	2.41E-11
2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	32598-14-4	2.33E-11
Octachlorodibenzo(p)dioxin	3268-87-9	2.29E-12
3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	32774-16-6	2.18E-11
1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	35822-46-9	2.43E-12
5-Methylchrysene	3697-24-3	1.55E-05
2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	38380-08-4	3.68E-11
Octachlorodibenzofuran	39001-02-0	3.56E-12
1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	39227-28-6	2.79E-12
2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	39635-31-9	1.70E-11
1,2,3,7,8-Pentachlorodibenzo(p)dioxin	40321-76-4	3.32E-12
Crotonaldehyde (Propylene aldehyde)	4170-30-3	1.08E-08
Chlorocyclopentadiene	41851-50-7	0.00E+00
Cyanogen (oxalonitrile)	460-19-5	0.00E+00
2-Butenenitrile	4786-20-3	0.00E+00
Formaldehyde	50-00-0	7.44E-06
Benzo(a)pyrene	50-32-8	2.68E-06
Cyanogen bromide (bromocyanide)	506-68-3	0.00E+00
Cyanogen chloride	506-77-4	0.00E+00
Chlorobenzilate	510-15-6	6.93E-06
2,3,7,8-Tetrachlorodibenzofuran	51207-31-9	2.51E-12
2,4-Dinitrophenol	51-28-5	1.71E-05
Ethyl carbamate (urethane)	51-79-6	0.00E+00
2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	52663-72-6	2.19E-11
1,2-Dinitrobenzene (o-Dinitrobenzene)	528-29-0	0.00E+00
2-Chloroacetophenone	532-27-4	0.00E+00
4,6-Dinitro-o-cresol	534-52-1	1.22E-05
Dibenz[a,h]anthracene	53-70-3	1.16E-07
Dibenzo(a,e)fluoranthene	5385-75-1	0.00E+00
1,2-Dichloroethene (total) (1,2-Dichloroethylene)	540-59-0	1.58E-07
1,2-Dimethylhydrazine	540-73-8	0.00E+00
2,2,4-Trimethylpentane	540-84-1	0.00E+00
1,3-Dichlorobenzene	541-73-1	7.72E-07
1,3-Dichloropropene	542-75-6	0.00E+00
Bis(chloromethyl)ether	542-88-1	0.00E+00
1,2,3,4,7,8,9-Heptachlorodibenzofuran	55673-89-7	2.36E-12
Carbon tetrachloride	56-23-5	3.93E-06
3-Methylcholanthrene	56-49-5	1.59E-05
Benzo(a)anthracene	56-55-3	2.55E-06
2,3,4,7,8-Pentachlorodibenzofuran	57117-31-4	1.36E-12
1,2,3,7,8-Pentachlorodibenzofuran	57117-41-6	1.29E-12
1,2,3,6,7,8-Hexachlorodibenzofuran	57117-44-9	1.36E-12
Strychnine	57-24-9	0.00E+00
3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	57465-28-8	1.34E-10
1,2,3,6,7,8,-Hexachlorodibenzo(p)dioxin	57653-85-7	2.75E-12
Chlordane	57-74-9	0.00E+00
2,6-Dimethylnaphthalene	581-42-0	6.70E-09
2,4-Toluene diisocyanate	584-84-9	0.00E+00
gamma-BHC (Lindane)	58-89-9	1.33E-09
2,3,4,6-Tetrachlorophenol	58-90-2	4.62E-05
3-Hexanone	589-38-8	2.80E-05

Table A-20 HLW Facility Emission Rates for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

COPC	CASRN	HLW Facility Emissions Rate
Benzene, iodo-	591-50-4	0.00E+00
2-Hexanone	591-78-6	6.40E-07
Bromoethene (Vinyl bromide)	593-60-2	2.12E-05
4-Chloro-3-methylphenol	59-50-7	5.41E-05
N-Nitrosomorpholine	59-89-2	6.04E-06
Dimethyl aminoazobenzene	60-11-7	5.52E-07
5-Nitroacenaphthene	602-87-9	9.85E-06
Ethyl ether	60-29-7	2.97E-08
Acetamide	60-35-5	6.07E-07
2,6-Dinitrotoluene	606-20-2	2.53E-06
2,3,4,6,7,8-Hexachlorodibenzofuran	60851-34-5	3.20E-12
Pentachlorobenzene	608-93-5	7.28E-07
Dichloropentadiene	61626-71-9	0.00E+00
N-Nitroso-di-n-propylamine	621-64-7	4.93E-05
Methyl isocyanate	624-83-9	0.00E+00
Ethyl methanesulfonate	62-50-0	5.68E-07
Aniline	62-53-3	1.99E-06
N-Nitroso-N,N-dimethylamine	62-75-9	9.64E-07
Hexanenitrile	628-73-9	2.74E-05
1,1,1,2-Tetrachloroethane	630-20-6	8.09E-05
Formic acid (methanoic acid)	64-18-6	0.00E+00
2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	65510-44-3	1.19E-10
Benzoic acid	65-85-0	1.36E-05
Methyl alcohol	67-56-1	3.35E-05
1,2,3,4,6,7,8-Heptachlorodibenzofuran	67562-39-4	2.71E-12
2-Propyl alcohol	67-63-0	1.91E-04
2-Propanone (Acetone)	67-64-1	1.08E-04
Chloroform	67-66-3	3.97E-06
Hexachloroethane	67-72-1	2.70E-06
2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	69782-90-7	3.68E-11
Hexachlorophene	70-30-4	0.00E+00
3,4,4',5-Tetrachlorobiphenyl (PCB 81)	70362-50-4	2.32E-11
1,2,3,4,7,8-Hexachlorodibenzofuran	70648-26-9	1.51E-12
n-Butyl alcohol	71-36-3	7.08E-07
Benzene	71-43-2	3.99E-06
1,1,1-Trichloroethane	71-55-6	9.37E-08
Methoxychlor	72-43-5	0.00E+00
4,4-DDE	72-55-9	3.48E-05
1,2,3,7,8,9-Hexachlorodibenzofuran	72918-21-9	3.19E-12
2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	74472-37-0	2.16E-11
Bromomethane	74-83-9	3.95E-06
Chloromethane	74-87-3	4.15E-06
Iodomethane	74-88-4	3.96E-06
Methylene bromide	74-95-3	1.80E-07
Bromochloromethane	74-97-5	2.28E-07
Chloroethane	75-00-3	4.75E-07
1-Chloroethene	75-01-4	2.84E-07
Fluoroethene (vinyl fluoride)	75-02-5	1.35E-06
Acetonitrile	75-05-8	7.49E-05
Acetaldehyde	75-07-0	3.72E-05
Dichloromethane (Methylene Chloride)	75-09-2	4.18E-06

Table A-20 HLW Facility Emission Rates for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

COPC	CASRN	HLW Facility Emissions Rate
Carbon disulfide	75-15-0	3.93E-06
Ethylene oxide (Oxirane)	75-21-8	6.34E-08
Bromoform	75-25-2	8.67E-07
Bromodichloromethane	75-27-4	1.84E-04
2-Chloropropane	75-29-6	7.16E-07
1,1-Dichloroethane	75-34-3	8.16E-08
1,1-Dichloroethene	75-35-4	1.27E-07
Phosgene (hydrogen phosphide)	75-44-5	0.00E+00
Chlorodifluoromethane	75-45-6	9.42E-11
Trimethylamine	75-50-3	3.32E-05
Trichlorofluoromethane	75-69-4	1.87E-07
Dichlorodifluoromethane	75-71-8	3.31E-07
Pentachloroethane	76-01-7	6.05E-07
1,2,2-Trichlorotrifluoroethane	76-13-1	5.24E-06
1,4-Dichloro-2-butene	764-41-0	3.81E-06
Heptachlor	76-44-8	6.73E-12
Glycidylaldehyde	765-34-4	0.00E+00
Hexachlorocyclopentadiene	77-47-4	1.29E-05
Dimethyl sulfate	77-78-1	0.00E+00
2-Methylpropyl alcohol	78-83-1	4.20E-04
1,2-Dichloropropane	78-87-5	1.34E-07
2-Butanone	78-93-3	7.62E-06
1,1,2-Trichloroethane	79-00-5	7.21E-07
1,1,2-Trichloroethylene	79-01-6	5.06E-06
2-Propenoic acid	79-10-7	1.25E-05
1,1,2,2-Tetrachloroethane	79-34-5	1.69E-06
2-Nitropropane	79-46-9	7.34E-08
Methyl methacrylate	80-62-6	0.00E+00
Hexamethylene-1,5-diisocyanate	822-06-0	0.00E+00
Toluene-2,6-diamine	823-40-5	0.00E+00
Pentachloronitrobenzene (PCNB)	82-68-8	3.69E-06
1-Methylphenanthrene	832-69-9	1.99E-09
Acenaphthene	83-32-9	1.08E-04
Diethyl phthalate	84-66-2	7.24E-06
Di-n-butylphthalate	84-74-2	1.69E-05
Phenanthrene	85-01-8	2.40E-05
Phthalic anhydride (1,2-benzenedicarboxylic anhydride)	85-44-9	0.00E+00
Butylbenzylphthalate	85-68-7	8.10E-05
Fluorene	86-73-7	2.71E-05
1,2,3-Trichlorobenzene	87-61-6	1.18E-07
Hexachlorobutadiene	87-68-3	6.91E-07
Pentachlorophenol	87-86-5	3.98E-06
2,4,6-Trichlorophenol	88-06-2	7.26E-05
o-Nitroaniline (2-nitroaniline)	88-74-4	1.11E-06
2-Nitrophenol	88-75-5	8.57E-05
o-Anisidine	90-04-0	0.00E+00
1-Methylnaphthalene	90-12-0	4.90E-09
Naphthalene	91-20-3	3.74E-04
Quinoline	91-22-5	0.00E+00
2-Methylnaphthalene	91-57-6	5.25E-06
2-Chloronaphthalene	91-58-7	2.61E-05

Table A-20 HLW Facility Emission Rates for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

COPC	CASRN	HLW Facility Emissions Rate
3,3'-Dichlorobenzidine	91-94-1	2.09E-06
N-Nitroso-di-n-Buetylamine	924-16-3	1.06E-06
1,1`-Biphenyl	92-52-4	7.05E-08
Safrole (5-(2-Propenyl)-1,3-benzodioxole)	94-59-7	7.86E-07
2,4-D	94-75-7	0.00E+00
o-Cresol	95-48-7	4.12E-05
o-Chlorotoluene	95-49-8	1.01E-07
1,2-Dichlorobenzene	95-50-1	9.65E-07
o-Toluidine	95-53-4	6.47E-07
2-Chlorophenol	95-57-8	9.06E-05
1,2,4-Trimethyl benzene	95-63-6	1.14E-07
1,2,4,5-Tetrachlorobenzene	95-94-3	6.33E-07
2,4,5-Trichlorophenol	95-95-4	6.15E-05
1,2-Dibromo-3-chloropropane	96-12-8	1.02E-06
1,2,3-Trichloropropane	96-18-4	1.80E-06
Ethylene thiourea	96-45-7	0.00E+00
Ethyl methacrylate	97-63-2	0.00E+00
Furfural	98-01-1	0.00E+00
tert-Butyl benzene	98-06-6	8.84E-08
Benzotrichloride	98-07-7	0.00E+00
Cumene	98-82-8	1.98E-07
Methyl styrene (mixed isomers)	98-83-9	0.00E+00
Acetophenone	98-86-2	6.57E-07
Nitrobenzene	98-95-3	5.67E-06
1,3,5-Trinitrobenzene	99-35-4	3.47E-05
1,3-Dinitrobenzene	99-65-0	3.77E-06
p-Cymene	99-87-6	8.15E-08
Inorganics		**g/s**
Ozone	10028-15-6	0.00E+00
Nitrogen dioxide	10102-44-0	4.48E-02
Carbon dioxide	124-38-9	1.87E+01
Phosphate	14265-44-2	6.63E-10
Nitrate	14797-55-8	1.77E-08
Nitrite	14797-65-0	1.95E-09
Sulfate	14808-79-8	1.00E-09
Chloride	16887-00-6	1.97E-10
Fluoride	16984-48-8	3.75E-09
Methyl mercury	22967-92-6	0.00E+00
Bromide	24959-67-9	0.00E+00
Cyanide	57-12-5	3.52E-15
Dimethyl Mercury	593-74-8	3.82E-09
Carbon monoxide	630-08-0	9.88E-03
Aluminum	7429-90-5	2.52E-06
Iron	7439-89-6	2.87E-06
Lead	7439-92-1	1.85E-07
Lithium	7439-93-2	1.34E-07
Magnesium	7439-95-4	1.57E-06
Manganese	7439-96-5	4.74E-08
Mercury	7439-97-6	9.24E-09
Molybdenum	7439-98-7	1.92E-07
Nickel	7440-02-0	4.00E-08

Table A-20 HLW Facility Emission Rates for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

COPC	CASRN	HLW Facility Emissions Rate
Rhodium	7440-16-6	2.63E-14
Silver	7440-22-4	1.27E-07
Sodium	7440-23-5	1.20E-04
Strontium (total)	7440-24-6	4.07E-08
Tantalum	7440-25-7	4.42E-15
Thallium	7440-28-0	1.62E-07
Tin	7440-31-5	7.20E-06
Tungsten	7440-33-7	2.83E-14
Antimony	7440-36-0	1.57E-07
Arsenic	7440-38-2	1.43E-07
Barium	7440-39-3	2.17E-07
Beryllium	7440-41-7	6.93E-09
Cadmium	7440-43-9	9.71E-09
Chromium	7440-47-3	1.06E-07
Cobalt	7440-48-4	2.93E-08
Copper	7440-50-8	9.94E-08
Uranium	7440-61-1	1.76E-12
Vanadium	7440-62-2	4.16E-08
Yttrium	7440-65-5	2.01E-15
Zinc	7440-66-6	1.99E-07
Zirconium	7440-67-7	5.43E-12
Sulfur dioxide	7446-09-5	4.64E-04
Hydrogen chloride	7647-01-0	2.57E-02
Hydrogen fluoride	7664-39-3	1.16E-04
Ammonia/Ammonium	7664-41-7	3.41E-01
Total sulfur	7704-34-9	2.79E-04
Phosphorus	7723-14-0	2.03E-07
Fluorine gas	7782-41-4	0.00E+00
Selenium	7782-49-2	1.62E-07
Chlorine	7782-50-5	9.71E-06
Radionuclides		**Ci/s**
Tritium	10028-17-8	3.27E-08
Cesium-137	10045-97-3	4.50E-12
Yttrium-90 – Note 2	10098-91-6	1.98E-13
Strontium-90	10098-97-2	1.98E-13
Cobalt-60	10198-40-0	2.32E-19
Uranium-234	13966-29-5	5.54E-19
Ruthenium-106	13967-48-1	4.24E-24
Cesium-134	13967-70-9	1.15E-20
Uranium-233	13968-55-3	1.88E-18
Curium-244	13981-15-2	3.32E-19
Plutonium-238	13981-16-3	6.72E-18
Nickel-63	13981-37-8	5.26E-16
Plutonium-242	13982-10-0	2.10E-21
Radium-226	13982-63-3	1.14E-13
Uranium-236	13982-70-2	1.55E-20
Neptunium-237	13994-20-2	7.74E-19
Plutonium-241	14119-32-5	2.64E-17
Plutonium-240	14119-33-6	2.25E-17
Technetium-99	14133-76-7	3.74E-14
Uranium-232	14158-29-3	2.37E-20

Table A-20 HLW Facility Emission Rates for the Pre-Demonstration Risk Assessment for the Baseline WTP Operating Configuration

COPC	CASRN	HLW Facility Emissions Rate
Antimony-125	14234-35-6	1.72E-20
Protactinium-231	14331-85-2	5.09E-20
Nickel-59	14336-70-0	8.44E-18
Europium-155	14391-16-3	8.05E-19
Americium-241	14596-10-2	7.28E-16
Europium-152	14683-23-9	1.69E-18
Carbon-14	14762-75-5	1.34E-07
Actinium-227	14952-40-0	4.22E-20
Americium-243	14993-75-0	3.14E-19
Iodine-129	15046-84-1	9.49E-10
Plutonium-239	15117-48-3	1.07E-16
Uranium-235	15117-96-1	2.08E-20
Radium-228	15262-20-1	1.05E-19
Curium-242	15510-73-3	3.13E-19
Europium-154	15585-10-1	1.24E-17
Thorium-229	15594-54-4	4.82E-21
Samarium-151	15715-94-3	8.54E-15
Zirconium-93	15751-77-6	1.61E-17
Curium-243	15757-87-6	2.63E-20
Selenium-79	15758-45-9	5.25E-16
Tin-126	15832-50-5	1.52E-17
Barium-137m – Note 3	378253-40-8	4.26E-12
Cadmium-113m	378253-44-2	5.33E-17
Niobium-93m	378782-82-2	2.65E-17
Thorium-232	7440-29-1	2.42E-20
Uranium-238	7440-61-1R	6.04E-19

Notes:
1. The estimated HLW Facility emissions mass flowrate of total PCBs for the refined feed vector is 1.17E-05 g/s.
2. ^{90}Y is assumed to be present in secular equilibrium with ^{90}Sr (Cember 1983).
3. The activity of ^{137}mBa is in secular equilibrium with ^{137}Cs (at 94.6% of the activity of ^{137}Cs) (24590-WTP-3DG-W12W-00002).

A.14 References

A.14.1 Project Documents

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A.14.2 Codes and Standards

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A.14.3 Other Documents

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Attachment: TWINS Analytical Data and Associated Phase Volume and Density

TWINS Analytical Data and Associated Phase Volume and Density

The tables which follow present the data extracted from the TWINS database for PCB Aroclor results for Hanford tank waste. In the tables which follow, yellow highlighting and a double-line border indicate those samples above the MDL, otherwise, the value shown is the MDL. Regular font in a highlighted cell indicates the data were flagged with a "J" to indicate the value shown is an estimated value, less than the estimated quantitation limit. Bold font in highlighted entries indicates quantities that have no data qualifier flags. Where data are not available, a cell presents "n/a" for "not available.". Primary and duplicate sample results are averaged into a single result with applicable quality indicators (highlighted and/or bold if one of the two, or both, had qualifiers).

Supernatant Results (mg/L)

Tank Name	Sample Number	Result Type	Aroclor 1016, CAS# 12674-11-2	Aroclor 1221, CAS# 11104-28-2	Aroclor 1232, CAS# 11141-16-5	Aroclor 1242, CAS# 53469-21-9	Aroclor 1248, CAS# 12672-29-6	Aroclor 1254, CAS# 11097-69-1	Aroclor 1260, CAS# 11096-82-5	Aroclor 1262, CAS# 37324-23-5	Total PCBs CAS# 1336-36-6	Total Tank Waste Phase (kL)	Ave. Density (g/mL)
241-A-101	B0HP02T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.022	0.017	n/a	0.050	225	1.49
241-AN-101	B0HR25T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.014	0.029	n/a	0.046	851	1.25
241-AN-101	B0HR27T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.014	0.029	n/a	0.046	851	1.25
241-AN-101	B0K8S1T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	851	1.25
241-AN-101	B0K8S2T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	851	1.25
241-AN-101	B0K8S3T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	851	1.25
241-AN-101	B0K8S4T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	851	1.25
241-AN-101	B0K8S5T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	851	1.25
241-AN-101	B0K8S6T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	851	1.25
241-AN-101	B0K9H1T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	851	1.25
241-AN-101	B0K9H8T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	851	1.25
241-AN-101	B0K9J4T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	851	1.25
241-AN-101	B0K9K0T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	851	1.25
241-AN-101	B0K9K6T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	851	1.25
241-AN-101	B0K9L2T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	851	1.25
241-AN-101	B0KJ60T	PRIMARY_RESULT	0.025	0.005	0.005	0.008	0.005	0.002	0.019	n/a	0.025	851	1.25
241-AN-101	B0KJ77T	PRIMARY_RESULT	0.025	0.005	0.005	0.008	0.005	0.002	0.019	n/a	0.025	851	1.25
241-AN-101	B0KJ84T	PRIMARY_RESULT	0.025	0.005	0.005	0.008	0.005	0.002	0.019	n/a	0.025	851	1.25
241-AN-101	B0KJ85T	PRIMARY_RESULT	0.025	0.005	0.005	0.008	0.005	0.002	0.019	n/a	0.025	851	1.25
241-AN-101	B0KJ86T	PRIMARY_RESULT	0.025	0.005	0.005	0.008	0.005	0.002	0.019	n/a	0.025	851	1.25

Supernatant Results (mg/L)

Tank Name	Sample Number	Result Type	Aroclor 1016, CAS# 12674-11-2	Aroclor 1221, CAS# 11104-28-2	Aroclor 1232, CAS# 11141-16-5	Aroclor 1242, CAS# 53469-21-9	Aroclor 1248, CAS# 12672-29-6	Aroclor 1254, CAS# 11097-69-1	Aroclor 1260, CAS# 11096-82-5	Aroclor 1262, CAS# 37324-23-5	Total PCBs CAS# 1336-36-6	Total Tank Waste Phase (kL)	Ave. Density (g/mL)
241-AN-101	B0KJC1T	PRIMARY_RESULT	0.025	0.005	0.005	0.008	0.005	0.002	0.019	n/a	0.025	851	1.25
241-AN-101	B0KJC2T	PRIMARY_RESULT	0.025	0.005	0.005	0.008	0.005	0.002	0.019	n/a	0.025	851	1.25
241-AN-101	B0KJC3T	PRIMARY_RESULT	0.025	0.005	0.005	0.008	0.005	0.002	0.019	n/a	0.025	851	1.25
241-AN-101	B0KK59T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	851	1.25
241-AN-101	B0KK64T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	851	1.25
241-AN-101	B0KK71T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	851	1.25
241-AN-101	B0KK77T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	851	1.25
241-AN-101	B0KK83T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	851	1.25
241-AN-101	B0KK89T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	851	1.25
241-AN-101	B0KK94T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	851	1.25
241-TX-118	B0GMN5T	PRIM/DUPL_RESULT	0.020	0.004	0.004	0.007	0.006	0.001	0.016	n/a	0.006	851	1.25
241-AN-101	B0KNF8T	PRIMARY_RESULT	0.022	0.004	0.005	0.007	0.004	0.002	0.017	n/a	0.022	851	1.25
241-AN-101	B0KNH5T	PRIMARY_RESULT	0.023	0.004	0.005	0.008	0.004	0.002	0.017	n/a	0.023	851	1.25
241-AN-101	B0KNJ2T	PRIMARY_RESULT	0.021	0.004	0.004	0.007	0.004	0.001	0.016	n/a	0.021	851	1.25
241-AN-101	B0KNJ9T	PRIMARY_RESULT	0.019	0.004	0.004	0.006	0.004	0.001	0.014	n/a	0.019	851	1.25
241-AN-101	B0L1N9T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	851	1.25
241-AN-101	B0L1P6T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	851	1.25
241-AN-101	B0L1Q3T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	851	1.25
241-AN-101	B0L1R0T	PRIM/DUPL_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	851	1.25
241-AN-101	B0L1R7T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	851	1.25
241-AN-101	B0L1S4T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	851	1.25
241-AN-102	B0GK00T	PRIM/DUPL_RESULT	0.010	0.010	0.010	0.010	0.010	0.010	0.010	n/a	0.010	3381	1.45
241-AN-102	B0GK01T	PRIM/DUPL_RESULT	0.012	0.012	0.012	0.012	0.012	0.012	0.012	n/a	0.012	3381	1.45
241-AN-102	B0GK02T	PRIM/DUPL_RESULT	0.012	0.012	0.012	0.012	0.012	0.012	0.012	n/a	0.012	3381	1.45
241-AN-102	B0JQL0T	PRIM/DUPL_RESULT	n/a	0.00020	0.00020	n/a	0.00020	0.00020	0.00020	n/a	0.0002	3381	1.45
241-AN-102	B0K7W5T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	3381	1.45
241-AN-102	B0K7X2T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3381	1.45
241-AN-102	B0K7X9T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3381	1.45
241-AN-102	B0K7Y6T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3381	1.45
241-AN-102	B0K7Z3T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3381	1.45

Supernatant Results (mg/L)

Tank Name	Sample Number	Result Type	Aroclor 1016, CAS# 12674-11-2	Aroclor 1221, CAS# 11104-28-2	Aroclor 1232, CAS# 11141-16-5	Aroclor 1242, CAS# 53469-21-9	Aroclor 1248, CAS# 12672-29-6	Aroclor 1254, CAS# 11097-69-1	Aroclor 1260, CAS# 11096-82-5	Aroclor 1262, CAS# 37324-23-5	Total PCBs CAS# 1336-36-6	Total Tank Waste Phase (kL)	Ave. Density (g/mL)
241-AN-102	B0KFB6T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3381	1.45
241-AN-102	B0KFC2T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3381	1.45
241-AN-102	B0KFD1T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3381	1.45
241-AN-102	B0KFD8T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3381	1.45
241-AN-102	B0KFF4T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3381	1.45
241-AN-102	B0KFH1T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3381	1.45
241-AN-102	B0KFH8T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3381	1.45
241-AN-102	B0KFJ5T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3381	1.45
241-AN-103	B0HJQ8T	PRIMARY_RESULT	0.009	0.025	0.023	0.013	0.007	0.007	0.009	0.0065	0.025	1716	1.48
241-AN-104	B0HJP4T	PRIMARY_RESULT	0.009	0.025	0.023	0.013	0.007	0.007	0.009	0.0065	0.025	2114	1.40
241-AN-105	B0GLK2T	PRIM/DUPL_RESULT	0.012	0.012	0.012	0.012	0.012	0.012	0.012	n/a	0.012	2225	1.42
241-AN-106	B0HHC8T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.013	0.017	0.013	0.050	1402	1.20
241-AN-106	B0HZK6T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.004	0.029	n/a	0.046	1402	1.20
241-AN-106	B0HZK7T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.004	0.029	n/a	0.046	1402	1.20
241-AN-106	B0K358T	PRIMARY_RESULT	0.038	0.007	0.006	0.013	0.007	0.003	0.029	n/a	0.038	1402	1.20
241-AN-106	B0K359T	PRIMARY_RESULT	0.038	0.007	0.006	0.013	0.007	0.003	0.029	n/a	0.038	1402	1.20
241-AN-106	B0K360T	PRIMARY_RESULT	0.038	0.007	0.006	0.013	0.007	0.003	0.029	n/a	0.038	1402	1.20
241-AN-106	B0K361T	PRIMARY_RESULT	0.038	0.007	0.006	0.013	0.007	0.003	0.029	n/a	0.038	1402	1.20
241-AN-106	B0K370T	PRIMARY_RESULT	0.038	0.007	0.006	0.013	0.007	0.003	0.029	n/a	0.038	1402	1.20
241-AN-106	B0K6B0T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	1402	1.20
241-AN-106	B0K6B1T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	1402	1.20
241-AN-106	B0K6B2T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	1402	1.20
241-AN-106	B0K6B3T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	1402	1.20
241-AN-106	B0K6B9T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	1402	1.20
241-AN-106	B0K6D1T	PRIMARY_RESULT	0.021	0.004	0.005	0.007	0.004	0.001	0.016	n/a	0.021	1402	1.20
241-AN-106	B0K6D7T	PRIMARY_RESULT	0.020	0.004	0.004	0.007	0.004	0.001	0.015	n/a	0.020	1402	1.20
241-AN-106	B0K6F3T	PRIMARY_RESULT	0.022	0.004	0.005	0.007	0.004	0.001	0.016	n/a	0.022	1402	1.20
241-AN-106	B0K6H5T	PRIMARY_RESULT	0.021	0.004	0.005	0.007	0.004	0.001	0.016	n/a	0.021	1402	1.20
241-AN-106	B0K755T	PRIMARY_RESULT	0.019	0.004	0.004	0.006	0.004	0.001	0.015	n/a	0.019	1402	1.20
241-AN-106	B0K756T	PRIMARY_RESULT	0.020	0.004	0.004	0.007	0.004	0.001	0.015	n/a	0.020	1402	1.20

Supernatant Results (mg/L)

Tank Name	Sample Number	Result Type	Aroclor 1016, CAS# 12674-11-2	Aroclor 1221, CAS# 11104-28-2	Aroclor 1232, CAS# 11141-16-5	Aroclor 1242, CAS# 53469-21-9	Aroclor 1248, CAS# 12672-29-6	Aroclor 1254, CAS# 11097-69-1	Aroclor 1260, CAS# 11096-82-5	Aroclor 1262, CAS# 37324-23-5	Total PCBs CAS# 1336-36-6	Total Tank Waste Phase (kL)	Ave. Density (g/mL)
241-AN-106	B0K757T	PRIMARY_RESULT	0.019	0.004	0.004	0.006	0.004	0.001	0.015	n/a	0.019	1402	1.20
241-AN-106	B0K758T	PRIMARY_RESULT	0.019	0.004	0.004	0.006	0.004	0.001	0.014	n/a	0.019	1402	1.20
241-AN-106	B0K759T	PRIMARY_RESULT	0.019	0.004	0.004	0.006	0.004	0.001	0.015	n/a	0.019	1402	1.20
241-AN-106	B0K760T	PRIMARY_RESULT	0.019	0.004	0.004	0.006	0.004	0.001	0.015	n/a	0.019	1402	1.20
241-AN-106	B0K761T	PRIMARY_RESULT	0.019	0.004	0.004	0.006	0.004	0.001	0.014	n/a	0.019	1402	1.20
241-AN-106	B0K762T	PRIMARY_RESULT	0.019	0.004	0.004	0.006	0.004	0.001	0.014	n/a	0.019	1402	1.20
241-AN-106	B0KCN0T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	1402	1.20
241-AN-106	B0KCN6T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	1402	1.20
241-AN-106	B0KCP1T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	1402	1.20
241-AN-106	B0KCP7T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	1402	1.20
241-AN-106	B0KCQ4T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	1402	1.20
241-AN-106	B0KH99T	PRIMARY_RESULT	0.025	0.005	0.005	0.008	0.005	0.002	0.019	n/a	0.025	1402	1.20
241-AN-106	B0KHB5T	PRIMARY_RESULT	0.025	0.005	0.005	0.008	0.005	0.002	0.019	n/a	0.025	1402	1.20
241-AN-106	B0KHC4T	PRIMARY_RESULT	0.025	0.005	0.005	0.008	0.005	0.002	0.019	n/a	0.025	1402	1.20
241-AN-106	B0KHD0T	PRIMARY_RESULT	0.025	0.005	0.005	0.008	0.005	0.002	0.019	n/a	0.025	1402	1.20
241-AN-106	B0KHD6T	PRIMARY_RESULT	0.025	0.005	0.005	0.008	0.005	0.002	0.019	n/a	0.025	1402	1.20
241-AN-106	B0KHF2T	PRIMARY_RESULT	0.025	0.005	0.005	0.008	0.005	0.002	0.019	n/a	0.025	1402	1.20
241-AN-106	B0KHH0T	PRIMARY_RESULT	0.025	0.005	0.005	0.008	0.005	0.002	0.019	n/a	0.025	1402	1.20
241-AN-106	B0KJF0T	PRIMARY_RESULT	0.025	0.005	0.005	0.008	0.005	0.002	0.019	n/a	0.025	1402	1.20
241-AN-106	B0KJF5T	PRIMARY_RESULT	0.025	0.005	0.005	0.008	0.005	0.002	0.019	n/a	0.025	1402	1.20
241-AN-106	B0KJH1T	PRIMARY_RESULT	0.025	0.005	0.005	0.008	0.005	0.002	0.019	n/a	0.025	1402	1.20
241-AN-106	B0KJH2T	PRIMARY_RESULT	0.025	0.005	0.005	0.008	0.005	0.002	0.019	n/a	0.025	1402	1.20
241-AN-106	B0KML2T	PRIM/DUPL_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	1402	1.20
241-AN-106	B0KMM1T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	1402	1.20
241-AN-106	B0KMM7T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	1402	1.20
241-AN-106	B0KMN3T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	1402	1.20
241-AN-106	B0KMN9T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	1402	1.20
241-AN-106	B0KYV8T	PRIM/DUPL_RESULT	0.126	0.024	0.027	0.042	0.024	0.009	0.095	n/a	0.126	1402	1.20
241-AN-106	B0KYW6T	PRIMARY_RESULT	0.126	0.024	0.027	0.042	0.024	0.009	0.095	n/a	0.126	1402	1.20
241-AN-106	B0KYX3T	PRIMARY_RESULT	0.126	0.024	0.027	0.042	0.024	0.009	0.095	n/a	0.126	1402	1.20

Supernatant Results (mg/L)

Tank Name	Sample Number	Result Type	Aroclor 1016, CAS# 12674-11-2	Aroclor 1221, CAS# 11104-28-2	Aroclor 1232, CAS# 11141-16-5	Aroclor 1242, CAS# 53469-21-9	Aroclor 1248, CAS# 12672-29-6	Aroclor 1254, CAS# 11097-69-1	Aroclor 1260, CAS# 11096-82-5	Aroclor 1262, CAS# 37324-23-5	Total PCBs CAS# 1336-36-6	Total Tank Waste Phase (kL)	Ave. Density (g/mL)
241-AN-106	B0KYY0T	PRIMARY_RESULT	0.126	0.024	0.027	0.042	0.024	0.009	0.095	n/a	0.126	1402	1.20
241-AN-106	B0KYY7T	PRIMARY_RESULT	0.126	0.024	0.027	0.042	0.024	0.009	0.095	n/a	0.126	1402	1.20
241-AN-107	B0GPJ2T	PRIMARY_RESULT	0.004	0.004	0.004	0.004	0.004	0.004	0.004	n/a	0.004	3130	1.44
241-AN-107	B0GPJ5T	PRIM/DUPL_RESULT	0.004	0.004	0.004	0.004	0.004	0.004	0.004	n/a	0.004	3130	1.44
241-AN-107	B0GPJ8T	PRIM/DUPL_RESULT	0.004	0.004	0.004	0.004	0.004	0.004	0.004	n/a	0.004	3130	1.44
241-AN-107	B0K8V8T	PRIMARY_RESULT	0.126	0.024	0.027	0.042	0.024	0.009	0.095	n/a	0.126	3130	1.44
241-AN-107	B0K8W4T	PRIMARY_RESULT	0.126	0.024	0.027	0.042	0.024	0.009	0.095	n/a	0.126	3130	1.44
241-AN-107	B0K8X0T	PRIMARY_RESULT	0.126	0.024	0.027	0.042	0.024	0.009	0.095	n/a	0.126	3130	1.44
241-AN-107	B0K8X6T	PRIMARY_RESULT	0.126	0.024	0.027	0.042	0.024	0.009	0.095	n/a	0.126	3130	1.44
241-AN-107	B0K8Y2T	PRIMARY_RESULT	0.126	0.024	0.027	0.042	0.024	0.009	0.095	n/a	0.126	3130	1.44
241-AN-107	B0L4T5T	PRIM/DUPL_RESULT	0.252	0.047	0.055	0.084	0.047	0.017	0.191	n/a	0.252	3130	1.44
241-AN-107	B0L4V3T	PRIMARY_RESULT	0.252	0.047	0.055	0.084	0.047	0.017	0.191	n/a	0.252	3130	1.44
241-AN-107	B0L4W1T	PRIMARY_RESULT	0.252	0.047	0.055	0.084	0.047	0.017	0.191	n/a	0.252	3130	1.44
241-AN-107	B0L4X5T	PRIMARY_RESULT	0.252	0.047	0.055	0.084	0.047	0.017	0.191	n/a	0.252	3130	1.44
241-AN-107	B0L4Y3T	PRIM/DUPL_RESULT	0.252	0.047	0.055	0.084	0.047	0.017	0.191	n/a	0.252	3130	1.44
241-AN-107	B0L4Z1T	PRIMARY_RESULT	0.252	0.047	0.055	0.084	0.047	0.017	0.191	n/a	0.252	3130	1.44
241-AN-107	B0L4Z9T	PRIMARY_RESULT	0.252	0.047	0.055	0.084	0.047	0.017	0.191	n/a	0.252	3130	1.44
241-AN-107	B0L507T	PRIMARY_RESULT	0.252	0.047	0.055	0.084	0.047	0.017	0.191	n/a	0.252	3130	1.44
241-AP-101	B0K485T	PRIMARY_RESULT	0.025	0.005	0.004	0.008	0.005	0.002	0.019	n/a	0.025	4542	1.40
241-AP-101	B0K492T	PRIMARY_RESULT	0.025	0.005	0.004	0.008	0.005	0.002	0.019	n/a	0.025	4542	1.40
241-AP-101	B0K499T	PRIMARY_RESULT	0.025	0.005	0.004	0.008	0.005	0.002	0.019	n/a	0.025	4542	1.40
241-AP-101	B0KPN9T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	4542	1.40
241-AP-101	B0KPQ1T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	4542	1.40
241-AP-101	B0KPQ2T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	4542	1.40
241-AP-101	B0KPQ8T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	4542	1.40
241-AP-101	B0KPQ9T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	4542	1.40
241-AP-101	B0KPS5T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	4542	1.40
241-AP-101	B0KPS6T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	4542	1.40
241-AP-101	B0KPT9T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	4542	1.40
241-AP-101	B0KPW2T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	4542	1.40

Supernatant Results (mg/L)

Tank Name	Sample Number	Result Type	Aroclor 1016, CAS# 12674-11-2	Aroclor 1221, CAS# 11104-28-2	Aroclor 1232, CAS# 11141-16-5	Aroclor 1242, CAS# 53469-21-9	Aroclor 1248, CAS# 12672-29-6	Aroclor 1254, CAS# 11097-69-1	Aroclor 1260, CAS# 11096-82-5	Aroclor 1262, CAS# 37324-23-5	Total PCBs CAS# 1336-36-6	Total Tank Waste Phase (kL)	Ave. Density (g/mL)
241-AP-101	B19BM1T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.004	0.029	n/a	0.046	4542	1.40
241-AP-101	B19BP2T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.004	0.029	n/a	0.046	4542	1.40
241-AP-101	B19BP9T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.004	0.029	n/a	0.046	4542	1.40
241-AP-102	B0L2C4T	PRIM/DUPL_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	927	1.22
241-AP-102	B0L2D1T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	927	1.22
241-AP-102	B0L2D8T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	927	1.22
241-AP-102	B0L2F5T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	927	1.22
241-AP-102	B0L2H2T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	927	1.22
241-AP-102	B0L2J2T	PRIM/DUPL_RESULT	0.126	0.024	0.027	0.042	0.024	0.009	0.095	n/a	0.126	927	1.22
241-AP-103	B0HJN9T	PRIMARY_RESULT	0.085	0.250	0.230	0.130	0.065	0.065	0.085	0.065	0.250	2516	1.41
241-AP-103	B0KTN3T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	2516	1.41
241-AP-103	B0KTP2T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	2516	1.41
241-AP-103	B0KTQ1T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	2516	1.41
241-AP-103	B0KTR0T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	2516	1.41
241-AP-103	B0KTR9T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	2516	1.41
241-AP-103	B0KTT0T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	2516	1.41
241-AP-104	B0GFR7T	PRIM/DUPL_RESULT	0.020	0.040	0.020	0.020	0.020	0.020	0.020	n/a	0.040	3579	1.40
241-AP-104	B0GFR8T	PRIM/DUPL_RESULT	0.020	0.040	0.020	0.020	0.020	0.020	0.020	n/a	0.040	3579	1.40
241-AP-104	B0GFR9T	PRIM/DUPL_RESULT	0.020	0.040	0.020	0.020	0.020	0.020	0.020	n/a	0.040	3579	1.40
241-AP-104	B0HG44T	PRIMARY_RESULT	0.057	0.167	0.153	0.087	0.043	0.043	0.057	0.043	0.167	3579	1.40
241-AP-104	B0HG57T	PRIMARY_RESULT	0.034	0.100	0.092	0.052	0.026	0.026	0.034	0.026	0.100	3579	1.40
241-AP-104	B0HW88T	PRIMARY_RESULT	0.038	0.071	0.046	0.026	0.013	0.004	0.029	n/a	0.071	3579	1.40
241-AP-104	B0HWB9T	PRIMARY_RESULT	0.038	0.071	0.046	0.026	0.013	0.004	0.029	n/a	0.071	3579	1.40
241-AP-104	B0HWC7T	PRIMARY_RESULT	0.038	0.071	0.046	0.026	0.013	0.004	0.029	n/a	0.071	3579	1.40
241-AP-104	B0KZ06T	PRIMARY_RESULT	0.126	0.024	0.027	0.042	0.024	0.009	0.095	n/a	0.126	3579	1.40
241-AP-104	B0KZ15T	PRIMARY_RESULT	0.126	0.024	0.027	0.042	0.024	0.009	0.095	n/a	0.126	3579	1.40
241-AP-104	B0KZ26T	PRIMARY_RESULT	0.126	0.024	0.027	0.042	0.024	0.009	0.095	n/a	0.126	3579	1.40
241-AP-104	B0KZ35T	PRIMARY_RESULT	0.126	0.024	0.027	0.042	0.024	0.009	0.095	n/a	0.126	3579	1.40
241-AP-104	B0KZ46T	PRIMARY_RESULT	0.126	0.024	0.027	0.042	0.024	0.009	0.095	n/a	0.126	3579	1.40
241-AP-104	B0KZ56T	PRIMARY_RESULT	0.126	0.024	0.027	0.042	0.024	0.009	0.095	n/a	0.126	3579	1.40

Supernatant Results (mg/L)

Tank Name	Sample Number	Result Type	Aroclor 1016, CAS# 12674-11-2	Aroclor 1221, CAS# 11104-28-2	Aroclor 1232, CAS# 11141-16-5	Aroclor 1242, CAS# 53469-21-9	Aroclor 1248, CAS# 12672-29-6	Aroclor 1254, CAS# 11097-69-1	Aroclor 1260, CAS# 11096-82-5	Aroclor 1262, CAS# 37324-23-5	Total PCBs CAS# 1336-36-6	Total Tank Waste Phase (kL)	Ave. Density (g/mL)
241-AP-104	B0KZ67T	PRIM/DUPL_RESULT	0.126	0.024	0.027	0.042	0.024	0.009	0.095	n/a	0.126	3579	1.40
241-AP-105	B0HLX7T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.022	0.017	n/a	0.050	4321	1.41
241-AP-105	B0HLY6T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.022	0.017	n/a	0.050	4321	1.41
241-AP-105	B0HLY7T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.022	0.017	n/a	0.050	4321	1.41
241-AP-105	B0HLY8T	PRIMARY_RESULT	0.020	0.059	0.054	0.031	0.015	0.025	0.020	n/a	0.059	4321	1.41
241-AP-105	B0HXY4T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.004	0.029	n/a	0.046	4321	1.41
241-AP-105	B0HY00T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.004	0.029	n/a	0.046	4321	1.41
241-AP-105	B0HY01T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.007	0.029	n/a	0.007	4321	1.41
241-AP-105	B0K3X9T	PRIMARY_RESULT	0.019	0.004	0.003	0.006	0.004	0.001	0.014	n/a	0.019	4321	1.41
241-AP-105	B0K3Y0T	PRIMARY_RESULT	0.019	0.004	0.003	0.006	0.004	0.001	0.014	n/a	0.019	4321	1.41
241-AP-105	B0K3Y1T	PRIMARY_RESULT	0.019	0.004	0.003	0.006	0.004	0.001	0.014	n/a	0.019	4321	1.41
241-AP-105	B0KF61T	PRIMARY_RESULT	0.063	0.012	0.014	0.021	0.012	0.004	0.048	n/a	0.063	4321	1.41
241-AP-105	B0KF68T	PRIMARY_RESULT	0.063	0.012	0.014	0.021	0.012	0.004	0.048	n/a	0.063	4321	1.41
241-AP-105	B0KF75T	PRIMARY_RESULT	0.063	0.012	0.014	0.021	0.012	0.004	0.048	n/a	0.063	4321	1.41
241-AP-105	B0KF82T	PRIMARY_RESULT	0.063	0.012	0.014	0.021	0.012	0.004	0.048	n/a	0.063	4321	1.41
241-AP-105	B0KF89T	PRIMARY_RESULT	0.063	0.012	0.014	0.021	0.012	0.004	0.048	n/a	0.063	4321	1.41
241-AP-105	B0KF96T	PRIMARY_RESULT	0.063	0.012	0.014	0.021	0.012	0.004	0.048	n/a	0.063	4321	1.41
241-AP-105	B0L0S3T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	4321	1.41
241-AP-105	B0L0T3T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	4321	1.41
241-AP-105	B0L0V1T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	4321	1.41
241-AP-105	B0L0V9T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	4321	1.41
241-AP-105	B0L0W7T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	4321	1.41
241-AP-105	B0L0Y9T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	4321	1.41
241-AP-105	B0L0Z0T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	4321	1.41
241-AP-105	B0L0Z1T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	4321	1.41
241-AP-105	B0L0Z9T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	4321	1.41
241-AP-106	B0HRL5T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.022	0.029	n/a	0.046	3143	1.24
241-AP-106	B0HRL6T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.022	0.029	n/a	0.046	3143	1.24
241-AP-106	B0KMV0T	PRIMARY_RESULT	0.063	0.012	0.014	0.021	0.012	0.004	0.048	n/a	0.063	3143	1.24
241-AP-106	B0KMW0T	PRIM/DUPL_RESULT	0.063	0.012	0.014	0.021	0.012	0.004	0.048	n/a	0.063	3143	1.24

Supernatant Results (mg/L)

Tank Name	Sample Number	Result Type	Aroclor 1016, CAS# 12674-11-2	Aroclor 1221, CAS# 11104-28-2	Aroclor 1232, CAS# 11141-16-5	Aroclor 1242, CAS# 53469-21-9	Aroclor 1248, CAS# 12672-29-6	Aroclor 1254, CAS# 11097-69-1	Aroclor 1260, CAS# 11096-82-5	Aroclor 1262, CAS# 37324-23-5	Total PCBs CAS# 1336-36-6	Total Tank Waste Phase (kL)	Ave. Density (g/mL)
241-AP-106	B0KMW6T	PRIMARY_RESULT	0.063	0.012	0.014	0.021	0.012	0.004	0.048	n/a	0.063	3143	1.24
241-AP-106	B0KMX2T	PRIMARY_RESULT	0.063	0.012	0.014	0.021	0.012	0.004	0.048	n/a	0.063	3143	1.24
241-AP-106	B0KMX8T	PRIMARY_RESULT	0.063	0.012	0.014	0.021	0.012	0.004	0.048	n/a	0.063	3143	1.24
241-AP-107	B0GFR1T	PRIM/DUPL_RESULT	0.020	0.040	0.020	0.020	0.020	0.020	0.020	n/a	0.040	4242	1.31
241-AP-107	B0GFR2T	PRIM/DUPL_RESULT	0.020	0.040	0.020	0.020	0.020	0.020	0.020	n/a	0.040	4242	1.31
241-AP-107	B0GFR3T	PRIM/DUPL_RESULT	0.020	0.040	0.020	0.020	0.020	0.020	0.020	n/a	0.040	4242	1.31
241-AP-107	B0H3C6T	PRIMARY_RESULT	n/a	n/a	0.020	0.020	0.020	0.020	0.020	n/a	0.020	4242	1.31
241-AP-107	B0H3C8T	PRIMARY_RESULT	n/a	n/a	0.020	0.020	0.020	0.020	0.020	n/a	0.020	4242	1.31
241-AP-107	B0H3D0T	PRIMARY_RESULT	n/a	n/a	0.020	0.020	0.020	0.020	0.020	n/a	0.020	4242	1.31
241-AP-107	B0HCD7T	PRIMARY_RESULT	0.005	0.015	0.014	0.008	0.004	0.004	0.005	0.004	0.015	4242	1.31
241-AP-107	B0HCF4T	PRIMARY_RESULT	0.005	0.015	0.014	0.008	0.004	0.004	0.005	0.004	0.015	4242	1.31
241-AP-107	B0HCF5T	PRIMARY_RESULT	0.005	0.015	0.014	0.008	0.004	0.004	0.005	0.004	0.015	4242	1.31
241-AP-107	B0HR77T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.022	0.017	n/a	0.050	4242	1.31
241-AP-107	B0HR92T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.022	0.017	n/a	0.050	4242	1.31
241-AP-107	B0HR93T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.022	0.017	n/a	0.050	4242	1.31
241-AP-107	B0HYW9T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.004	0.029	n/a	0.046	4242	1.31
241-AP-107	B0HZ01T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.004	0.029	n/a	0.046	4242	1.31
241-AP-107	B0HZ09T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.004	0.029	n/a	0.046	4242	1.31
241-AP-107	B0K9N0T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	4242	1.31
241-AP-107	B0K9Q3T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	4242	1.31
241-AP-107	B0K9Q4T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	4242	1.31
241-AP-107	B0K9Q5T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	4242	1.31
241-AP-108	B0H4D9T	PRIMARY_RESULT	n/a	n/a	0.040	0.040	0.040	0.040	0.040	n/a	0.040	4275	1.42
241-AP-108	B0H4F5T	PRIMARY_RESULT	n/a	n/a	0.040	0.040	0.040	0.040	0.040	n/a	0.040	4275	1.42
241-AP-108	B0H4G1T	PRIMARY_RESULT	n/a	n/a	0.040	0.040	0.040	0.040	0.040	n/a	0.040	4275	1.42
241-AP-108	B0HJ15T	PRIM/DUPL_RESULT	0.017	0.050	0.046	0.026	0.013	0.013	0.017	0.013	0.050	4275	1.42
241-AP-108	B0HJ16T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.013	0.017	0.013	0.050	4275	1.42
241-AP-108	B0HJ17T	PRIM/DUPL_RESULT	0.022	0.063	0.058	0.033	0.017	0.017	0.022	0.017	0.063	4275	1.42
241-AP-108	B0HN50T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.022	0.017	n/a	0.050	4275	1.42
241-AP-108	B0HN52T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.022	0.017	n/a	0.050	4275	1.42

Supernatant Results (mg/L)

Tank Name	Sample Number	Result Type	Aroclor 1016, CAS# 12674-11-2	Aroclor 1221, CAS# 11104-28-2	Aroclor 1232, CAS# 11141-16-5	Aroclor 1242, CAS# 53469-21-9	Aroclor 1248, CAS# 12672-29-6	Aroclor 1254, CAS# 11097-69-1	Aroclor 1260, CAS# 11096-82-5	Aroclor 1262, CAS# 37324-23-5	Total PCBs CAS# 1336-36-6	Total Tank Waste Phase (kL)	Ave. Density (g/mL)
241-AP-108	B0HN54T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.022	0.017	n/a	0.050	4275	1.42
241-AP-108	B0HV88T	PRIMARY_RESULT	0.038	0.071	0.046	0.026	0.013	0.004	0.029	n/a	0.071	4275	1.42
241-AP-108	B0HV89T	PRIMARY_RESULT	0.038	0.071	0.046	0.026	0.013	0.004	0.029	n/a	0.071	4275	1.42
241-AP-108	B0HV90T	PRIMARY_RESULT	0.038	0.071	0.046	0.026	0.013	0.004	0.029	n/a	0.071	4275	1.42
241-AW-101	B0GQH5T	PRIMARY_RESULT	0.004	0.004	0.004	0.004	0.004	0.004	0.004	n/a	0.004	2770	1.47
241-AW-101	B0GQH6T	PRIMARY_RESULT	0.004	0.004	0.004	0.004	0.004	0.004	0.004	n/a	0.004	2770	1.47
241-AW-101	B0GQH7T	PRIMARY_RESULT	0.004	0.004	0.004	0.004	0.004	0.004	0.004	n/a	0.004	2770	1.47
241-AW-102	B0GFN9T	PRIM/DUPL_RESULT	0.060	0.120	0.060	0.060	0.060	0.060	0.060	n/a	0.120	3744	1.30
241-AW-102	B0GWB1T	PRIMARY_RESULT	0.010	0.010	0.010	0.010	0.010	0.010	0.010	n/a	0.010	3744	1.30
241-AW-102	B0GWC0T	PRIMARY_RESULT	0.010	0.010	0.010	0.010	0.010	0.010	0.010	n/a	0.010	3744	1.30
241-AW-102	B0GWD1T	PRIMARY_RESULT	0.015	0.015	0.015	0.015	0.015	0.015	0.015	n/a	0.015	3744	1.30
241-AW-102	B0HSS7T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.007	0.029	n/a	0.007	3744	1.30
241-AW-102	B0HSS8T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.005	0.029	n/a	0.005	3744	1.30
241-AW-102	B0K1B3T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.003	0.029	n/a	0.046	3744	1.30
241-AW-102	B0K1C0T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.003	0.029	n/a	0.046	3744	1.30
241-AW-102	B0K1C7T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.003	0.029	n/a	0.046	3744	1.30
241-AW-102	B0K1D4T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.003	0.029	n/a	0.046	3744	1.30
241-AW-102	B0KNY2T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3744	1.30
241-AW-102	B0KNZ2T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3744	1.30
241-AW-102	B0KP00T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3744	1.30
241-AW-102	B0KP08T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3744	1.30
241-AW-102	B0KP18T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3744	1.30
241-AW-103	B0L3C0T	PRIM/DUPL_RESULT	0.189	0.036	0.041	0.063	0.036	0.013	0.143	n/a	0.189	2888	1.33
241-AW-103	B0L3C7T	PRIMARY_RESULT	0.189	0.036	0.041	0.063	0.036	0.013	0.143	n/a	0.189	2888	1.33
241-AW-103	B0L3D4T	PRIMARY_RESULT	0.189	0.036	0.041	0.063	0.036	0.013	0.143	n/a	0.189	2888	1.33
241-AW-103	B0L3F1T	PRIMARY_RESULT	0.189	0.036	0.041	0.063	0.036	0.013	0.143	n/a	0.189	2888	1.33
241-AW-103	B0L3F8T	PRIMARY_RESULT	0.189	0.036	0.041	0.063	0.036	0.013	0.143	n/a	0.189	2888	1.33
241-AW-103	B0L3H5T	PRIMARY_RESULT	0.189	0.036	0.041	0.063	0.036	0.013	0.143	n/a	0.189	2888	1.33
241-AW-104	B0HHS8T	PRIMARY_RESULT	0.085	0.250	0.230	0.130	0.065	0.065	0.085	0.065	0.250	3273	1.38
241-AW-104	B0HTW0T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.004	0.029	n/a	0.046	3273	1.38

Supernatant Results (mg/L)

Tank Name	Sample Number	Result Type	Aroclor 1016, CAS# 12674-11-2	Aroclor 1221, CAS# 11104-28-2	Aroclor 1232, CAS# 11141-16-5	Aroclor 1242, CAS# 53469-21-9	Aroclor 1248, CAS# 12672-29-6	Aroclor 1254, CAS# 11097-69-1	Aroclor 1260, CAS# 11096-82-5	Aroclor 1262, CAS# 37324-23-5	Total PCBs CAS# 1336-36-6	Total Tank Waste Phase (kL)	Ave. Density (g/mL)
241-AW-104	B0HTW5T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.004	0.029	n/a	0.046	3273	1.38
241-AW-105	B0HJM1T	PRIMARY_RESULT	0.007	0.020	0.018	0.010	0.005	0.005	0.007	0.0052	0.020	2614	1.36
241-AW-106	B0HFZ6T	PRIMARY_RESULT	0.005	0.015	0.014	0.008	0.004	0.004	0.005	0.004	0.015	333	1.24
241-AW-106	B0HST3T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.004	0.029	n/a	0.046	333	1.24
241-AW-106	B0HST4T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.004	0.029	n/a	0.046	333	1.24
241-AW-106	B0K6L1T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	333	1.24
241-AW-106	B0K6L9T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	333	1.24
241-AW-106	B0K6M8T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	333	1.24
241-AW-106	B0K6N6T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	333	1.24
241-AW-106	B0KJZ4T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	333	1.24
241-AW-106	B0KK00T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	333	1.24
241-AW-106	B0KK08T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	333	1.24
241-AW-106	B0KK17T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	333	1.24
241-AX-101	B0HP25T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.022	0.017	n/a	0.050	177	1.54
241-AY-101	B0HD03T	PRIMARY_RESULT	0.010	0.030	0.028	0.016	0.008	0.008	0.010	0.008	0.030	3208	1.30
241-AY-101	B0HD04T	PRIM/DUPL_RESULT	0.010	0.030	0.028	0.016	0.008	0.008	0.010	0.008	0.030	3208	1.30
241-AY-101	B0K2C8T	PRIMARY_RESULT	0.038	0.007	0.006	0.013	0.007	0.003	0.029	n/a	0.038	3208	1.30
241-AY-101	B0K818T	PRIMARY_RESULT	0.040	0.007	0.009	0.013	0.007	0.003	0.030	n/a	0.040	3208	1.30
241-AY-101	B0K822T	PRIMARY_RESULT	0.020	0.004	0.004	0.007	0.004	0.001	0.015	n/a	0.020	3208	1.30
241-AY-101	B0K828T	PRIMARY_RESULT	0.020	0.004	0.004	0.007	0.004	0.001	0.015	n/a	0.020	3208	1.30
241-AY-101	B0K834T	PRIMARY_RESULT	0.020	0.004	0.004	0.007	0.004	0.001	0.015	n/a	0.020	3208	1.30
241-AY-101	B0K840T	PRIMARY_RESULT	0.020	0.004	0.004	0.007	0.004	0.001	0.015	n/a	0.020	3208	1.30
241-AY-101	B0K846T	PRIMARY_RESULT	0.020	0.004	0.004	0.007	0.004	0.001	0.015	n/a	0.020	3208	1.30
241-AY-101	B0K852T	PRIMARY_RESULT	0.020	0.004	0.004	0.007	0.004	0.001	0.015	n/a	0.020	3208	1.30
241-AY-101	B0KCH2T	PRIMARY_RESULT	0.020	0.004	0.004	0.007	0.004	0.001	0.015	n/a	0.020	3208	1.30
241-AY-101	B0KCH3T	PRIMARY_RESULT	0.020	0.004	0.004	0.007	0.004	0.001	0.015	n/a	0.020	3208	1.30
241-AY-101	B0KCH4T	PRIMARY_RESULT	0.019	0.004	0.004	0.006	0.004	0.001	0.015	n/a	0.019	3208	1.30
241-AY-101	B0KCH5T	PRIMARY_RESULT	0.021	0.004	0.005	0.007	0.004	0.001	0.016	n/a	0.021	3208	1.30
241-AY-101	B0KCH6T	PRIMARY_RESULT	0.019	0.004	0.004	0.006	0.004	0.001	0.014	n/a	0.019	3208	1.30
241-AY-101	B0KCH7T	PRIMARY_RESULT	0.022	0.004	0.005	0.007	0.004	0.002	0.017	n/a	0.022	3208	1.30

Supernatant Results (mg/L)

Tank Name	Sample Number	Result Type	Aroclor 1016, CAS# 12674-11-2	Aroclor 1221, CAS# 11104-28-2	Aroclor 1232, CAS# 11141-16-5	Aroclor 1242, CAS# 53469-21-9	Aroclor 1248, CAS# 12672-29-6	Aroclor 1254, CAS# 11097-69-1	Aroclor 1260, CAS# 11096-82-5	Aroclor 1262, CAS# 37324-23-5	Total PCBs CAS# 1336-36-6	Total Tank Waste Phase (kL)	Ave. Density (g/mL)
241-AY-101	B0KCH8T	PRIMARY_RESULT	0.021	0.004	0.005	0.007	0.004	0.001	0.016	n/a	0.021	3208	1.30
241-AY-101	B0KL98T	PRIM/DUPL_RESULT	0.043	0.008	0.009	0.014	0.008	0.003	0.033	n/a	0.043	3208	1.30
241-AY-101	B0KLB6T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	3208	1.30
241-AY-101	B0KLC4T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	3208	1.30
241-AY-101	B0KLD2T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	3208	1.30
241-AY-101	B0KLD9T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	3208	1.30
241-AY-101	B0KLF6T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	3208	1.30
241-AY-101	B0KLH3T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	3208	1.30
241-AY-101	B0KLJ0T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	3208	1.30
241-AY-101	B0KLJ7T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	3208	1.30
241-AY-101	B0KLK5T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	3208	1.30
241-AY-101	B0L1D2T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3208	1.30
241-AY-101	B0L1F1T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3208	1.30
241-AY-101	B0L1H0T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3208	1.30
241-AY-101	B0L1J1T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3208	1.30
241-AY-101	B0L1K2T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3208	1.30
241-AY-101	B0L1L3T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3208	1.30
241-AY-101	B0L1L8T	PRIM/DUPL_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3208	1.30
241-AY-102	B0H2W8T	PRIM/DUPL_RESULT	0.006	0.006	0.006	0.006	0.006	0.006	0.006	n/a	0.006	22	1.14
241-AY-102	B0HQT1T	PRIMARY_RESULT	0.050	0.150	0.140	0.080	0.040	0.040	0.050	0.04	0.150	22	1.14
241-AY-102	B0HQT2T	PRIMARY_RESULT	0.050	0.150	0.140	0.080	0.040	0.040	0.050	0.04	0.150	22	1.14
241-AZ-101	B0HKF9T	PRIMARY_RESULT	0.020	0.058	0.053	0.030	0.015	0.015	0.020	0.015	0.058	3450	1.32
241-AZ-101	B0KBL3T	PRIMARY_RESULT	0.079	0.015	0.017	0.026	0.015	0.005	0.060	n/a	0.079	3450	1.32
241-AZ-101	B0KBM0T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3450	1.32
241-AZ-101	B0KBM7T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3450	1.32
241-AZ-101	B0KBN4T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3450	1.32
241-AZ-101	B0KBP1T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3450	1.32
241-AZ-101	B0KBP8T	PRIMARY_RESULT	0.126	0.024	0.027	0.042	0.024	0.009	0.095	n/a	0.126	3450	1.32
241-AZ-102	B0HK97T	PRIMARY_RESULT	0.085	0.250	0.230	0.130	0.065	0.065	0.085	0.065	0.250	2551	1.35
241-AZ-102	B0K8C8T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	2551	1.35

Supernatant Results (mg/L)

Tank Name	Sample Number	Result Type	Aroclor 1016, CAS# 12674-11-2	Aroclor 1221, CAS# 11104-28-2	Aroclor 1232, CAS# 11141-16-5	Aroclor 1242, CAS# 53469-21-9	Aroclor 1248, CAS# 12672-29-6	Aroclor 1254, CAS# 11097-69-1	Aroclor 1260, CAS# 11096-82-5	Aroclor 1262, CAS# 37324-23-5	Total PCBs CAS# 1336-36-6	Total Tank Waste Phase (kL)	Ave. Density (g/mL)
241-AZ-102	B0K8F0T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	2551	1.35
241-AZ-102	B0K8F1T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	2551	1.35
241-AZ-102	B0KHQ7T	PRIMARY_RESULT	0.038	0.007	0.008	0.013	0.007	0.003	0.029	n/a	0.038	2551	1.35
241-AZ-102	B0KHR6T	PRIMARY_RESULT	0.047	0.009	0.010	0.016	0.009	0.003	0.035	n/a	0.047	2551	1.35
241-AZ-102	B0KHS8T	PRIMARY_RESULT	0.061	0.011	0.013	0.020	0.011	0.004	0.046	n/a	0.061	2551	1.35
241-AZ-102	B0KHT7T	PRIMARY_RESULT	0.068	0.013	0.015	0.023	0.013	0.005	0.051	n/a	0.068	2551	1.35
241-AZ-102	B0KHV6T	PRIMARY_RESULT	0.052	0.010	0.011	0.017	0.010	0.004	0.039	n/a	0.052	2551	1.35
241-AZ-102	B0KHW4T	PRIMARY_RESULT	0.047	0.009	0.010	0.016	0.009	0.003	0.036	n/a	0.047	2551	1.35
241-AZ-102	B0KHX3T	PRIMARY_RESULT	0.043	0.008	0.009	0.014	0.008	0.003	0.033	n/a	0.043	2551	1.35
241-AZ-102	B0KHY2T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	2551	1.35
241-AZ-102	B0KHZ1T	PRIMARY_RESULT	0.044	0.008	0.010	0.015	0.008	0.003	0.034	n/a	0.044	2551	1.35
241-AZ-102	B0KJ00T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	2551	1.35
241-AZ-102	B0KJ09T	PRIMARY_RESULT	0.079	0.015	0.017	0.026	0.015	0.005	0.060	n/a	0.079	2551	1.35
241-AZ-102	B0KN79T	PRIM/DUPL_RESULT	0.126	0.024	0.027	0.042	0.024	0.009	0.095	n/a	0.126	2551	1.35
241-AZ-102	B0KN87T	PRIMARY_RESULT	0.126	0.024	0.027	0.042	0.024	0.009	0.095	n/a	0.126	2551	1.35
241-AZ-102	B0KN99T	PRIMARY_RESULT	0.126	0.024	0.027	0.042	0.024	0.009	0.095	n/a	0.126	2551	1.35
241-AZ-102	B0KNB9T	PRIMARY_RESULT	0.126	0.024	0.027	0.042	0.024	0.009	0.095	n/a	0.126	2551	1.35
241-B-106	B19C07T	PRIMARY_RESULT	0.050	0.010	0.061	0.035	0.017	0.005	0.038	n/a	0.061	4	1.26
241-BX-103	B19C43T	PRIMARY_RESULT	0.061	0.011	0.074	0.042	0.021	0.007	0.046	n/a	0.074	42	1.13
241-BX-110	B19C73T	PRIMARY_RESULT	0.094	0.018	0.120	0.065	0.032	0.010	0.072	n/a	0.120	148	1.27
241-BY-103	B0HWJ4T	PRIMARY_RESULT	0.038	0.071	0.046	0.026	0.013	0.004	0.029	n/a	0.071	237	1.24
241-BY-104	B0HP62T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.022	0.017	n/a	0.050	160	1.51
241-BY-105	B0HJS1T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.013	0.017	0.013	0.050	194	1.42
241-BY-106	B0HJW8T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.013	0.017	0.013	0.050	199	1.31
241-BY-107	B0HWP4T	PRIMARY_RESULT	0.038	0.071	0.046	0.026	0.013	0.004	0.029	n/a	0.071	139	1.46
241-BY-110	B0HWS7T	PRIMARY_RESULT	0.038	0.071	0.046	0.026	0.013	0.004	0.029	n/a	0.071	96	1.44
241-BY-112	B0HP74T	PRIMARY_RESULT	0.020	0.059	0.054	0.031	0.015	0.025	0.020	n/a	0.059	49	1.47
241-C-103	B0HHL9T	PRIMARY_RESULT	0.024	0.071	0.066	0.037	0.019	0.019	0.024	0.019	0.071	0.93	0.98
241-C-103	B0HHM0T	PRIMARY_RESULT	0.021	0.063	0.058	0.033	0.016	0.016	0.021	0.016	0.063	0.93	0.98
241-C-103	B0K0B3T	PRIM/DUPL_RESULT	0.005	0.001	0.007	0.004	0.002	0.001	0.004	n/a	0.007	1	0.98

Supernatant Results (mg/L)

Tank Name	Sample Number	Result Type	Aroclor 1016, CAS# 12674-11-2	Aroclor 1221, CAS# 11104-28-2	Aroclor 1232, CAS# 11141-16-5	Aroclor 1242, CAS# 53469-21-9	Aroclor 1248, CAS# 12672-29-6	Aroclor 1254, CAS# 11097-69-1	Aroclor 1260, CAS# 11096-82-5	Aroclor 1262, CAS# 37324-23-5	Total PCBs CAS# 1336-36-6	Total Tank Waste Phase (kL)	Ave. Density (g/mL)
241-C-103	B0K0B4T	PRIMARY_RESULT	0.005	0.001	0.007	0.004	0.002	0.001	0.004	n/a	0.007	0.93	0.98
241-C-105	B0HWV8T	PRIMARY_RESULT	0.038	0.071	0.046	0.026	0.013	0.004	0.029	n/a	0.071	0.322	1.02
241-C-106	B0HZ81T	PRIM/DUPL_RESULT	0.009	0.002	0.012	0.007	0.003	0.001	0.007	n/a	0.012	0.322	1.02
241-C-106	B0HZ82T	PRIMARY_RESULT	0.009	0.002	0.012	0.007	0.003	0.001	0.007	n/a	0.012	0.322	1.02
241-S-101	B0HJZ8T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.013	0.017	0.013	0.050	78	1.47
241-S-102	B0HK19T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.013	0.017	0.013	0.050	9	1.00
241-S-107	B0HK46T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.013	0.017	0.013	0.050	33	1.40
241-S-109	B0HJV2T	PRIMARY_RESULT	0.034	0.100	0.092	0.052	0.026	0.026	0.034	0.026	0.100	102	1.49
241-S-111	B0HK72T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.013	0.017	0.013	0.050	160	1.36
241-S-112	B0HG14T	PRIM/DUPL_RESULT	0.170	0.500	0.460	0.260	0.130	0.130	0.170	0.130	0.500	0.47	1.27
241-S-112	B0HG15T	PRIM/DUPL_RESULT	0.170	0.500	0.460	0.260	0.130	0.130	0.170	0.130	0.500	0.47	1.27
241-S-112	B0HG16T	PRIM/DUPL_RESULT	0.170	0.500	0.460	0.260	0.130	0.130	0.170	0.130	0.500	0.47	1.27
241-S-112	B0HJJ9T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.013	0.017	0.013	0.050	0.469	1.27
241-S-112	B0HJK0T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.013	0.017	0.013	0.050	0.469	1.27
241-S-112	B0HJK1T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.013	0.017	0.013	0.050	0.469	1.27
241-SX-101	B0HP83T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.022	0.017	n/a	0.050	83	1.48
241-SX-102	B0HPH5T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.022	0.017	n/a	0.050	108	1.46
241-SX-103	B0HPF0T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.022	0.017	n/a	0.050	138	1.47
241-SX-105	B0HPK7T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.022	0.017	n/a	0.050	142	1.47
241-SY-101	B0HK88T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.013	0.017	0.013	0.050	3384	1.16
241-SY-101	B0HSH8T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.004	0.029	n/a	0.046	3384	1.16
241-SY-101	B0HSK6T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.004	0.029	n/a	0.046	3384	1.16
241-SY-101	B0HSK8T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.004	0.029	n/a	0.046	3384	1.16
241-SY-101	B0K3Q0T	PRIMARY_RESULT	0.038	0.007	0.006	0.013	0.007	0.003	0.029	n/a	0.038	3384	1.16
241-SY-101	B0L1X5T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3384	1.16
241-SY-101	B0L1Y3T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3384	1.16
241-SY-101	B0L1Z4T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3384	1.16
241-SY-101	B0L211T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3384	1.16
241-SY-101	B0L212T	PRIM/DUPL_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3384	1.16
241-SY-101	B0L221T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3384	1.16

Supernatant Results (mg/L)

Tank Name	Sample Number	Result Type	Aroclor 1016, CAS# 12674-11-2	Aroclor 1221, CAS# 11104-28-2	Aroclor 1232, CAS# 11141-16-5	Aroclor 1242, CAS# 53469-21-9	Aroclor 1248, CAS# 12672-29-6	Aroclor 1254, CAS# 11097-69-1	Aroclor 1260, CAS# 11096-82-5	Aroclor 1262, CAS# 37324-23-5	Total PCBs CAS# 1336-36-6	Total Tank Waste Phase (kL)	Ave. Density (g/mL)
241-SY-101	B0L229T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	3384	1.16
241-SY-101	B19H27T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.004	0.029	n/a	0.046	3384	1.16
241-SY-101	B19H28T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.004	0.029	n/a	0.046	3384	1.16
241-SY-101	B19H29T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.004	0.029	n/a	0.046	3384	1.16
241-SY-101	B19H30T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.004	0.029	n/a	0.046	3384	1.16
241-SY-101	B19H31T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.004	0.029	n/a	0.046	3384	1.16
241-SY-102	B0HB15T	PRIMARY_RESULT	0.020	0.040	0.020	0.020	0.020	0.020	0.020	n/a	0.040	1257	1.17
241-SY-102	B0HGK1T	PRIMARY_RESULT	0.170	0.500	0.460	0.260	0.130	0.130	0.170	0.13	0.500	1257	1.17
241-SY-102	B0HGK2T	PRIMARY_RESULT	0.170	0.500	0.460	0.260	0.130	0.130	0.170	0.13	0.500	1257	1.17
241-SY-102	B0HJ00T	PRIM/DUPL_RESULT	0.043	0.125	0.115	0.065	0.033	0.033	0.043	0.033	0.125	1257	1.17
241-SY-102	B0HJ01T	PRIM/DUPL_RESULT	0.071	0.208	0.192	0.108	0.054	0.054	0.071	0.054	0.208	1257	1.17
241-SY-102	B0HJ02T	PRIM/DUPL_RESULT	0.043	0.125	0.115	0.065	0.033	0.033	0.043	0.033	0.125	1257	1.17
241-SY-102	B0HMB5T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.022	0.017	n/a	0.050	1257	1.17
241-SY-102	B0HMB6T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.022	0.017	n/a	0.050	1257	1.17
241-SY-102	B0HSP7T	PRIMARY_RESULT	0.047	0.009	0.058	0.032	0.017	0.005	0.036	n/a	0.058	1257	1.17
241-SY-102	B0HSP8T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.004	0.029	n/a	0.046	1257	1.17
241-SY-102	B0K0Q5T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.003	0.029	n/a	0.046	1257	1.17
241-SY-102	B0K0Q6T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.003	0.029	n/a	0.046	1257	1.17
241-SY-102	B0K0Q7T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.003	0.029	n/a	0.046	1257	1.17
241-SY-102	B0K0Q8T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.003	0.029	n/a	0.046	1257	1.17
241-SY-102	B0K0Q9T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.003	0.029	n/a	0.046	1257	1.17
241-SY-102	B0K0R0T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.003	0.029	n/a	0.046	1257	1.17
241-SY-102	B0K1X4T	PRIMARY_RESULT	0.038	0.007	0.006	0.013	0.007	0.003	0.029	n/a	0.038	1257	1.17
241-SY-102	B0K1X5T	PRIMARY_RESULT	0.038	0.007	0.006	0.013	0.007	0.003	0.029	n/a	0.038	1257	1.17
241-SY-102	B0K1X6T	PRIMARY_RESULT	0.038	0.007	0.006	0.013	0.007	0.003	0.029	n/a	0.038	1257	1.17
241-SY-102	B0K1X7T	PRIMARY_RESULT	0.038	0.007	0.006	0.013	0.007	0.003	0.029	n/a	0.038	1257	1.17
241-SY-102	B0K1X8T	PRIMARY_RESULT	0.038	0.007	0.006	0.013	0.007	0.003	0.029	n/a	0.038	1257	1.17
241-SY-102	B0K1X9T	PRIMARY_RESULT	0.038	0.007	0.006	0.013	0.007	0.003	0.029	n/a	0.038	1257	1.17
241-SY-102	B0K1Y0T	PRIMARY_RESULT	0.038	0.007	0.006	0.013	0.007	0.003	0.029	n/a	0.038	1257	1.17
241-SY-102	B0K1Y1T	PRIMARY_RESULT	0.038	0.007	0.006	0.013	0.007	0.003	0.029	n/a	0.038	1257	1.17

Supernatant Results (mg/L)

Tank Name	Sample Number	Result Type	Aroclor 1016, CAS# 12674-11-2	Aroclor 1221, CAS# 11104-28-2	Aroclor 1232, CAS# 11141-16-5	Aroclor 1242, CAS# 53469-21-9	Aroclor 1248, CAS# 12672-29-6	Aroclor 1254, CAS# 11097-69-1	Aroclor 1260, CAS# 11096-82-5	Aroclor 1262, CAS# 37324-23-5	Total PCBs CAS# 1336-36-6	Total Tank Waste Phase (kL)	Ave. Density (g/mL)
241-SY-102	B0KJR5T	PRIMARY_RESULT	0.019	0.004	0.004	0.006	0.004	0.001	0.015	n/a	0.019	1257	1.17
241-SY-102	B0KJS1T	PRIMARY_RESULT	0.021	0.004	0.005	0.007	0.004	0.001	0.016	n/a	0.021	1257	1.17
241-SY-102	B0KJS9T	PRIMARY_RESULT	0.020	0.004	0.004	0.007	0.004	0.001	0.015	n/a	0.020	1257	1.17
241-SY-102	B0KJT5T	PRIMARY_RESULT	0.021	0.004	0.004	0.007	0.004	0.001	0.016	n/a	0.021	1257	1.17
241-SY-102	B0KJV1T	PRIMARY_RESULT	0.021	0.004	0.005	0.007	0.004	0.001	0.016	n/a	0.021	1257	1.17
241-SY-102	B0KJV7T	PRIMARY_RESULT	0.021	0.004	0.005	0.007	0.004	0.001	0.016	n/a	0.021	1257	1.17
241-SY-102	B0KJW5T	PRIMARY_RESULT	0.019	0.004	0.004	0.006	0.004	0.001	0.014	n/a	0.019	1257	1.17
241-SY-102	B0KRM1T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	1257	1.17
241-SY-102	B0KRM2T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	1257	1.17
241-SY-102	B0KRT1T	PRIM/DUPL_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	1257	1.17
241-SY-102	B0KSF6T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	1257	1.17
241-SY-102	B0KSN9T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	1257	1.17
241-SY-102	B0KT23T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	1257	1.17
241-SY-102	B19HD2T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.004	0.029	n/a	0.046	1257	1.17
241-SY-102	B19HG0T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.004	0.029	n/a	0.046	1257	1.17
241-SY-102	B19HG1T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.004	0.029	n/a	0.046	1257	1.17
241-SY-102	B19HG2T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.004	0.029	n/a	0.046	1257	1.17
241-SY-102	B19HG3T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.004	0.029	n/a	0.046	1257	1.17
241-SY-102	B19HH2T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.004	0.029	n/a	0.046	1257	1.17
241-SY-103	B0HPL9T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.022	0.017	n/a	0.050	1444	1.49
241-SY-103	B0L3N1T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	1444	1.49
241-SY-103	B0L3P1T	PRIM/DUPL_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	1444	1.49
241-SY-103	B0L3Q1T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	1444	1.49
241-SY-103	B0L3R1T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	1444	1.49
241-SY-103	B0L3S1T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	1444	1.49
241-SY-103	B0L3T1T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	1444	1.49
241-SY-103	B0L4B4T	PRIMARY_RESULT	0.076	0.014	0.016	0.025	0.014	0.005	0.057	n/a	0.076	1444	1.49
241-T-103	B19CJ2T	PRIMARY_RESULT	0.110	0.020	0.130	0.074	0.037	0.012	0.082	n/a	0.130	13	1.19
241-TX-104	B19CM3T	PRIMARY_RESULT	0.063	0.012	0.077	0.043	0.022	0.007	0.048	n/a	0.077	32	1.44
241-U-102	B0HPN6T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.022	0.017	n/a	0.050	165	1.52

Supernatant Results (mg/L)

Tank Name	Sample Number	Result Type	Aroclor 1016, CAS# 12674-11-2	Aroclor 1221, CAS# 11104-28-2	Aroclor 1232, CAS# 11141-16-5	Aroclor 1242, CAS# 53469-21-9	Aroclor 1248, CAS# 12672-29-6	Aroclor 1254, CAS# 11097-69-1	Aroclor 1260, CAS# 11096-82-5	Aroclor 1262, CAS# 37324-23-5	Total PCBs CAS# 1336-36-6	Total Tank Waste Phase (kL)	Ave. Density (g/mL)
241-U-103	B19CQ2T	PRIMARY_RESULT	0.069	0.013	0.084	0.047	0.024	0.007	0.052	n/a	0.084	115	1.44
241-U-106	B19CV1T	PRIMARY_RESULT	0.076	0.014	0.092	0.052	0.026	0.008	0.057	n/a	0.092	154	1.34
241-U-107	B0HV01T	PRIMARY_RESULT	0.038	0.007	0.046	0.026	0.013	0.011	0.029	n/a	0.011	205	1.43
241-U-107	B0HV02T	PRIMARY_RESULT	0.049	0.009	0.060	0.034	0.017	0.009	0.037	n/a	0.009	205	1.43
241-U-108	B0HPQ8T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.022	0.017	n/a	0.050	244	1.40
241-U-109	B0HPS9T	PRIMARY_RESULT	0.028	0.083	0.077	0.043	0.022	0.036	0.028	n/a	0.083	170	1.47
241-U-111	B0HPV2T	PRIMARY_RESULT	0.017	0.050	0.046	0.026	0.013	0.022	0.017	n/a	0.050	139	1.31
241-U-201	B0HS97T	PRIMARY_RESULT	0.017	0.007	0.046	0.026	0.013	0.022	0.017	n/a	0.046	4	1.26
241-U-202	B0HS58T	PRIMARY_RESULT	0.019	0.008	0.052	0.030	0.015	0.024	0.019	n/a	0.052	4	1.28
241-U-204	B0HSV6T	PRIMARY_RESULT	0.033	0.014	0.088	0.050	0.025	0.041	0.033	n/a	0.088	4	1.11

Saltcake Results (dry weight, µg/g)

Tank Name	Sample Number	Result Type	Aroclor 1016, CAS# 12674-11-2	Aroclor 1221, CAS# 11104-28-2	Aroclor 1232, CAS# 11141-16-5	Aroclor 1242, CAS# 53469-21-9	Aroclor 1248, CAS# 12672-29-6	Aroclor 1254, CAS# 11097-69-1	Aroclor 1260, CAS# 11096-82-5	Aroclor 1262, CAS# 37324-23-5	Total PCBs CAS# 1336-36-6	Total Tank Waste Phase (kL)	Ave. Density (g/mL)
241-A-101	B0HP04T	PRIMARY_RESULT	0.128	0.781	0.719	0.406	0.042	0.024	0.176	n/a	0.781	777	1.68
241-A-101	B0HP06T	PRIMARY_RESULT	0.117	0.714	0.657	0.371	0.038	0.022	0.161	n/a	0.714	777	1.68
241-AN-102	B0GJY5T	PRIMARY_RESULT	1.501	1.501	1.501	1.501	1.501	1.501	1.501	n/a	1.501	601	1.53
241-AN-102	B0GJY6T	PRIMARY_RESULT	1.108	1.108	1.108	1.108	1.108	1.108	1.108	n/a	1.108	601	1.53
241-AN-102	B0GJY7T	PRIMARY_RESULT	1.378	1.378	1.378	1.378	1.378	1.378	1.378	n/a	1.378	601	1.53
241-AN-102	B0JQL1T	PRIM/DUPL_RESULT	n/a	0.02	0.02	n/a	0.02	**0.031**	**0.048**	n/a	**0.079**	601	1.53
241-AN-103	B0GL52T	PRIMARY_RESULT	1.785	1.785	1.785	1.785	1.785	1.785	1.785	n/a	1.785	1688	1.72
241-AN-103	B0GL53T	PRIMARY_RESULT	1.722	1.722	1.722	1.722	1.722	1.722	1.722	n/a	1.722	1688	1.72
241-AN-103	B0GL54T	PRIMARY_RESULT	1.702	1.702	1.702	1.702	1.702	1.702	1.702	n/a	1.702	1688	1.72
241-AN-104	B0GL04T	PRIMARY_RESULT	0.722	0.722	0.722	0.722	0.722	0.722	0.722	n/a	0.722	1745	1.59
241-AN-104	B0GL07T	PRIMARY_RESULT	0.722	0.722	0.722	0.722	0.722	0.722	0.722	n/a	0.722	1745	1.59
241-AN-104	B0GL08T	PRIMARY_RESULT	0.722	0.722	0.722	0.722	0.722	0.722	0.722	n/a	0.722	1745	1.59
241-AN-105	B0GLJ5T	PRIMARY_RESULT	1.223	1.223	1.223	1.223	1.223	1.223	1.223	n/a	1.223	1918	1.57
241-AN-107	B0GPK3T	PRIMARY_RESULT	0.045	0.045	0.045	0.045	0.045	0.045	0.045	n/a	0.045	909	1.48
241-AN-107	B0GPK5T	PRIMARY_RESULT	0.045	0.045	0.045	0.045	0.045	0.045	0.045	n/a	0.045	909	1.48
241-AN-107	B0GPK7T	PRIMARY_RESULT	0.045	0.045	0.045	0.045	0.045	0.045	0.045	n/a	0.045	909	1.48
241-AP-105	B0HLY0T	PRIMARY_RESULT	0.294	0.865	0.796	0.450	0.225	0.225	0.294	n/a	0.865	387	1.61
241-AW-101	B0GQF1T	PRIMARY_RESULT	1.216	1.216	1.216	1.216	1.216	1.216	1.216	n/a	1.216	1403	1.59
241-AW-101	B0GQF2T	PRIMARY_RESULT	2.597	2.597	2.597	2.597	2.597	2.597	2.597	n/a	2.597	1403	1.59
241-AW-101	B0GQF3T	PRIMARY_RESULT	1.162	1.162	1.162	1.162	1.162	1.162	1.162	n/a	1.162	1403	1.59
241-AW-102	B0HYG6T	PRIMARY_RESULT	0.140	0.043	0.760	0.140	0.044	0.026	0.190	n/a	0.760	168	1.60
241-AW-104	B0HHV6T	PRIMARY_RESULT	0.242	0.712	0.655	0.370	0.185	0.185	0.242	0.185	0.712	451	1.60
241-AW-106	B0GFX9T	PRIM/DUPL_RESULT	0.012	0.025	0.012	0.012	0.012	0.012	0.012	n/a	0.025	997	1.77
241-AX-101	B0HP27T	PRIMARY_RESULT	0.132	0.806	0.742	0.419	0.043	0.025	0.182	n/a	0.806	1026	1.68
241-AX-101	B0HP29T	PRIMARY_RESULT	0.130	0.794	0.730	0.413	0.042	0.025	0.179	n/a	0.794	1026	1.68
241-AX-102	B0HRW2T	PRIMARY_RESULT	0.061	0.376	0.346	0.195	0.020	**0.189**	0.085	n/a	**0.189**	90	1.58
241-AX-103	B0HWD5T	PRIMARY_RESULT	0.059	0.019	0.330	0.060	0.019	0.012	0.081	n/a	0.012	276	1.61
241-AX-103	B0HWD8T	PRIMARY_RESULT	0.061	0.020	0.350	0.063	0.020	0.029	0.085	n/a	0.029	276	1.61
241-B-101	B0HWF6T	PRIMARY_RESULT	0.042	0.013	0.240	0.043	0.014	0.014	0.058	n/a	0.014	327	1.54

Saltcake Results (dry weight, µg/g)

Tank Name	Sample Number	Result Type	Aroclor 1016, CAS# 12674-11-2	Aroclor 1221, CAS# 11104-28-2	Aroclor 1232, CAS# 11141-16-5	Aroclor 1242, CAS# 53469-21-9	Aroclor 1248, CAS# 12672-29-6	Aroclor 1254, CAS# 11097-69-1	Aroclor 1260, CAS# 11096-82-5	Aroclor 1262, CAS# 37324-23-5	Total PCBs CAS# 1336-36-6	Total Tank Waste Phase (kL)	Ave. Density (g/mL)
241-B-101	B0HWF9T	PRIMARY_RESULT	0.039	0.012	0.220	0.040	0.013	0.022	0.054	n/a	0.022	327	1.54
241-B-104	B19BY4T	PRIMARY_RESULT	0.097	0.031	0.550	0.099	0.031	0.066	0.130	n/a	0.066	1346	1.59
241-B-104	B19BY7T	PRIMARY_RESULT	0.100	0.032	0.560	0.100	0.032	0.019	0.140	n/a	0.560	1346	1.59
241-B-107	B19C17T	PRIMARY_RESULT	0.061	0.019	0.340	0.062	0.020	0.035	0.084	n/a	0.035	209	1.70
241-B-108	B19C24T	PRIMARY_RESULT	0.063	0.020	0.350	0.064	0.020	0.012	0.087	n/a	0.350	272	1.75
241-B-108	B19C27T	PRIMARY_RESULT	0.062	0.020	0.350	0.063	0.020	0.072	0.086	n/a	0.072	272	1.75
241-BX-110	B19C68T	PRIMARY_RESULT	0.057	0.018	0.320	0.059	0.019	0.068	0.079	n/a	0.068	656	1.72
241-BX-110	B19C71T	PRIMARY_RESULT	0.037	0.012	0.210	0.038	0.012	0.047	0.052	n/a	0.047	656	1.72
241-BX-111	B19C82T	PRIMARY_RESULT	0.041	0.013	0.230	0.042	0.013	0.030	0.057	n/a	0.030	271	1.45
241-BX-111	B19C85T	PRIMARY_RESULT	0.048	0.015	0.270	0.049	0.015	0.090	0.066	n/a	0.090	271	1.45
241-BY-102	B0HWG9T	PRIMARY_RESULT	0.046	0.015	0.260	0.047	0.015	**0.400**	0.064	n/a	**0.400**	1052	1.53
241-BY-102	B0HWH1T	PRIMARY_RESULT	0.045	0.014	0.250	0.046	0.015	**0.380**	0.062	n/a	**0.380**	1052	1.53
241-BY-103	B0HWH8T	PRIMARY_RESULT	0.093	0.030	0.520	0.095	0.030	**0.590**	0.130	n/a	**0.590**	1229	1.72
241-BY-103	B0HWJ1T	PRIMARY_RESULT	0.043	0.014	0.240	0.044	0.014	**0.120**	0.060	n/a	**0.120**	1229	1.72
241-BY-103	B0HWJ7T	PRIMARY_RESULT	0.110	0.033	0.590	0.110	0.034	0.020	0.150	n/a	0.590	1229	1.72
241-BY-104	B0HP59T	PRIMARY_RESULT	0.085	0.521	0.479	0.271	0.028	0.016	0.117	n/a	0.521	1192	1.74
241-BY-104	B0HP60T	PRIMARY_RESULT	0.114	0.694	0.639	0.361	0.037	0.022	0.157	n/a	0.694	1030	1.75
241-BY-105	B0HJS3T	PRIMARY_RESULT	0.177	0.521	0.479	0.271	0.135	**0.132**	0.177	0.135	**0.132**	1293	1.85
241-BY-105	B0HJS5T	PRIMARY_RESULT	0.172	0.505	0.464	0.262	0.131	**0.031**	0.172	0.131	**0.031**	1293	1.85
241-BY-106	B0HJX0T	PRIM/DUPL_RESULT	0.307	0.904	0.832	0.470	0.235	0.235	0.307	n/a	0.904	1147	1.68
241-BY-106	B0HJX2T	PRIMARY_RESULT	0.233	0.684	0.630	0.356	0.178	**0.091**	0.233	0.178	**0.091**	1147	1.68
241-BY-107	B0HWN9T	PRIMARY_RESULT	0.060	0.019	0.340	0.061	0.020	**0.088**	0.083	n/a	**0.088**	799	1.72
241-BY-107	B0HWP2T	PRIMARY_RESULT	0.068	0.021	0.380	0.069	0.022	**0.089**	0.093	n/a	**0.089**	799	1.72
241-BY-108	B0HWN0T	PRIMARY_RESULT	0.180	0.056	1.000	0.180	0.058	**11.0**	0.240	n/a	**11.00**	673	1.51
241-BY-109	B0HWR2T	PRIMARY_RESULT	0.140	0.044	0.790	0.140	0.045	**2.40**	0.190	n/a	**2.40**	693	1.71
241-BY-109	B0HWR3T	PRIM/DUPL_RESULT	0.200	0.063	1.100	0.200	0.065	**2.80**	0.275	n/a	**2.80**	779	1.74
241-BY-110	B0HWS2T	PRIMARY_RESULT	0.048	0.015	0.270	0.049	**0.120**	**0.100**	0.066	n/a	**0.22**	1183	1.58
241-BY-110	B0HWS5T	PRIMARY_RESULT	0.058	0.018	0.330	0.059	0.019	0.011	0.080	n/a	0.330	1183	1.58
241-BY-111	B19CB2T	PRIMARY_RESULT	0.046	0.015	0.260	0.047	0.015	0.056	0.063	n/a	0.056	1146	1.70

Saltcake Results (dry weight, µg/g)

Tank Name	Sample Number	Result Type	Aroclor 1016, CAS# 12674-11-2	Aroclor 1221, CAS# 11104-28-2	Aroclor 1232, CAS# 11141-16-5	Aroclor 1242, CAS# 53469-21-9	Aroclor 1248, CAS# 12672-29-6	Aroclor 1254, CAS# 11097-69-1	Aroclor 1260, CAS# 11096-82-5	Aroclor 1262, CAS# 37324-23-5	Total PCBs CAS# 1336-36-6	Total Tank Waste Phase (kL)	Ave. Density (g/mL)
241-BY-111	B19CB5T	PRIMARY_RESULT	0.048	0.015	0.270	0.049	0.016	**0.540**	0.067	n/a	**0.540**	1146	1.70
241-BY-112	B0HP71T	PRIMARY_RESULT	0.105	0.641	0.590	0.333	0.034	0.020	0.145	n/a	0.641	820	1.76
241-BY-112	B0HP73T	PRIMARY_RESULT	0.097	0.595	0.548	0.310	0.032	**0.058**	0.134	n/a	**0.058**	820	1.76
241-S-101	B0HJZ3T	PRIMARY_RESULT	0.189	0.556	0.511	0.289	0.144	0.144	0.189	0.144	0.556	334	1.56
241-S-102	B0HK14T	PRIMARY_RESULT	0.118	0.347	0.319	0.181	0.090	0.090	0.118	0.090	0.347	219	1.69
241-S-102	B0HK17T	PRIMARY_RESULT	0.134	0.394	0.362	0.205	0.102	0.102	0.134	0.102	0.394	219	1.69
241-S-104	B19CC2T	PRIMARY_RESULT	0.041	0.013	0.230	0.042	0.013	0.008	0.056	n/a	0.230	934	1.72
241-S-104	B19CC4T	PRIMARY_RESULT	0.041	0.013	0.230	0.042	0.013	0.008	0.057	n/a	0.230	934	1.72
241-S-105	B0HKP9T	PRIMARY_RESULT	0.175	0.516	0.475	0.268	0.134	0.134	0.175	0.134	0.516	1283	1.68
241-S-105	B0HKQ3T	PRIMARY_RESULT	0.174	0.512	0.471	0.266	0.133	0.133	0.174	0.133	0.512	1283	1.68
241-S-109	B0HJV4T	PRIMARY_RESULT	0.298	0.877	0.807	0.456	0.228	0.228	0.298	0.228	0.877	1688	1.66
241-S-109	B0HJV6T	PRIMARY_RESULT	0.190	0.559	0.515	0.291	0.145	0.145	0.190	0.145	0.559	1688	1.66
241-S-110	B19CC8T	PRIMARY_RESULT	0.042	0.013	0.240	0.043	0.014	0.008	0.058	n/a	0.240	1322	1.68
241-S-110	B19CD0T	PRIMARY_RESULT	0.043	0.014	0.240	0.044	0.014	0.008	0.060	n/a	0.240	1322	1.68
241-S-111	B0HK70T	PRIMARY_RESULT	0.117	0.345	0.317	0.179	0.090	0.090	0.117	0.090	0.345	857	1.53
241-S-112	B0HJC5T	PRIMARY_RESULT	0.069	0.204	0.188	0.106	0.053	0.053	0.069	0.053	0.204	10	1.90
241-S-112	B0HJD2T	PRIMARY_RESULT	0.109	0.321	0.295	0.167	0.083	0.083	0.109	0.083	0.321	10	1.90
241-SX-101	B0HP85T	PRIMARY_RESULT	0.114	0.694	0.639	0.361	0.037	0.022	0.157	n/a	0.694	1443	1.69
241-SX-101	B0HP87T	PRIMARY_RESULT	0.095	0.581	0.535	0.302	0.031	0.018	0.131	n/a	0.581	1443	1.69
241-SX-102	B0HPH7T	PRIMARY_RESULT	0.120	0.735	0.676	0.382	0.039	0.023	0.166	n/a	0.735	1186	1.72
241-SX-102	B0HPH9T	PRIMARY_RESULT	0.122	0.746	0.687	0.388	0.040	0.023	0.168	n/a	0.746	1186	1.72
241-SX-103	B0HPF2T	PRIMARY_RESULT	0.111	0.676	0.622	0.351	0.036	0.021	0.152	n/a	0.676	1533	1.72
241-SX-103	B0HPF4T	PRIMARY_RESULT	0.115	0.704	0.648	0.366	0.037	0.022	0.159	n/a	0.704	1533	1.72
241-SX-105	B0HPK9T	PRIMARY_RESULT	0.071	0.435	0.400	0.226	0.023	0.014	0.098	n/a	0.435	1188	1.65
241-SX-105	B0HPL1T	PRIMARY_RESULT	0.117	0.714	0.657	0.371	0.038	0.022	0.161	n/a	0.714	1188	1.65
241-SX-106	B19CH2T	PRIMARY_RESULT	0.058	0.018	0.320	0.059	0.019	0.011	0.079	n/a	0.320	206	1.66
241-SX-106	B19CH5T	PRIMARY_RESULT	0.055	0.017	0.310	0.056	0.018	0.010	0.076	n/a	0.310	206	1.66
241-SY-101	B0HK90T	PRIMARY_RESULT	0.358	1.053	0.969	0.547	0.274	0.274	0.358	0.274	1.053	773	1.66
241-SY-103	B0HPM1T	PRIMARY_RESULT	0.130	0.794	0.730	0.413	0.042	0.025	0.179	n/a	0.794	1258	1.67
241-SY-103	B0HPM3T	PRIMARY_RESULT	0.122	0.746	0.687	0.388	0.040	0.023	0.168	n/a	0.746	1258	1.67
241-SY-103	B0L3V5T	PRIM/DUPL_RESULT	0.048	0.015	0.084	0.049	0.016	**0.015**	0.067	n/a	**0.015**	1258	1.67

Saltcake Results (dry weight, µg/g)

Tank Name	Sample Number	Result Type	Aroclor 1016, CAS# 12674-11-2	Aroclor 1221, CAS# 11104-28-2	Aroclor 1232, CAS# 11141-16-5	Aroclor 1242, CAS# 53469-21-9	Aroclor 1248, CAS# 12672-29-6	Aroclor 1254, CAS# 11097-69-1	Aroclor 1260, CAS# 11096-82-5	Aroclor 1262, CAS# 37324-23-5	Total PCBs CAS# 1336-36-6	Total Tank Waste Phase (kL)	Ave. Density (g/mL)
241-SY-103	B0L3X5T	PRIMARY_RESULT	0.047	0.015	0.081	0.048	0.015	0.009	0.064	n/a	0.081	1258	1.67
241-SY-103	B0L3Z8T	PRIMARY_RESULT	0.052	0.017	0.092	0.053	0.017	0.010	0.072	n/a	0.092	1258	1.67
241-SY-103	B0L414T	PRIMARY_RESULT	0.080	0.025	0.139	0.082	0.026	0.015	0.110	n/a	0.139	1258	1.67
241-SY-103	B0L431T	PRIMARY_RESULT	0.094	0.030	0.164	0.096	0.031	0.018	0.130	n/a	0.164	1258	1.67
241-SY-103	B0L449T	PRIMARY_RESULT	0.052	0.016	0.090	0.053	0.017	0.010	0.072	n/a	0.090	1258	1.67
241-SY-103	B0L465T	PRIMARY_RESULT	0.043	0.014	0.075	0.044	0.014	0.008	0.060	n/a	0.075	1258	1.67
241-T-108	B19CL2T	PRIMARY_RESULT	0.051	0.016	0.290	0.053	0.017	**0.380**	0.071	n/a	**0.380**	23	1.72
241-T-108	B19CL4T	PRIMARY_RESULT	0.068	0.021	0.380	0.069	0.022	**1.80**	0.093	n/a	**1.80**	23	1.72
241-TX-104	B19CL9T	PRIMARY_RESULT	1.400	0.460	8.100	1.500	0.470	**17.0**	2.000	n/a	**17.0**	217	1.77
241-TX-104	B19CM1T	PRIMARY_RESULT	1.200	0.390	7.000	1.300	0.400	**14.0**	1.700	n/a	**14.0**	217	1.77
241-TX-113	B19CM9T	PRIMARY_RESULT	0.043	0.014	0.240	0.044	0.014	**0.270**	0.060	n/a	**0.270**	1715	1.64
241-TX-113	B19CN2T	PRIMARY_RESULT	0.041	0.013	0.230	0.042	0.013	**0.150**	0.057	n/a	**0.150**	1715	1.64
241-TX-116	B19CP3T	PRIMARY_RESULT	0.051	0.016	0.290	0.052	0.017	**1.000**	0.070	n/a	**1.000**	1499	1.68
241-TX-118	B0GMN5T	PRIM/DUPL_RESULT	1.460	2.920	1.460	1.460	1.460	1.460	1.460	n/a	2.920	611	1.66
241-U-102	B0HPN3T	PRIMARY_RESULT	0.066	0.407	0.374	0.211	0.022	0.013	0.092	n/a	0.407	875	1.68
241-U-102	B0HPN5T	PRIMARY_RESULT	0.087	0.532	0.489	0.277	0.028	0.017	0.120	n/a	0.532	875	1.68
241-U-103	B19CP7T	PRIMARY_RESULT	0.048	0.015	0.084	0.049	0.016	0.009	0.067	n/a	0.084	1121	1.72
241-U-103	B19CQ0T	PRIMARY_RESULT	0.051	0.016	0.089	0.052	0.017	0.010	0.070	n/a	0.089	1163	1.73
241-U-105	B19CR3T	PRIMARY_RESULT	0.052	0.016	0.090	0.053	0.017	0.010	0.071	n/a	0.090	964	1.70
241-U-105	B19CR6T	PRIMARY_RESULT	0.054	0.017	0.095	0.056	0.018	0.010	0.075	n/a	0.095	1085	1.70
241-U-106	B19CT9T	PRIMARY_RESULT	0.071	0.023	0.120	0.073	0.023	0.014	0.098	n/a	0.120	470	1.62
241-U-108	B0HPQ5T	PRIMARY_RESULT	0.078	0.476	0.438	0.248	0.025	0.015	0.107	n/a	0.476	1148	1.73
241-U-108	B0HPQ7T	PRIMARY_RESULT	0.061	0.370	0.341	0.193	0.020	0.012	0.084	n/a	0.370	1148	1.73
241-U-109	B0HPT1T	PRIMARY_RESULT	0.134	0.820	0.754	0.426	0.044	0.025	0.185	n/a	0.820	963	1.67
241-U-109	B0HPT3T	PRIMARY_RESULT	0.051	0.314	0.289	0.164	0.017	0.010	0.071	n/a	0.314	867	1.67

Sludge Results (dry weight, µg/g)

Tank Name	Sample Number	Result Type	Aroclor 1016, CAS# 12674-11-2	Aroclor 1221, CAS# 11104-28-2	Aroclor 1232, CAS# 11141-16-5	Aroclor 1242, CAS# 53469-21-9	Aroclor 1248, CAS# 12672-29-6	Aroclor 1254, CAS# 11097-69-1	Aroclor 1260, CAS# 11096-82-5	Aroclor 1262, CAS# 37324-23-5	Total PCBs CAS# 1336-36-6	Total Tank Waste Phase (kL)	Ave. Density (g/mL)
241-AW-104	B0HHV5T	PRIMARY_RESULT	0.34	1.00	0.92	0.52	0.26	n/a	0.34	0.26	1.00	255	1.28
241-AW-105	B0HJM3T	PRIMARY_RESULT	0.42	1.22	1.13	0.64	0.32	**2.55**	0.42	0.32	**2.55**	937	1.34
241-AW-105	B0HJM5T	PRIMARY_RESULT	0.49	1.43	1.31	0.74	0.37	**0.44**	0.49	0.37	**0.44**	937	1.34
241-AY-101	B0HD24T	PRIMARY_RESULT	0.33	0.97	0.89	0.51	0.25	**0.28**	0.33	0.25	**0.28**	337	1.87
241-AY-101	B0HD25T	PRIMARY_RESULT	0.39	1.13	1.04	0.59	0.29	0.29	0.39	0.29	1.13	337	1.87
241-AY-101	B0K2K5T	PRIMARY_RESULT	0.07	0.01	0.02	0.05	0.03	0.02	0.03	n/a	0.07	337	1.87
241-AY-102	B0GFT1T	PRIM/DUPL_RESULT	0.103	0.210	0.103	0.103	0.103	0.012	0.103	n/a	0.21	43	1.76
241-AY-102	B0HQT3T	PRIMARY_RESULT	1.79	5.26	4.84	2.74	1.37	1.37	1.79	1.37	5.26	43	1.76
241-AY-102	B0HQT4T	PRIMARY_RESULT	1.87	5.50	5.06	2.86	1.43	1.43	1.87	1.43	5.50	43	1.76
241-AZ-101	B0HKG1T	PRIMARY_RESULT	0.20	0.59	0.55	0.31	0.15	0.15	0.20	0.15	0.59	197	1.59
241-AZ-102	B0HK99T	PRIMARY_RESULT	0.25	0.74	0.68	0.38	0.19	0.19	0.25	0.19	0.74	393	1.41
241-AZ-102	B0HKB1T	PRIMARY_RESULT	0.22	0.64	0.59	0.33	0.17	0.17	0.22	0.17	0.64	393	1.41
241-B-106	B19C02T	PRIMARY_RESULT	0.11	0.03	0.61	0.11	0.04	**0.61**	0.15	n/a	**0.61**	439	1.39
241-B-106	B19C05T	PRIMARY_RESULT	0.11	0.03	0.60	0.11	0.04	0.14	0.15	n/a	0.14	439	1.39
241-B-107	B19C14T	PRIMARY_RESULT	0.09	0.03	0.51	0.09	0.03	**0.27**	0.13	n/a	**0.27**	318	1.66
241-B-109	B19C34T	PRIMARY_RESULT	0.52	0.16	2.90	0.53	0.17	**6.00**	0.71	n/a	**6.00**	189	1.85
241-BX-103	B19C38T	PRIMARY_RESULT	0.05	0.02	0.30	0.06	0.09	0.09	0.08	n/a	0.18	235	1.50
241-BX-103	B19C41T	PRIMARY_RESULT	0.23	0.07	1.30	0.24	**18.00**	**19.00**	0.32	n/a	**37.00**	235	1.50
241-BX-105	B19C50T	PRIMARY_RESULT	0.04	0.01	0.24	0.04	0.01	0.07	0.06	n/a	**0.07**	160	1.73
241-BX-109	B19C54T	PRIMARY_RESULT	0.54	0.17	3.00	0.55	**2.60**	**7.70**	0.75	n/a	**10.30**	714	1.52
241-BX-109	B19C57T	PRIMARY_RESULT	0.08	0.03	0.44	0.08	0.03	0.03	0.11	n/a	0.03	714	1.52
241-BX-112	B19C94T	PRIMARY_RESULT	0.13	0.04	0.76	0.14	0.04	0.03	0.19	n/a	0.76	737	1.50
241-BX-112	B19C97T	PRIMARY_RESULT	0.11	0.04	0.63	0.11	0.04	**0.72**	0.15	n/a	**0.72**	737	1.50
241-BY-108	B0HWM9T	PRIMARY_RESULT	0.03	0.01	0.18	0.03	0.01	0.01	0.04	n/a	0.18	167	1.53
241-C-101	B0HWV1T	PRIMARY_RESULT	0.04	0.01	0.25	0.05	0.01	**0.32**	0.06	n/a	**0.32**	21	1.38
241-C-101	B0HWV2T	PRIMARY_RESULT	0.08	0.03	0.44	0.08	0.03	**0.37**	0.11	n/a	**0.37**	21	1.38
241-C-101	B0KPD4T	PRIMARY_RESULT	0.08	0.01	0.02	0.05	0.03	0.02	0.03	n/a	0.08	21	1.38
241-C-101	B0KPH1T	PRIM/DUPL_RESULT	0.077	0.013	0.022	0.051	0.029	**0.087**	0.030	n/a	**0.087**	21	1.38
241-C-101	B0KPJ8T	PRIMARY_RESULT	0.08	0.01	0.02	0.05	0.03	0.02	0.03	n/a	0.02	21	1.38

Sludge Results (dry weight, µg/g)

Tank Name	Sample Number	Result Type	Aroclor 1016, CAS# 12674-11-2	Aroclor 1221, CAS# 11104-28-2	Aroclor 1232, CAS# 11141-16-5	Aroclor 1242, CAS# 53469-21-9	Aroclor 1248, CAS# 12672-29-6	Aroclor 1254, CAS# 11097-69-1	Aroclor 1260, CAS# 11096-82-5	Aroclor 1262, CAS# 37324-23-5	Total PCBs CAS# 1336-36-6	Total Tank Waste Phase (kL)	Ave. Density (g/mL)
241-C-101	B0KPL3T	PRIMARY_RESULT	0.09	0.02	0.03	0.06	0.04	0.02	0.04	n/a	0.02	21	1.38
241-C-101	B0KPM2T	PRIMARY_RESULT	0.09	0.01	0.03	0.06	0.03	0.04	0.04	n/a	0.04	21	1.38
241-C-102	B0HWY9T	PRIMARY_RESULT	0.04	0.01	0.24	0.04	0.01	0.01	0.06	n/a	0.24	59	1.60
241-C-102	B0HWZ2T	PRIMARY_RESULT	0.04	0.01	0.25	0.05	0.01	0.01	0.06	n/a	0.25	59	1.60
241-C-102	B0L0P1T	PRIM/DUPL_RESULT	0.021	0.013	0.027	0.009	0.006	0.004	0.008	n/a	0.03	59	1.60
241-C-102	B0L0P2T	PRIMARY_RESULT	0.02	0.01	0.03	0.01	0.01	0.02	0.01	n/a	0.02	59	1.60
241-C-102	B0L0P3T	PRIMARY_RESULT	0.03	0.02	0.03	0.01	0.01	0.03	0.01	n/a	0.03	59	1.60
241-C-102	B0L0P4T	PRIMARY_RESULT	0.02	0.01	0.03	0.01	0.01	0.04	0.01	n/a	0.04	59	1.60
241-C-103	B0HL26T	PRIMARY_RESULT	0.83	2.45	2.25	1.27	0.64	**6.45**	0.83	n/a	**6.45**	8.6	1.61
241-C-103	B0HL28T	PRIMARY_RESULT	0.77	2.25	2.07	1.17	0.59	**6.94**	0.77	n/a	**6.94**	8.6	1.61
241-C-103	B0K0C7T	PRIM/DUPL_RESULT	0.041	0.013	0.231	0.042	0.013	0.008	0.057	n/a	0.23	8.6	1.61
241-C-103	B0K0F0T	PRIMARY_RESULT	0.04	0.01	0.23	0.04	0.01	0.01	0.06	n/a	0.23	8.6	1.61
241-C-103	B0K0H3T	PRIMARY_RESULT	0.05	0.01	0.26	0.05	0.02	0.01	0.06	n/a	0.26	8.6	1.61
241-C-104	B0KKM5T	PRIM/DUPL_RESULT	0.094	0.015	0.026	0.063	0.035	n/a	0.037	n/a	0.09	6.9	1.58
241-C-104	B0KKP0T	PRIMARY_RESULT	0.06	0.01	0.02	0.04	0.02	n/a	0.02	n/a	0.06	6.9	1.58
241-C-104	B0KKQ5T	PRIMARY_RESULT	0.07	0.01	0.02	0.05	0.03	n/a	0.03	n/a	0.07	6.9	1.58
241-C-104	B0KKS0T	PRIMARY_RESULT	0.07	0.01	0.02	0.05	0.03	n/a	0.03	n/a	0.07	6.9	1.58
241-C-105	B0HWV6T	PRIMARY_RESULT	0.04	0.01	0.24	0.04	0.01	**0.06**	0.06	n/a	**0.06**	5.5	2.24
241-C-105	B0HWV9T	PRIMARY_RESULT	0.07	0.02	0.38	0.07	0.02	**0.11**	0.09	n/a	**0.11**	5.5	2.24
241-C-104	B0KKM5T	PRIM/DUPL_RESULT	0.100	0.032	0.570	0.100	0.033	0.019	0.140	n/a	0.57	10	1.56
241-C-106	B0HYV0T	PRIMARY_RESULT	0.11	0.03	0.60	0.11	0.03	0.02	0.15	n/a	0.60	10	1.56
241-C-106	B0HZB5T	PRIM/DUPL_RESULT	0.073	0.023	0.410	0.075	0.024	0.014	0.100	n/a	0.41	10	1.56
241-C-106	B0HZC8T	PRIMARY_RESULT	0.08	0.02	0.43	0.08	0.03	0.28	0.11	n/a	0.28	10	1.56
241-C-107	B0HH27T	PRIMARY_RESULT	3.18	9.36	8.61	4.87	2.43	2.43	3.18	2.43	9.36	39	1.69
241-C-107	B0HH32T	PRIMARY_RESULT	3.92	11.53	10.61	6.00	3.00	**7.14**	3.92	3.00	**7.14**	39	1.69
241-C-107	B0KNR5T	PRIMARY_RESULT	0.05	0.01	0.01	0.03	0.02	0.01	0.02	n/a	0.05	39	1.69
241-C-107	B0KNS2T	PRIMARY_RESULT	0.05	0.01	0.01	0.03	0.02	0.03	0.02	n/a	0.03	39	1.69
241-C-107	B0KNV0T	PRIM/DUPL_RESULT	0.043	0.007	0.012	0.029	0.016	0.010	0.017	n/a	0.04	39	1.69
241-C-108	B0HWW9T	PRIMARY_RESULT	0.04	0.01	0.24	0.04	0.01	0.01	0.06	n/a	0.24	12	2.09
241-C-108	B0HWX0T	PRIMARY_RESULT	0.06	0.02	0.36	0.07	0.02	0.05	0.09	n/a	0.05	12	2.09

Sludge Results (dry weight, µg/g)

Tank Name	Sample Number	Result Type	Aroclor 1016, CAS# 12674-11-2	Aroclor 1221, CAS# 11104-28-2	Aroclor 1232, CAS# 11141-16-5	Aroclor 1242, CAS# 53469-21-9	Aroclor 1248, CAS# 12672-29-6	Aroclor 1254, CAS# 11097-69-1	Aroclor 1260, CAS# 11096-82-5	Aroclor 1262, CAS# 37324-23-5	Total PCBs CAS# 1336-36-6	Total Tank Waste Phase (kL)	Ave. Density (g/mL)
241-C-108	B0K7S3T	PRIMARY_RESULT	0.16	0.03	0.04	0.11	0.06	0.04	0.06	n/a	0.16	12	2.09
241-C-108	B0K7S4T	PRIMARY_RESULT	0.13	0.02	0.04	0.09	0.05	0.03	0.05	n/a	0.13	12	2.09
241-C-108	B0K7V0T	PRIM/DUPL_RESULT	0.152	0.025	0.043	0.101	0.057	0.198	0.059	n/a	0.20	12	2.09
241-C-108	B0KJ29T	PRIMARY_RESULT	0.10	0.02	0.03	0.07	0.04	**0.42**	0.04	n/a	**0.42**	12	2.09
241-C-108	B0KJ35T	PRIMARY_RESULT	0.10	0.02	0.03	0.07	0.04	**0.26**	0.04	n/a	**0.26**	12	2.09
241-C-108	B0KJ49T	PRIM/DUPL_RESULT	0.101	0.017	0.028	0.067	0.038	0.15	0.039	n/a	0.15	12	2.09
241-C-109	B0KCK5T	PRIM/DUPL_RESULT	0.132	0.022	0.037	0.088	0.050	0.03	0.052	n/a	0.13	7.2	1.74
241-C-109	B0KL38T	PRIM/DUPL_RESULT	0.050	0.008	0.014	0.033	0.019	0.01	0.020	n/a	0.05	7.2	1.74
241-C-109	B0KL56T	PRIMARY_RESULT	0.06	0.01	0.02	0.04	0.02	0.01	0.02	n/a	0.06	7.2	1.74
241-C-109	B0KL74T	PRIMARY_RESULT	0.06	0.01	0.02	0.04	0.02	0.02	0.02	n/a	0.06	7.2	1.74
241-C-110	B0KBV1T	PRIM/DUPL_RESULT	0.208	0.034	0.058	0.139	0.079	0.05	0.082	n/a	0.21	7.5	1.24
241-C-110	B0KM20T	PRIM/DUPL_RESULT	0.059	0.010	0.017	0.040	0.022	0.03	0.023	n/a	0.03	7.5	1.24
241-C-110	B0KM35T	PRIMARY_RESULT	0.06	0.01	0.02	0.04	0.02	0.02	0.03	n/a	0.06	7.5	1.24
241-C-110	B0KM50T	PRIMARY_RESULT	0.07	0.01	0.02	0.05	0.03	0.02	0.03	n/a	0.07	7.5	1.24
241-C-110	B0KM65T	PRIMARY_RESULT	0.06	0.01	0.02	0.04	0.02	0.03	0.02	n/a	0.03	7.5	1.24
241-C-111	B0HWX7T	PRIMARY_RESULT	0.10	0.03	0.54	0.10	0.03	**0.17**	0.13	n/a	**0.17**	19	1.40
241-C-111	B0HWX8T	PRIMARY_RESULT	0.14	0.04	0.77	0.14	0.05	**37.00**	0.19	n/a	**37.00**	19	1.40
241-C-111	B0L235T	PRIM/DUPL_RESULT	0.110	0.069	0.145	0.050	0.034	0.02	0.044	n/a	0.14	19	1.40
241-C-111	B0L251T	PRIMARY_RESULT	0.11	0.07	0.14	0.05	0.03	0.02	0.04	n/a	0.14	19	1.40
241-C-111	B0L267T	PRIMARY_RESULT	0.10	0.06	0.13	0.05	0.03	0.02	0.04	n/a	0.13	19	1.40
241-C-111	B0L281T	PRIMARY_RESULT	0.08	0.05	0.11	0.04	0.02	0.02	0.03	n/a	0.11	19	1.40
241-C-112	B0KP62T	PRIM/DUPL_RESULT	0.046	0.008	0.013	0.031	0.017	0.01	0.018	n/a	0.05	38	1.84
241-C-112	B0KP88T	PRIM/DUPL_RESULT	0.069	0.011	0.019	0.046	0.026	**0.08**	0.027	n/a	**0.08**	38	1.84
241-C-201	B0HR40T	PRIMARY_RESULT	0.04	0.27	0.25	0.14	0.01	0.01	0.06	n/a	0.27	0.54	1.75
241-C-201	B19B92T	PRIM/DUPL_RESULT	0.045	0.015	0.255	0.046	0.015	**0.10**	0.062	n/a	**0.10**	0.54	1.75
241-C-202	B0HR30T	PRIMARY_RESULT	0.04	0.24	0.22	0.13	0.01	0.01	0.06	n/a	0.24	0.55	1.75
241-C-202	B0HZP9T	PRIMARY_RESULT	0.10	0.03	0.55	0.10	0.03	0.02	0.13	n/a	0.55	0.55	1.75
241-C-202	B0HZQ5T	PRIM/DUPL_RESULT	0.103	0.033	0.580	0.104	0.034	0.02	0.140	n/a	0.58	0.55	1.75
241-C-202	B19GL5T	PRIM/DUPL_RESULT	0.205	0.064	1.150	0.205	0.066	0.04	0.280	n/a	1.15	0.55	1.75
241-C-202	B19GL6T	PRIMARY_RESULT	0.21	0.07	1.20	0.21	0.07	0.04	0.29	n/a	1.20	0.55	1.75

Sludge Results (dry weight, µg/g)

Tank Name	Sample Number	Result Type	Aroclor 1016, CAS# 12674-11-2	Aroclor 1221, CAS# 11104-28-2	Aroclor 1232, CAS# 11141-16-5	Aroclor 1242, CAS# 53469-21-9	Aroclor 1248, CAS# 12672-29-6	Aroclor 1254, CAS# 11097-69-1	Aroclor 1260, CAS# 11096-82-5	Aroclor 1262, CAS# 37324-23-5	Total PCBs CAS# 1336-36-6	Total Tank Waste Phase (kL)	Ave. Density (g/mL)
241-C-203	B0HQS2T	PRIMARY_RESULT	0.05	0.28	0.26	0.15	0.01	**0.58**	0.06	n/a	**0.58**	0.48	1.93
241-C-203	B0HZV8T	PRIM/DUPL_RESULT	0.077	0.025	0.430	0.078	0.025	**0.40**	0.105	n/a	**0.40**	0.48	1.93
241-C-203	B0HZW3T	PRIM/DUPL_RESULT	0.250	0.080	1.400	0.255	0.082	**0.58**	0.345	n/a	**0.58**	0.48	1.93
241-C-203	B19FK5T	PRIM/DUPL_RESULT	0.099	0.014	0.024	0.055	0.032	0.20	0.033	n/a	0.20	0.48	1.93
241-C-203	B19FL3T	PRIMARY_RESULT	0.10	0.01	0.02	0.05	0.03	0.19	0.03	n/a	0.19	0.48	1.93
241-C-204	B0K161T	PRIM/DUPL_RESULT	0.108	0.015	0.025	0.060	0.034	0.21	0.035	n/a	0.21	0.51	1.77
241-C-204	B0K162T	PRIMARY_RESULT	0.10	0.01	0.02	0.05	0.03	0.19	0.03	n/a	0.19	0.51	1.77
241-C-204	B19BD6T	PRIMARY_RESULT	0.41	0.13	2.30	0.42	0.13	0.08	0.56	n/a	2.30	0.51	1.77
241-C-204	B19BF1T	PRIM/DUPL_RESULT	0.440	0.140	2.500	0.450	0.140	0.08	0.605	n/a	2.50	0.51	1.77
241-S-101	B0HJZ6T	PRIMARY_RESULT	0.15	0.44	0.40	0.23	0.11	0.11	0.15	0.11	0.44	890	1.70
241-S-107	B0HK41T	PRIMARY_RESULT	0.18	0.54	0.50	0.28	0.14	0.14	0.18	0.14	0.54	1242	1.80
241-S-107	B0HK44T	PRIMARY_RESULT	0.22	0.63	0.58	0.33	0.16	0.16	0.22	0.16	0.63	1242	1.80
241-S-111	B0HK67T	PRIMARY_RESULT	0.23	0.68	0.63	0.36	0.18	0.18	0.23	0.18	0.68	230	1.67
241-S-112	B0K3K1T	PRIM/DUPL_RESULT	0.068	0.011	0.019	0.045	0.026	0.02	0.027	n/a	0.07	9.63	1.90
241-S-112	B0K3L3T	PRIMARY_RESULT	0.06	0.01	0.02	0.04	0.02	0.01	0.02	n/a	0.06	10	1.90
241-SX-108	B19CF7T	PRIMARY_RESULT	0.04	0.01	0.22	0.04	0.01	0.01	0.05	n/a	0.22	249	1.77
241-SX-113	B19CG0T	PRIMARY_RESULT	0.04	0.01	0.23	0.04	0.01	0.04	0.06	n/a	0.04	82	1.16
241-SX-113	B19CG2T	PRIMARY_RESULT	0.04	0.01	0.24	0.04	0.01	0.01	0.06	n/a	0.24	82	1.16
241-SX-115	B19CG6T	PRIMARY_RESULT	0.04	0.01	0.24	0.04	0.01	**0.12**	0.06	n/a	**0.12**	15	1.77
241-SY-102	B0HGH3T	PRIMARY_RESULT	0.49	1.43	1.31	0.74	0.37	**4.19**	0.49	0.37	**4.19**	830	1.66
241-SY-102	B0HGH4T	PRIMARY_RESULT	0.48	1.42	1.31	0.74	0.37	**4.23**	0.48	0.37	**4.23**	830	1.66
241-SY-102	B0HGH5T	PRIMARY_RESULT	0.49	1.43	1.31	0.74	0.37	**1.00**	0.49	0.37	**1.00**	830	1.66
241-SY-102	B0HGH6T	PRIMARY_RESULT	0.48	1.41	1.30	0.74	0.37	**4.40**	0.48	0.37	**4.40**	830	1.66
241-SY-102	B0KRP5T	PRIM/DUPL_RESULT	0.095	0.030	0.165	0.097	0.031	0.02	0.131	n/a	0.17	830	1.66
241-SY-102	B0KRP6T	PRIMARY_RESULT	0.10	0.03	0.18	0.11	0.03	0.02	0.14	n/a	0.18	830	1.66
241-SY-102	B0KRT2T	PRIMARY_RESULT	0.11	0.03	0.18	0.11	0.03	0.04	0.15	n/a	0.04	830	1.66
241-SY-102	B0KRZ5T	PRIMARY_RESULT	0.09	0.03	0.15	0.09	0.03	0.02	0.12	n/a	0.15	830	1.66
241-SY-102	B0KS14T	PRIMARY_RESULT	0.09	0.03	0.16	0.09	0.03	0.02	0.13	n/a	0.16	830	1.66
241-SY-102	B0KS90T	PRIMARY_RESULT	0.13	0.04	0.22	0.13	0.04	0.02	0.18	n/a	0.22	830	1.66
241-SY-102	B0KS91T	PRIMARY_RESULT	0.11	0.03	0.19	0.11	0.03	0.02	0.15	n/a	0.19	830	1.66

Sludge Results (dry weight, µg/g)

Tank Name	Sample Number	Result Type	Aroclor 1016, CAS# 12674-11-2	Aroclor 1221, CAS# 11104-28-2	Aroclor 1232, CAS# 11141-16-5	Aroclor 1242, CAS# 53469-21-9	Aroclor 1248, CAS# 12672-29-6	Aroclor 1254, CAS# 11097-69-1	Aroclor 1260, CAS# 11096-82-5	Aroclor 1262, CAS# 37324-23-5	Total PCBs CAS# 1336-36-6	Total Tank Waste Phase (kL)	Ave. Density (g/mL)
241-SY-102	B0KSF7T	PRIMARY_RESULT	0.11	0.04	0.20	0.12	0.04	0.02	0.16	n/a	0.20	830	1.66
241-SY-102	B0KSJ8T	PRIMARY_RESULT	0.08	0.02	0.14	0.08	0.03	0.01	0.11	n/a	0.14	830	1.66
241-SY-102	B0KSP0T	PRIMARY_RESULT	0.14	0.04	0.24	0.14	0.04	0.04	0.19	n/a	0.04	830	1.66
241-SY-102	B0KSP1T	PRIM/DUPL_RESULT	0.106	0.034	0.185	0.108	0.034	**0.09**	0.146	n/a	**0.09**	830	1.66
241-SY-102	B0KSY9T	PRIM/DUPL_RESULT	0.151	0.048	0.263	0.154	0.049	0.03	0.208	n/a	0.26	830	1.66
241-SY-102	B0KT24T	PRIMARY_RESULT	0.15	0.05	0.26	0.15	0.05	**0.91**	0.21	n/a	**0.91**	830	1.66
241-SY-102	B0KT42T	PRIMARY_RESULT	0.05	0.02	0.09	0.05	0.02	**0.23**	0.07	n/a	**0.23**	830	1.66
241-T-105	B19CJ6T	PRIMARY_RESULT	0.10	0.03	0.58	0.11	0.03	**1.40**	0.14	n/a	**1.40**	347	1.38
241-T-105	B19CJ9T	PRIMARY_RESULT	38.00	12.00	220.00	39.00	13.00	**370.00**	53.00	n/a	**370**	347	1.38
241-T-106	B19CK5T	PRIMARY_RESULT	0.72	0.23	4.10	0.74	0.23	**11.00**	1.00	n/a	**11.00**	80	1.56
241-T-106	B19CK8T	PRIMARY_RESULT	4.60	1.40	26.00	4.70	1.50	**42.00**	6.30	n/a	**42.00**	80	1.56
241-TY-104	B0HWY3T	PRIM/DUPL_RESULT	0.052	0.017	0.290	0.053	0.017	**0.01**	0.072	n/a	**0.01**	155	1.65
241-TY-106	B0HMT8T	PRIMARY_RESULT	5.60	34.20	31.50	17.80	**38.33**	**62.63**	7.72	n/a	**101.0**	48	1.40
241-TY-106	B0HMT9T	PRIMARY_RESULT	0.06	0.34	0.31	0.18	**0.70**	**0.76**	0.08	n/a	**1.5**	48	1.40
241-U-112	B19CT1T	PRIMARY_RESULT	0.05	0.02	0.08	0.05	0.02	0.05	0.07	n/a	0.05	164	1.72
241-U-112	B19CT4T	PRIMARY_RESULT	2.60	0.81	4.50	2.60	0.83	**56.00**	3.50	n/a	**56.0**	164	1.72
241-U-201	B0HSB3T	PRIMARY_RESULT	0.05	0.32	0.29	0.17	0.02	**0.01**	0.07	n/a	**0.01**	15	1.63
241-U-201	B0HSC0T	PRIMARY_RESULT	0.05	0.30	0.27	0.16	0.02	0.01	0.07	n/a	0.30	15	1.63
241-U-201	B0HSC7T	PRIMARY_RESULT	0.04	0.27	0.24	0.14	0.01	0.01	0.06	n/a	0.27	15	1.63
241-U-202	B0HS53T	PRIMARY_RESULT	0.05	0.28	0.26	0.15	0.01	0.01	0.06	n/a	0.28	14	1.51
241-U-202	B0HS64T	PRIMARY_RESULT	0.04	0.25	0.23	0.13	0.01	0.01	0.06	n/a	0.25	14	1.51
241-U-202	B0HS71T	PRIMARY_RESULT	0.06	0.39	0.36	0.20	0.02	0.01	0.09	n/a	0.39	14	1.51
241-U-203	B0HSQ6T	PRIMARY_RESULT	0.22	1.37	1.26	0.71	0.07	0.04	0.31	n/a	1.37	9.0	1.59
241-U-203	B0HSR5T	PRIMARY_RESULT	0.24	1.50	1.38	0.78	0.08	0.05	0.34	n/a	1.50	9.0	1.59
241-U-203	B0HSR6T	PRIMARY_RESULT	0.19	1.17	1.08	0.61	0.06	0.04	0.26	n/a	1.17	9.0	1.59
241-U-204	B0HSV9T	PRIMARY_RESULT	0.07	0.46	0.42	0.24	**0.16**	**0.16**	0.10	n/a	**0.3**	7.0	1.47
241-U-204	B0HSW6T	PRIMARY_RESULT	0.04	0.24	0.22	0.13	0.01	**0.02**	0.05	n/a	**0.02**	7.0	1.47

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Appendix B

Air Dispersion Modeling

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Acronyms

COPC	constituents of potential concern
DWP	*Dangerous Waste Permit*, WA7890008967
EMF	Effluent Management Facility
EPA	US Environmental Protection Agency
HLW	high-level waste
LAW	low-activity waste
PT	Pretreatment
RAWP	*Risk Assessment Work Plan*
WTP	Hanford Tank Waste Treatment and Immobilization Plant

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Appendix B
Air Dispersion Modeling

The airborne vapor and particulate emissions from the Pretreatment (PT) Facility, low-activity waste (LAW) and high-level waste (HLW) vitrification processes, and the Effluent Management Facility (EMF) will be reduced by engineered air pollution control equipment, described in Sections 5.2.1.2, 5.2.2.2, 5.2.3.2, and 5.2.5.1 of Supplement 5, and Section 2.2 of Supplement 6 of the *Risk Assessment Work Plan* (RAWP) (*Dangerous Waste Permit*, WA7890008967 [DWP] Appendix 6.2.5). Once the treated emissions leave the facility stacks they will be dispersed by air currents and deposited on the surface of soil and vegetation around the Hanford Tank Waste Treatment and Immobilization Plant (WTP) and on the surface of the Columbia River. The CALPUFF modeling system[1] was used to model how the emitted chemicals and radionuclides would be dispersed. The rationale for selecting CALPUFF for air dispersion modeling is described in Supplement 5 of the RAWP (24590-WTP-RPT-ENV-08-001, *Hanford Tank Waste Treatment and Immobilization Plant Risk Assessment Air Quality Modeling Protocol*), Section 4. The general model description in Section 6 of the RAWP should be consulted for additional detail on model settings and input data.

B.1 General Description and Model Rationale for the CALPUFF Model

CALPUFF is a multi-layer, multi-species non-steady-state puff dispersion model that can simulate the effects of time and space varying meteorological conditions on pollutant transport, transformation, and removal. CALPUFF's interface allows users to generate text files (ASCII) used by the system components to combine selected inputs and perform air dispersion modeling. The model has been adopted by the US Environmental Protection Agency (EPA) in 40 CFR 51, *Guideline on Air Quality Models*, which provides for the use of Professional CALPUFF on a case-by-case basis for air quality estimates involving complex meteorological flow conditions, where steady-state straight-line transport assumptions are inappropriate. For these reasons, CALPUFF was chosen as the appropriate air dispersion model for the WTP (CCN 057108, *Discuss and Resolve a Number of Outstanding Risk Assessment Issues in the WTP Risk Assessment Work Plan (RAWP)*). CALPUFF results are used as input for the human health and ecological risk assessments required by condition III.10.C.11 of the DWP.

B.2 Major Components

The CALPUFF system consists of three main components (applications):

- CALMET (version 5.8.5)
- CALPUFF (version 5.8.5)
- CALPOST (version 6.221)

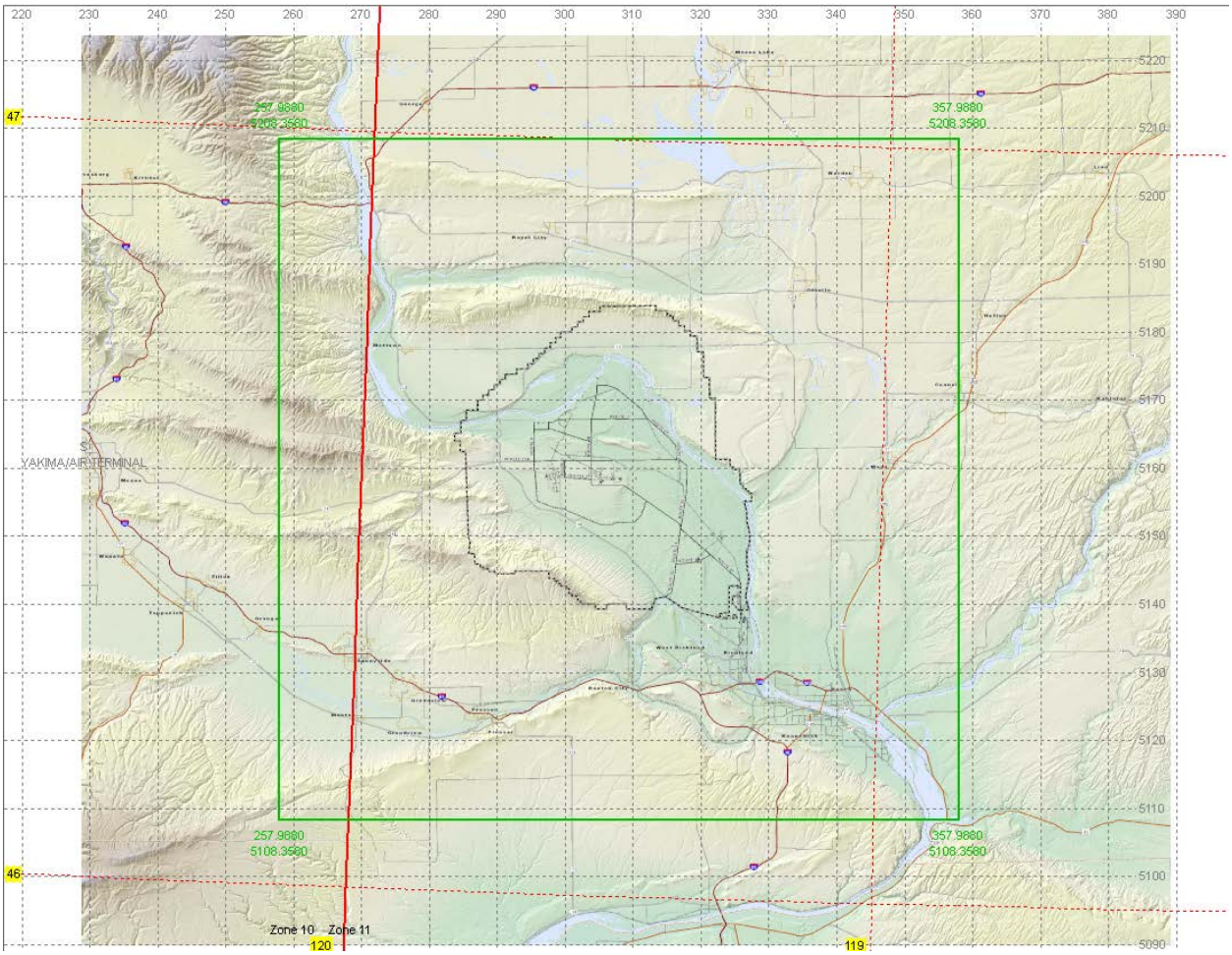
These components are described in sections 6.1.2.1 through 6.1.2.4 of the RAWP for CALMET applications, Sections 6.1.3 through 6.1.4.3 for CALPUFF applications. CALPOST, the post-processing component of the CALPUFF system, was used to extract the results presented in this section.

[1] The CALPUFF modeling system was operated using Professional CalPuff developed by Providence© (Copyright 2015-2016 Providence Engineering and Environmental Group LLC.). Professional CalPuff is commercial off-the-shelf software that provides a menu-driven, graphical user interface to execute the CALPUFF modeling system.

B.3 Air Dispersion Modeling

Air dispersion was modeled using CALPUFF, an integrated Lagrangian puff model that incorporates diagnostic 3-dimensional meteorological data to model air dispersion. CALPUFF models a series of Gaussian puffs that move and disperse according to local conditions that vary in time and space. The corresponding output is in hourly concentrations and deposition flux (dry and wet) at select receptor locations. Air dispersion was modeled over a 100 km by 100 km grid with a 1 km grid mesh size and 9 vertical levels, ranging from the surface elevation to 4000 m. The grid was centered in the middle of the Hanford site, near where the WTP facilities are to be built, so that the model grid extended approximately 50 km in all directions from the WTP facility (see Figure B-1).

Figure B-1 Air Dispersion Model Domain



The green square represents the modeling domain.

CALPUFF was used to compute concentration and deposition at potential receptor exposure grids. These grids represent locations for possible exposures onsite; offsite; at the Columbia River; at Gable Mountain; at a hunter/gatherer area surrounding the Hanford Site interior; and at a future hunter/gatherer area representing the entire Hanford Site, except the industrialized Central Plateau. These receptor grids represent key locations on and off the Hanford site. Each receptor grid represents a geographical subset within the model domain where finer grid node spacing is used to interpolate potential downwind concentration and deposition values a receptor may be exposed to. The CALPUFF model was run for all

the receptor grids combined within the modeling domain (postprocessing of the data was used later to subset results by receptor grid). Depending on the exposure scenario, a receptor could be exposed within one or more of the receptor exposure grids. Exposure grids and their respective dimensions are presented in Table B-1, and described in greater detail in the RAWP. Figure B-2 shows a three-dimensional relief of the topography of the WTP air quality model study area along with receptor grids, location of the WTP, the meteorological surface stations, other nearby surface features, water bodies, and local communities. Figure B-3 provides an overview of the exposure grids, with an inset detailing the onsite exposure grid. Note that the onsite grid was also used to assess ecological exposures (terrestrial receptors) on the Central Plateau, and the Columbia River exposure grid was used to assess ecological exposures (aquatic receptors and all water consumption).

CALPUFF was used to compute the highest one-hour average concentration for the worst-case hour to assess potential acute inhalation exposures, as might occur for an onsite worker. An acute inhalation scenario is recommended by EPA530-R-05-006, *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, because it is possible for air concentrations of constituents of potential concern (COPC) to significantly exceed the annual average concentration for a brief period and, thus, result in acute effects to receptor populations via inhalation. CALPUFF was used to compute both the unitized hourly air concentration from vapor phase, *Chv* (in $\mu g \cdot s/g \cdot m^3$), and unitized hourly air concentration from particle phase, *Chp* (in $\mu g \cdot s/g \cdot m^3$) associated with the emissions of each source.

Table B-1 Receptor Exposure Grids and Grid Node Spacing

Receptor Exposure Grids	Description	Grid Node Spacing	No. of Grid Nodes
Onsite	Location of predicted ground-level concentrations of both airborne and deposited emissions in the immediate vicinity of WTP. Receptors who are likely to receive exposures at this location are limited to onsite workers and terrestrial ecological receptors.	60 meters	1,538
Offsite	Location of predicted ground-level concentrations of both airborne and deposited emissions outside the Hanford Site boundary. For conservatism, the residence of all receptors is assumed to occupy this grid.	500 meters	1,809
Columbia River	Location of predicted ground-level concentrations of both airborne and deposited emissions at the Columbia River. This location is used to evaluate potential risks to aquatic ecological receptors, as a source of potable water for human receptors, and as a source of fish for human receptors. Receptors at this location also include aquatic ecological receptors.	500 meters	83
Gable Mountain	Location of predicted ground-level concentrations of both airborne and deposited emissions at Gable Mountain. Gable Mountain represents a site of American Indian tribal ceremonial activities.	500 meters	53
Hunter-Gatherer (Current)	Location of predicted ground-level concentrations of both airborne and deposited emissions for grazing game and native plant species. This area is limited to the region around the Hanford Site interior.	1 kilometer	768
Hunter-Gatherer (Future)	An expanded version (post-operations) of the current hunter/gatherer area that includes portions of the Hanford Site interior.	1 kilometer	1,380

Figure B-2 Major Landforms of the CALPUFF Model Study Area

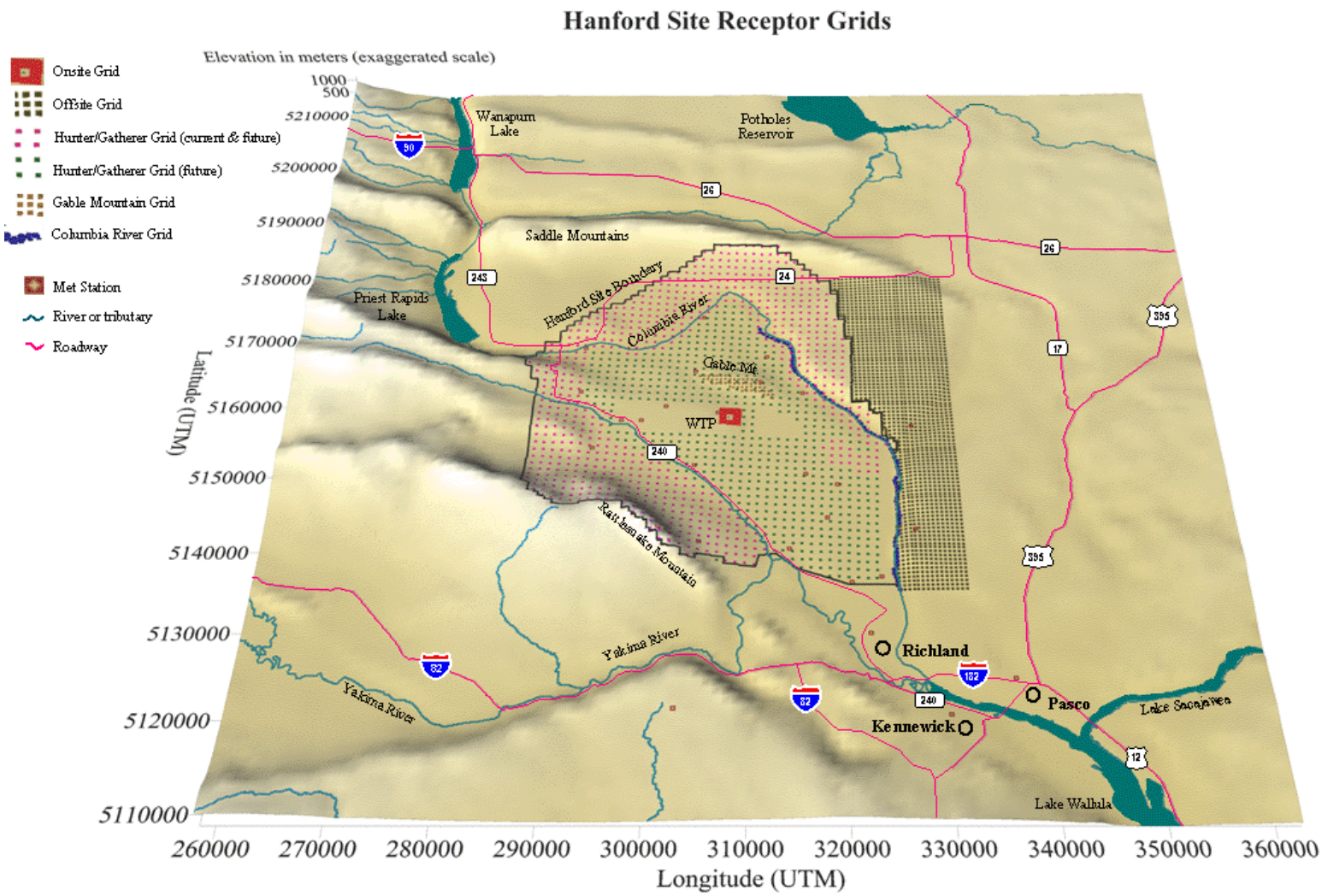
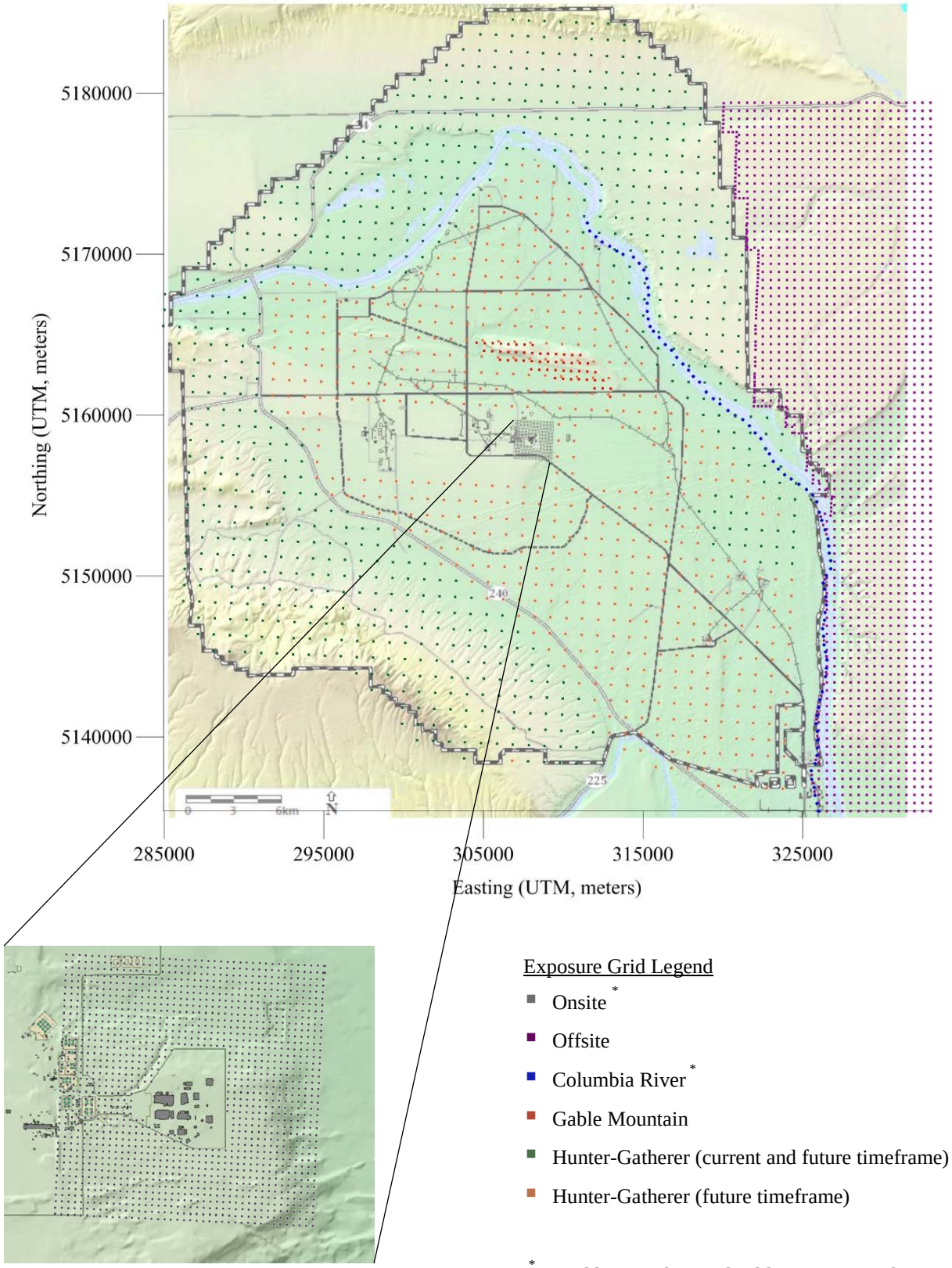


Figure B-3 CALPUFF Exposure Grids



* In addition to human health assessment, these grids are used for evaluation of ecological receptors.

For assessment of chronic or long-term risks, exposures are based on the annual average ambient air concentrations and deposition rates for each COPC at each exposure location, as calculated by the CALPUFF model. CALPUFF was utilized to model 9 specific unitized species for each facility:

- Unitized yearly air concentration from vapor phase, *Cyv* (in µg·s/g·m^3)
- Unitized yearly air concentration from particle phase (modeled as 1-micron diameter particles), Cyp_1 (in µg·s/g·m^3)
- Unitized yearly air concentration from particle phase (modeled as 2.5-micron diameter particles), $Cyp_{2.5}$ (in µg·s/g·m^3)
- Unitized yearly average dry deposition from vapor phase, *Dydv* (in s/m^2·yr)
- Unitized yearly average dry deposition from particle phase (modeled as 1-micron diameter particles), $Dydp_1$ (in s/m^2·yr)
- Unitized yearly average dry deposition from particle phase (modeled as 2.5-micron diameter particles), $Dydp_{2.5}$ (in s/m^2·yr)
- Unitized yearly average wet deposition from vapor phase, *Dywv* (in s/m^2·yr)
- Unitized yearly average wet deposition from particle phase (modeled as 1-micron diameter particles), $Dywp_1$ (in s/m^2·yr)
- Unitized yearly average wet deposition from particle phase (modeled as 2.5-micron diameter particles), $Dywp_{2.5}$ (in s/m^2·yr)

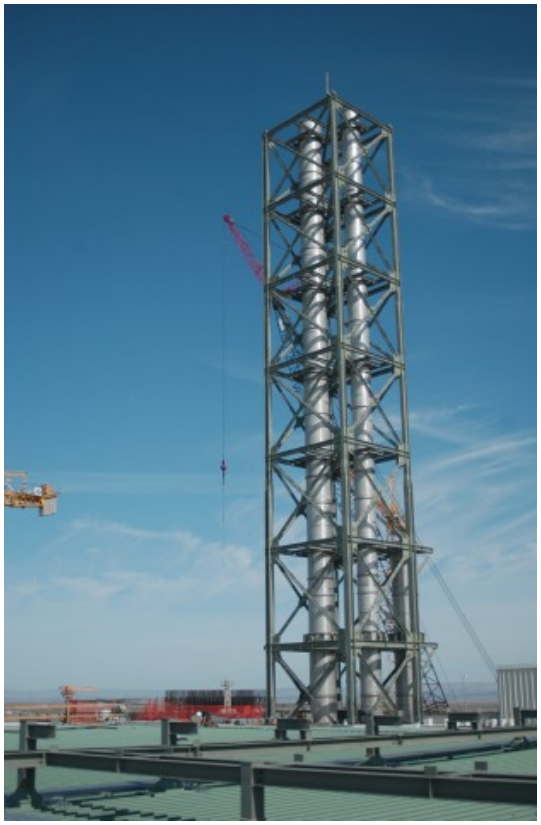
Vapor and particulate transport, concentration, and deposition are modeled independently. Vapors are represented by their respective model species, particulates are represented by the 1 micron particles, and particle-bound constituents are represented by 2.5 micron particles (CCN 194345, *Modeling Particle-bound Constituents in CalPuff*). CALPUFF was run with a unitized (normalized) 1 g/s emission rate for vapor, 1 micron particles, and 2.5 micron particles for each facility. The modeled impact (concentration and deposition rate), based on a unit emissions rate, can simply be multiplied by the actual emissions rate of an individual COPC to determine the actual COPC concentration and deposition. Emission sources were modeled for the PT Facility, LAW Facility, HLW Facility, and the EMF. Since the PT Facility, LAW Facility, HLW Facility exhaust flues are bundled together in structural steel lattices that support the individual flues for each facility (refer to Figure B-4), they are modeled as virtual (composite) stacks, with the exhaust rate of each flue contributing to an overall stack flow rate and temperature.

B.4 Dispersion Results

This section discusses general trends of the CALPUFF results. CALPUFF was used to predict the unitized concentration and deposition for all the receptor grids.

The general wind direction from the WTP is to the southeast. A wind rose corresponding to the 200 East meteorological surface station data, for years 2002 through 2006, near WTP, is shown in Figure B-5. The wind rose shows the direction, frequency, and magnitude from which wind blows and indicates a southeastern dispersion trend for the modeled weather data, consistent with actual measured data at the 200 East meteorological station (refer to Supplement 5 of the RAWP, Section 4 and Figure 4-2).

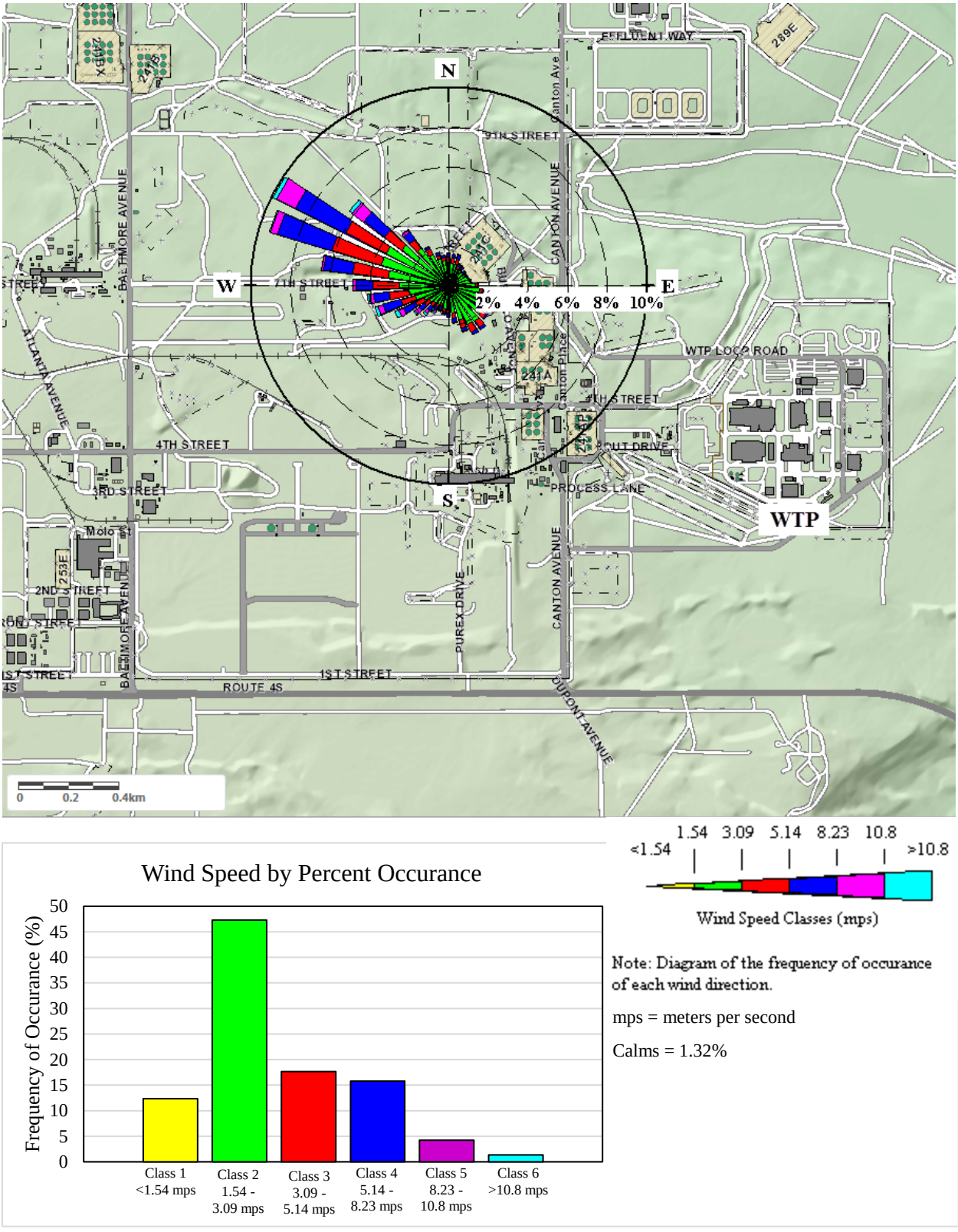
Figure B-4 LAW Facility Stack Lattice



The LAW Facility stack

LAW flues enclosed within the stack lattice

Figure B-5 Wind Rose for WTP (2002-2006)



The distribution of hourly concentration values (vapor and particles) was assessed. Table B-2 provides the mean, standard deviation, minimum, maximum, median, 90th percentile, and distribution-free 95% upper confidence limit of the median. Bold font highlights the values used in the assessment of acute human health impacts. The higher fluxes associated with EMF are the result of its stack height of 46 m (150 ft), verses that of the PT, LAW, and HLW Facilities which have 61 m (200 ft) stacks.

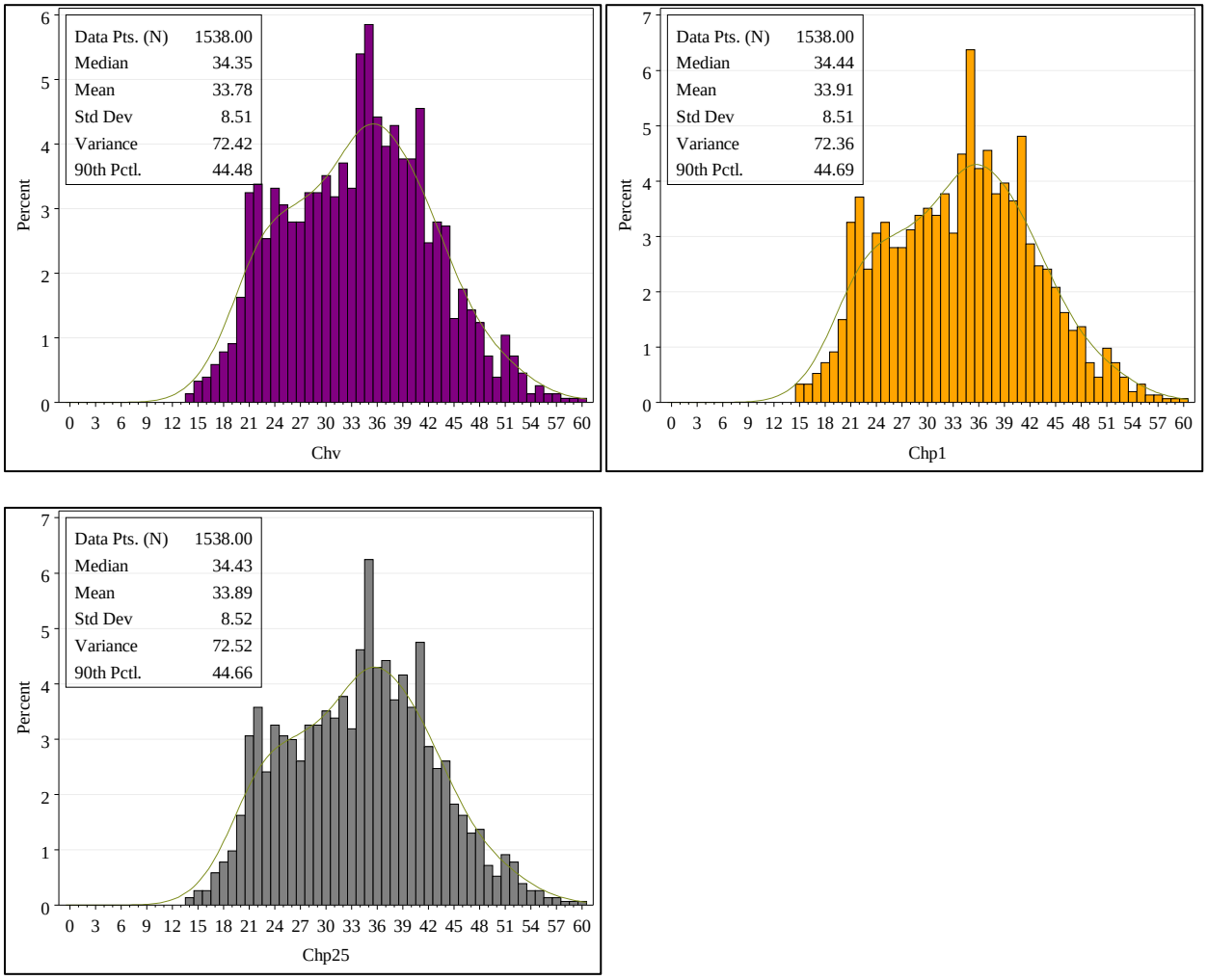
Table B-2 Basic Statistical Quantities for Hourly Concentration, Acute Exposure Grid[1]
(Acute Values in µg·s/g·m^3, Onsite Exposure Grid, all years, 7690 grid points assessed)

Specie	Mean	Standard Deviation	Minimum	Maximum	Median	90th Percentile	95% UCL of the Median
PT Facility							
Chv	6.2292	2.7755	1.8289	**38.699**	5.7673	9.2436	5.8150
Chp_1	6.2560	2.7830	1.8332	**38.749**	5.7968	9.2822	5.8396
$Chp_{2.5}$	6.2537	2.7819	1.8328	**38.735**	5.7948	9.2775	5.8381
LAW Facility							
Chv	6.2427	2.8628	1.7216	**44.266**	5.7076	9.3233	5.7541
Chp_1	6.2651	2.8676	1.7235	**44.295**	5.7300	9.3531	5.7821
$Chp_{2.5}$	6.2627	2.8670	1.7233	**44.288**	5.7269	9.3499	5.7805
HLW Facility							
Chv	6.9689	3.0185	2.1981	**34.635**	6.3547	10.6665	6.4114
Chp_1	6.9912	3.0270	2.2131	**34.637**	6.3740	10.7020	6.4326
$Chp_{2.5}$	6.9885	3.0260	2.2128	**34.637**	6.3708	10.6975	6.4317
EMF							
Chv	20.0844	8.4879	7.0632	**99.1000**	18.3830	29.5185	18.5190
Chp_1	20.7551	8.8213	7.3590	**99.3890**	18.7915	31.3885	18.9550
$Chp_{2.5}$	20.4704	8.5918	7.0812	**99.3200**	18.6950	30.3420	18.8160

[1] Values shown in bold font indicate inputs to the risk assessment. Refer to Section B.5.

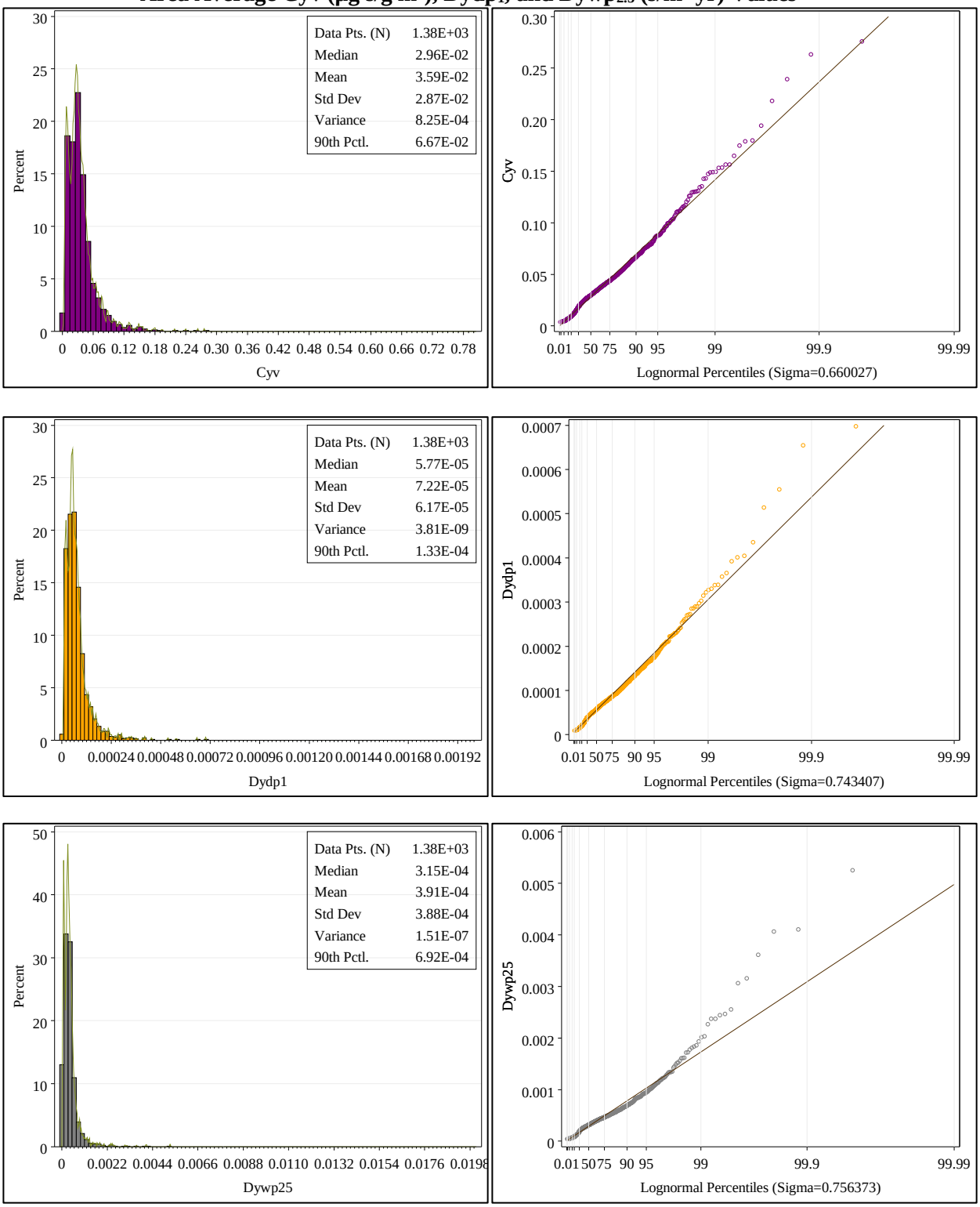
Figure B-6 shows the histograms for the maximum hourly concentration values (average of years 2002 through 2006) for the baseline WTP operating configuration (PT, LAW, and HLW Facilities). Generally, the distribution fits a curve, with some skew and a slight binormal distribution.

Figure B-6 Histograms for the Annual Average Hourly Concentration Values Chv, Chp_1, and $Chp_{2.5}$ in units of µg·s/g·m^3



To examine the distribution of the data (annual average concentration and deposition), results for the future hunter/gatherer grid for each facility were summed to generate a single data point for each specie for each receptor grid node, and then averaged across the years of the CALPUFF run. The future hunter/gatherer grid was chosen because it contains a large number of grid nodes, evenly positioned across the non-industrial portion of the Hanford site. Percentiles were computed and the data were plotted in histograms and ranked frequency plots to assess distribution characteristics (examples for *Cyv*, $Dydp_1$, and $Dywp_{2.5}$ are shown in Figure B-7). The general pattern shown in the histograms is that a large percentage of results for concentration and deposition data lie within the lower half of the range of values, with potential outliers at the extremes. Examination of the ranked frequency plots suggests data in the lower range follow a lognormal distribution, with a greater deviation from this pattern at the higher values. The modeling results are consistent with information indicating that higher air concentrations and depositions occur closer to the emission source, with values lessening and leveling out as downwind dispersion occurs.

Figure B-7 Example Histograms and Ranked Frequency Plots for the Future Hunter/Gatherer Area Average Cyv (μg·s/g·m^3), Dydp$_1$, and Dywp$_{2.5}$ (s/m^2·yr) Values



Basic statistical quantities were computed for each specie, source, and receptor exposure grid for the annual average ambient air concentrations and deposition results of CALPUFF. Table B-3 provides the

mean, standard deviation, minimum, maximum, median, 90th percentile, and distribution-free 95% upper confidence limit of the median. Air concentration values (Cyv, Cyp_1, and $Cyp_{2.5}$) are in units of $\mu g \cdot s/g \cdot m^3$. Deposition values (Dydv, $Dydp_1$, $Dydp_{2.5}$, Dywv, $Dywp_1$, and $Dydp_{2.5}$) are in units of $s/m^2 \cdot yr$. Bold font highlights the values used in the assessment of chronic human health and ecological impacts (refer to Sections B.5 and B.6). The statistical quantities indicate a wide distribution of data amongst all species and exposure grids. The average unitized concentration and dry/wet deposition fluxes were plotted for each facility and receptor grid (Figure B-8). A comparison of these values indicates higher values at the onsite grid, followed by the Gable Mountain grid (note the logarithmic vertical scale). The Gable Mountain results reflect the influence of the topography on the dispersion of the emissions. A comparison of the onsite and Columbia River maximum grid data indicates a 22-fold increase in concentration and a 43-fold higher deposition at the onsite grid. This is important to note because, while the ecological assessment presumes all terrestrial receptors occupy the onsite exposure grid, in reality, many of these receptors live near or on the riparian corridor.

Table B-3 Basic Statistical Quantities for Dispersed Species, by Source and Receptor Exposure Grid[1]

Specie	Mean	Standard Deviation	Minimum	Maximum	Median	90th Percentile	95% UCL of the Median
PT Facility (Onsite Exposure Grid, all years, 7690 grid points assessed)							
Cyv	5.6460E-02	3.0757E-02	1.6660E-02	**2.0756E-01**	4.9808E-02	**9.6959E-02**	5.0357E-02
Cyp_{1}	5.7305E-02	3.0786E-02	1.7339E-02	**2.0837E-01**	5.0665E-02	**9.7851E-02**	5.1206E-02
$Cyp_{2.5}$	5.7087E-02	3.0783E-02	1.7177E-02	**2.0816E-01**	5.0454E-02	**9.7630E-02**	5.0996E-02
Dydv	2.4129E-03	1.2093E-03	6.4217E-04	**8.1751E-03**	2.1979E-03	**3.9098E-03**	2.2246E-03
$Dydp_{1}$	1.3445E-04	9.0528E-05	3.4800E-05	**6.9035E-04**	1.1208E-04	**2.4109E-04**	1.1312E-04
$Dydp_{2.5}$	4.8686E-04	3.7877E-04	1.1648E-04	**3.5636E-03**	3.7821E-04	**9.4179E-04**	3.8114E-04
Dywv	3.8794E-03	3.0904E-03	2.8112E-04	**3.3463E-02**	3.0569E-03	**7.9024E-03**	3.1069E-03
$Dywp_{1}$	1.2283E-03	9.4886E-04	1.1302E-04	**9.9934E-03**	9.7998E-04	**2.4652E-03**	9.9660E-04
$Dywp_{2.5}$	1.2280E-03	9.4883E-04	1.1284E-04	**9.9931E-03**	9.7979E-04	**2.4649E-03**	9.9629E-04
LAW Facility (Onsite Exposure Grid, all years, 7690 grid points assessed)							
Specie	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**	**Median**	**90th Percentile**	**95% UCL of the Median**
Cyv	4.8789E-02	3.3181E-02	1.3905E-02	**2.4567E-01**	4.0212E-02	**8.0695E-02**	4.0783E-02
Cyp_{1}	4.9673E-02	3.3206E-02	1.4745E-02	**2.4659E-01**	4.1035E-02	**8.1473E-02**	4.1644E-02
$Cyp_{2.5}$	4.9442E-02	3.3205E-02	1.4576E-02	**2.4641E-01**	4.0827E-02	**8.1267E-02**	4.1427E-02
Dydv	2.1306E-03	1.3148E-03	5.5134E-04	**9.7437E-03**	1.8213E-03	**3.4206E-03**	1.8472E-03
$Dydp_{1}$	1.0900E-04	9.3577E-05	2.4807E-05	**7.3564E-04**	8.2080E-05	**1.8279E-04**	8.3555E-05
$Dydp_{2.5}$	3.5731E-04	2.7299E-04	9.6352E-05	**2.2168E-03**	2.8755E-04	**5.7793E-04**	2.9064E-04
Dywv	3.9108E-03	3.3899E-03	2.6702E-04	**2.8603E-02**	2.9200E-03	**7.9691E-03**	2.9755E-03
$Dywp_{1}$	1.2431E-03	1.0447E-03	1.1168E-04	**8.7112E-03**	9.4340E-04	**2.4950E-03**	9.5885E-04
$Dywp_{2.5}$	1.2428E-03	1.0447E-03	1.1139E-04	**8.7109E-03**	9.4324E-04	**2.4946E-03**	9.5851E-04
HLW Facility (Onsite Exposure Grid, all years, 7690 grid points assessed)							
Specie	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**	**Median**	**90th Percentile**	**95% UCL of the Median**
Cyv	5.3106E-02	2.2622E-02	1.3196E-02	**1.1062E-01**	4.7967E-02	**8.7800E-02**	4.8558E-02
Cyp_{1}	5.4106E-02	2.2658E-02	1.3935E-02	**1.1157E-01**	4.8958E-02	**8.8838E-02**	4.9561E-02
$Cyp_{2.5}$	5.3842E-02	2.2654E-02	1.3753E-02	**1.1137E-01**	4.8697E-02	**8.8575E-02**	4.9272E-02
Dydv	2.3688E-03	1.0331E-03	5.0514E-04	**5.0401E-03**	2.1524E-03	**3.9381E-03**	2.1814E-03
$Dydp_{1}$	1.1735E-04	5.4908E-05	2.3132E-05	**2.9668E-04**	1.0517E-04	**1.9668E-04**	1.0659E-04
$Dydp_{2.5}$	3.9601E-04	1.7521E-04	9.0802E-05	**1.7083E-03**	3.6296E-04	**6.3372E-04**	3.6768E-04
Dywv	4.0398E-03	3.5272E-03	2.6772E-04	**3.3274E-02**	2.9727E-03	**8.2801E-03**	3.0337E-03
$Dywp_{1}$	1.2746E-03	1.0763E-03	9.1886E-05	**1.0352E-02**	9.5152E-04	**2.5833E-03**	9.7093E-04
$Dywp_{2.5}$	1.2743E-03	1.0763E-03	9.1716E-05	**1.0352E-02**	9.5117E-04	**2.5830E-03**	9.7052E-04
EMF (Onsite Exposure Grid, all years, 7690 grid points assessed)							
Specie	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**	**Median**	**90th Percentile**	**95% UCL of the Median**
Cyv	1.6715E-01	6.3204E-02	5.3078E-02	**6.0905E-01**	1.6028E-01	**2.4535E-01**	1.6163E-01
Cyp_{1}	1.6987E-01	6.3262E-02	5.5348E-02	**6.1215E-01**	1.6291E-01	**2.4798E-01**	1.6426E-01
$Cyp_{2.5}$	1.6912E-01	6.3260E-02	5.4694E-02	**6.1119E-01**	1.6216E-01	**2.4733E-01**	1.6355E-01
Dydv	6.8336E-03	2.5356E-03	2.0760E-03	**1.9957E-02**	6.5959E-03	**1.0241E-02**	6.6531E-03
$Dydp_{1}$	3.4130E-04	1.4524E-04	1.0181E-04	**1.1518E-03**	3.1963E-04	**5.1224E-04**	3.2208E-04
$Dydp_{2.5}$	1.1887E-03	4.7241E-04	3.6632E-04	**4.3040E-03**	1.1209E-03	**1.7753E-03**	1.1296E-03
Dywv	4.5697E-03	4.4393E-03	1.7593E-04	**5.0376E-02**	3.2619E-03	**9.6675E-03**	3.3368E-03
$Dywp_{1}$	1.4484E-03	1.3627E-03	6.9953E-05	**1.5182E-02**	1.0559E-03	**3.0152E-03**	1.0764E-03
$Dywp_{2.5}$	1.4476E-03	1.3627E-03	6.9631E-05	**1.5181E-02**	1.0552E-03	**3.0147E-03**	1.0757E-03

Table B-3 Basic Statistical Quantities for Dispersed Species, by Source and Receptor Exposure Grid[1]

Specie	Mean	Standard Deviation	Minimum	Maximum	Median	90th Percentile	95% UCL of the Median
PT Facility (Offsite Exposure Grid, all years, 9045 grid points assessed)							
Cyv	5.8234E-03	1.6333E-03	2.5017E-03	1.1102E-02	5.6604E-03	**8.0438E-03**	5.6976E-03
Cyp_1	6.5972E-03	1.7216E-03	3.0150E-03	1.2258E-02	6.4538E-03	**8.9110E-03**	6.4945E-03
$Cyp_{2.5}$	6.3983E-03	1.6907E-03	2.8954E-03	1.1941E-02	6.2499E-03	**8.6742E-03**	6.2921E-03
Dydv	2.8970E-04	7.4536E-05	1.4346E-04	5.2769E-04	2.8013E-04	**3.9865E-04**	2.8182E-04
$Dydp_1$	1.2103E-05	2.7616E-06	6.2454E-06	2.2329E-05	1.1717E-05	**1.5953E-05**	1.1766E-05
$Dydp_{2.5}$	5.1477E-05	1.9941E-05	2.0745E-05	1.6912E-04	4.7746E-05	**7.7765E-05**	4.8064E-05
Dywv	1.1778E-04	5.0966E-05	2.4860E-05	3.9984E-04	1.1814E-04	**1.7678E-04**	1.1886E-04
$Dywp_1$	5.2638E-05	2.4081E-05	9.2552E-06	1.7412E-04	5.2911E-05	**7.9982E-05**	5.3318E-05
$Dywp_{2.5}$	5.2429E-05	2.4010E-05	9.2006E-06	1.7375E-04	5.2668E-05	**7.9676E-05**	5.3113E-05
LAW Facility (Offsite Exposure Grid, all years, 9045 grid points assessed)							
Specie	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**	**Median**	**90th Percentile**	**95% UCL of the Median**
Cyv	6.1281E-03	1.7485E-03	2.5796E-03	1.2001E-02	5.9598E-03	**8.5054E-03**	5.9984E-03
Cyp_1	6.9067E-03	1.8325E-03	3.0953E-03	1.2880E-02	6.7643E-03	**9.3819E-03**	6.8107E-03
$Cyp_{2.5}$	6.7070E-03	1.8036E-03	2.9744E-03	1.2626E-02	6.5594E-03	**9.1411E-03**	6.6010E-03
Dydv	3.0243E-04	8.0444E-05	1.4708E-04	5.5469E-04	2.9170E-04	**4.2101E-04**	2.9321E-04
$Dydp_1$	1.2635E-05	2.9766E-06	6.3867E-06	2.3731E-05	1.2130E-05	**1.6781E-05**	1.2184E-05
$Dydp_{2.5}$	5.3977E-05	2.1475E-05	2.1311E-05	1.8954E-04	4.9496E-05	**8.2243E-05**	4.9830E-05
Dywv	1.1964E-04	5.2417E-05	2.3000E-05	4.3658E-04	1.1980E-04	**1.8084E-04**	1.2065E-04
$Dywp_1$	5.3306E-05	2.4602E-05	8.7566E-06	1.8582E-04	5.3696E-05	**8.1347E-05**	5.4072E-05
$Dywp_{2.5}$	5.3095E-05	2.4532E-05	8.7039E-06	1.8546E-04	5.3488E-05	**8.1025E-05**	5.3838E-05
HLW Facility (Offsite Exposure Grid, all years, 9045 grid points assessed)							
Specie	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**	**Median**	**90th Percentile**	**95% UCL of the Median**
Cyv	6.3383E-03	1.8795E-03	2.6619E-03	1.3202E-02	6.1567E-03	**8.9004E-03**	6.2086E-03
Cyp_1	7.2042E-03	1.9826E-03	3.2440E-03	1.4357E-02	7.0499E-03	**9.8893E-03**	7.1028E-03
$Cyp_{2.5}$	6.9791E-03	1.9470E-03	3.1063E-03	1.4017E-02	6.8172E-03	**9.6327E-03**	6.8733E-03
Dydv	3.0865E-04	8.2554E-05	1.4995E-04	5.5913E-04	2.9879E-04	**4.2618E-04**	3.0058E-04
$Dydp_1$	1.3062E-05	3.1292E-06	6.6358E-06	2.4479E-05	1.2618E-05	**1.7420E-05**	1.2686E-05
$Dydp_{2.5}$	5.5648E-05	2.1728E-05	2.2184E-05	1.8272E-04	5.1716E-05	**8.4242E-05**	5.2063E-05
Dywv	1.1843E-04	5.0997E-05	2.1671E-05	4.2523E-04	1.1811E-04	**1.7851E-04**	1.1912E-04
$Dywp_1$	5.3036E-05	2.4067E-05	8.3816E-06	1.8359E-04	5.3290E-05	**8.0915E-05**	5.3712E-05
$Dywp_{2.5}$	5.2796E-05	2.3987E-05	8.3249E-06	1.8316E-04	5.3031E-05	**8.0552E-05**	5.3457E-05
EMF (Offsite Exposure Grid, all years, 9045 grid points assessed)							
Specie	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**	**Median**	**90th Percentile**	**95% UCL of the Median**
Cyv	7.7387E-03	2.7159E-03	2.9169E-03	1.8329E-02	7.4045E-03	**1.1426E-02**	7.4620E-03
Cyp_1	9.3842E-03	3.0634E-03	3.7595E-03	2.1198E-02	9.0902E-03	**1.3467E-02**	9.1640E-03
$Cyp_{2.5}$	8.9093E-03	2.9361E-03	3.5893E-03	2.0264E-02	8.6157E-03	**1.2824E-02**	8.6776E-03
Dydv	3.5721E-04	9.9784E-05	1.6786E-04	7.1527E-04	3.5112E-04	**4.8941E-04**	3.5286E-04
$Dydp_1$	1.6349E-05	4.4587E-06	7.7106E-06	3.4024E-05	1.5854E-05	**2.2290E-05**	1.5960E-05
$Dydp_{2.5}$	6.8133E-05	2.5803E-05	2.5581E-05	2.0615E-04	6.4926E-05	**1.0107E-04**	6.5491E-05
Dywv	1.2131E-04	5.2499E-05	2.2873E-05	4.4879E-04	1.1933E-04	**1.8443E-04**	1.2018E-04
Dywp1	5.5580E-05	2.5039E-05	8.8790E-06	2.0074E-04	5.5387E-05	**8.5254E-05**	5.5793E-05
Dywp2.5	5.5160E-05	2.4892E-05	8.7913E-06	1.9994E-04	5.4933E-05	**8.4665E-05**	5.5336E-05

Table B-3 Basic Statistical Quantities for Dispersed Species, by Source and Receptor Exposure Grid[1]

Specie	Mean	Standard Deviation	Minimum	Maximum	Median	90th Percentile	95% UCL of the Median
PT Facility (Columbia River Exposure Grid, all years, 415 grid points assessed)							
Cyv	7.2784E-03	8.6154E-04	5.7594E-03	**9.6760E-03**	7.1046E-03	8.7144E-03	7.1504E-03
Cyp_1	8.1455E-03	8.5540E-04	6.7322E-03	**1.0484E-02**	7.9574E-03	9.5482E-03	8.0231E-03
$Cyp_{2.5}$	7.8854E-03	8.5519E-04	6.4617E-03	**1.0235E-02**	7.7053E-03	9.2951E-03	7.7610E-03
Dydv	2.4797E-04	3.2610E-05	1.9751E-04	**3.4131E-04**	2.4329E-04	2.9846E-04	2.4636E-04
$Dydp_1$	1.3766E-05	2.0065E-06	1.1124E-05	**1.9860E-05**	1.3174E-05	1.6958E-05	1.3462E-05
$Dydp_{2.5}$	5.4012E-05	8.0970E-06	4.2747E-05	**1.0285E-04**	5.1861E-05	6.4488E-05	5.2690E-05
Dywv	1.9192E-04	8.2082E-05	4.1621E-05	**5.1432E-04**	1.8070E-04	2.9363E-04	1.8690E-04
$Dywp_1$	8.0367E-05	3.5246E-05	1.6103E-05	**2.6417E-04**	7.7601E-05	1.2373E-04	7.9628E-05
$Dywp_{2.5}$	8.0121E-05	3.5174E-05	1.6020E-05	**2.6386E-04**	7.7389E-05	1.2339E-04	7.9420E-05
LAW Facility (Columbia River Exposure Grid, all years, 415 grid points assessed)							
Specie	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**	**Median**	**90th Percentile**	**95% UCL of the Median**
Cyv	7.3675E-03	8.4013E-04	5.7612E-03	**9.5695E-03**	7.1759E-03	8.7686E-03	7.2561E-03
Cyp_1	8.2442E-03	8.3986E-04	6.7942E-03	**1.0442E-02**	8.0441E-03	9.6023E-03	8.1372E-03
$Cyp_{2.5}$	7.9823E-03	8.3806E-04	6.4620E-03	**1.0193E-02**	7.7835E-03	9.3535E-03	7.8760E-03
Dydv	2.5210E-04	3.2672E-05	2.0001E-04	**3.4617E-04**	2.4726E-04	3.0414E-04	2.5249E-04
$Dydp_1$	1.3970E-05	2.0041E-06	1.1173E-05	**1.9602E-05**	1.3506E-05	1.7239E-05	1.3668E-05
$Dydp_{2.5}$	5.4736E-05	8.1158E-06	4.2779E-05	**1.0627E-04**	5.2905E-05	6.5317E-05	5.3640E-05
Dywv	1.9352E-04	7.8860E-05	4.5087E-05	**5.2331E-04**	1.9008E-04	2.9354E-04	1.9542E-04
$Dywp_1$	8.0791E-05	3.4162E-05	1.7422E-05	**2.5282E-04**	7.9691E-05	1.2231E-04	8.2646E-05
$Dywp_{2.5}$	8.0539E-05	3.4089E-05	1.7334E-05	**2.5251E-04**	7.9445E-05	1.2200E-04	8.2394E-05
HLW Facility (Columbia River Exposure Grid, all years, 415 grid points assessed)							
Specie	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**	**Median**	**90th Percentile**	**95% UCL of the Median**
Cyv	7.7895E-03	8.7782E-04	6.1762E-03	**1.0004E-02**	7.5949E-03	9.1454E-03	7.6638E-03
Cyp_1	8.7818E-03	8.8442E-04	7.2097E-03	**1.1012E-02**	8.5665E-03	1.0137E-02	8.6703E-03
$Cyp_{2.5}$	8.4815E-03	8.7845E-04	6.9575E-03	**1.0673E-02**	8.2887E-03	9.7780E-03	8.3584E-03
Dydv	2.6276E-04	3.3779E-05	2.0728E-04	**3.5601E-04**	2.5821E-04	3.1530E-04	2.6265E-04
$Dydp_1$	1.4755E-05	2.0702E-06	1.1934E-05	**2.0579E-05**	1.4274E-05	1.8019E-05	1.4502E-05
$Dydp_{2.5}$	5.8041E-05	8.2508E-06	4.5973E-05	**1.0453E-04**	5.6194E-05	6.8764E-05	5.6822E-05
Dywv	1.9016E-04	7.8775E-05	4.4387E-05	**5.4270E-04**	1.8441E-04	2.8706E-04	1.8981E-04
$Dywp_1$	7.9972E-05	3.4414E-05	1.7074E-05	**2.6207E-04**	7.8862E-05	1.2022E-04	8.2180E-05
$Dywp_{2.5}$	7.9691E-05	3.4328E-05	1.6981E-05	**2.6170E-04**	7.8531E-05	1.1985E-04	8.1956E-05
EMF (Columbia River Exposure Grid, all years, 415 grid points assessed)							
Specie	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**	**Median**	**90th Percentile**	**95% UCL of the Median**
Cyv	1.2432E-02	2.5323E-03	7.9318E-03	**2.1600E-02**	1.1706E-02	1.5966E-02	1.1889E-02
Cyp_1	1.4728E-02	2.8217E-03	9.5412E-03	**2.4692E-02**	1.3857E-02	1.8745E-02	1.4211E-02
$Cyp_{2.5}$	1.3952E-02	2.6735E-03	9.1094E-03	**2.3511E-02**	1.3151E-02	1.7744E-02	1.3430E-02
Dydv	3.7290E-04	6.1353E-05	2.8382E-04	**5.8373E-04**	3.5866E-04	4.7209E-04	3.6465E-04
$Dydp_1$	2.3294E-05	4.8540E-06	1.6023E-05	**3.9429E-05**	2.1737E-05	3.0669E-05	2.2604E-05
$Dydp_{2.5}$	9.3704E-05	1.9769E-05	6.2735E-05	**1.6751E-04**	8.6374E-05	1.2405E-04	8.8919E-05
Dywv	2.0295E-04	8.5005E-05	5.8818E-05	**6.2350E-04**	1.9334E-04	3.2984E-04	1.9969E-04
$Dywp_1$	8.7053E-05	3.6242E-05	2.3073E-05	**2.5967E-04**	8.6339E-05	1.3801E-04	8.8064E-05
$Dywp_{2.5}$	8.6520E-05	3.6058E-05	2.2907E-05	**2.5888E-04**	8.5737E-05	1.3736E-04	8.7440E-05

Table B-3 Basic Statistical Quantities for Dispersed Species, by Source and Receptor Exposure Grid[1]

PT Facility (Gable Mountain Exposure Grid, all years, 265 grid points assessed)							
Specie	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**	**Median**	**90th Percentile**	**95% UCL of the Median**
Cyv	1.5418E-02	2.7406E-03	1.1224E-02	**2.7324E-02**	1.4749E-02	1.9398E-02	1.5165E-02
Cyp_{1}	1.6242E-02	2.7702E-03	1.2031E-02	**2.8312E-02**	1.5629E-02	2.0293E-02	1.5954E-02
$Cyp_{2.5}$	1.6022E-02	2.7671E-03	1.1807E-02	**2.8109E-02**	1.5369E-02	2.0047E-02	1.5753E-02
Dydv	5.6074E-04	8.1150E-05	4.2564E-04	**9.0527E-04**	5.4573E-04	6.7474E-04	5.6077E-04
$Dydp_{1}$	3.2883E-05	5.3979E-06	2.3652E-05	**5.1798E-05**	3.2053E-05	4.0458E-05	3.2728E-05
$Dydp_{2.5}$	1.6064E-04	9.3519E-05	8.2325E-05	**5.4746E-04**	1.2098E-04	3.0967E-04	1.2711E-04
Dywv	5.7747E-04	2.8111E-04	8.8783E-05	**1.6710E-03**	5.0855E-04	9.2262E-04	5.4277E-04
$Dywp_{1}$	2.0762E-04	9.9415E-05	3.4043E-05	**5.6894E-04**	1.8556E-04	3.4847E-04	2.0208E-04
$Dywp_{2.5}$	2.0735E-04	9.9357E-05	3.3933E-05	**5.6853E-04**	1.8525E-04	3.4825E-04	2.0187E-04
LAW Facility (Gable Mountain Exposure Grid, all years, 265 grid points assessed)							
Specie	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**	**Median**	**90th Percentile**	**95% UCL of the Median**
Cyv	1.5235E-02	2.8460E-03	1.0672E-02	**2.7028E-02**	1.4699E-02	1.8859E-02	1.5017E-02
Cyp_{1}	1.6101E-02	2.8837E-03	1.1335E-02	**2.8086E-02**	1.5601E-02	1.9882E-02	1.5807E-02
$Cyp_{2.5}$	1.5867E-02	2.8779E-03	1.1156E-02	**2.7856E-02**	1.5350E-02	1.9658E-02	1.5588E-02
Dydv	5.5690E-04	8.5542E-05	4.0877E-04	**9.0483E-04**	5.4283E-04	6.6831E-04	5.5825E-04
$Dydp_{1}$	3.2777E-05	5.5933E-06	2.3315E-05	**5.4712E-05**	3.1826E-05	3.9821E-05	3.2618E-05
$Dydp_{2.5}$	1.6041E-04	9.6825E-05	8.0871E-05	**6.0880E-04**	1.2123E-04	3.0449E-04	1.2739E-04
Dywv	5.5968E-04	2.5666E-04	1.0101E-04	**1.6601E-03**	5.0886E-04	8.4393E-04	5.2656E-04
$Dywp_{1}$	1.9874E-04	9.0011E-05	3.7925E-05	**5.7515E-04**	1.7764E-04	2.9852E-04	1.8765E-04
$Dywp_{2.5}$	1.9847E-04	8.9946E-05	3.7815E-05	**5.7471E-04**	1.7736E-04	2.9827E-04	1.8742E-04
HLW Facility (Gable Mountain Exposure Grid, all years, 265 grid points assessed)							
Specie	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**	**Median**	**90th Percentile**	**95% UCL of the Median**
Cyv	1.6420E-02	3.1312E-03	1.1280E-02	**3.0122E-02**	1.5827E-02	2.0431E-02	1.6062E-02
Cyp_{1}	1.7406E-02	3.1764E-03	1.2201E-02	**3.1362E-02**	1.6753E-02	2.1542E-02	1.7024E-02
$Cyp_{2.5}$	1.7136E-02	3.1693E-03	1.1934E-02	**3.1097E-02**	1.6467E-02	2.1283E-02	1.6790E-02
Dydv	5.9281E-04	9.3321E-05	4.3192E-04	**9.8310E-04**	5.7556E-04	7.0830E-04	5.9111E-04
$Dydp_{1}$	3.5143E-05	6.0469E-06	2.3774E-05	**5.8219E-05**	3.4321E-05	4.2785E-05	3.5021E-05
$Dydp_{2.5}$	1.7047E-04	9.8209E-05	8.2927E-05	**6.1688E-04**	1.3292E-04	3.1785E-04	1.3697E-04
Dywv	5.4319E-04	2.6351E-04	7.4381E-05	**1.7509E-03**	4.8474E-04	8.5128E-04	5.1615E-04
$Dywp_{1}$	1.9287E-04	9.2507E-05	2.9041E-05	**6.0451E-04**	1.7481E-04	3.0319E-04	1.8375E-04
$Dywp_{2.5}$	1.9255E-04	9.2424E-05	2.8923E-05	**6.0398E-04**	1.7445E-04	3.0276E-04	1.8345E-04
EMF (Gable Mountain Exposure Grid, all years, 265 grid points assessed)							
Specie	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**	**Median**	**90th Percentile**	**95% UCL of the Median**
Cyv	3.8420E-02	8.4815E-03	2.2347E-02	**6.8630E-02**	3.8063E-02	4.8508E-02	3.9165E-02
Cyp_{1}	4.1183E-02	8.6647E-03	2.4219E-02	**7.1679E-02**	4.0966E-02	5.1274E-02	4.1647E-02
$Cyp_{2.5}$	4.0358E-02	8.6011E-03	2.3705E-02	**7.0777E-02**	4.0255E-02	5.0481E-02	4.1005E-02
Dydv	1.2338E-03	2.1550E-04	7.9975E-04	**2.0501E-03**	1.2180E-03	1.4932E-03	1.2496E-03
$Dydp_{1}$	7.4870E-05	1.4449E-05	4.4396E-05	**1.1597E-04**	7.5466E-05	9.4617E-05	7.7462E-05
$Dydp_{2.5}$	3.4304E-04	1.4405E-04	1.5869E-04	**8.9906E-04**	3.0731E-04	5.5907E-04	3.1924E-04
Dywv	6.4759E-04	2.7779E-04	8.7071E-05	**1.9504E-03**	6.1754E-04	1.0000E-03	6.3712E-04
$Dywp_{1}$	2.3661E-04	9.6351E-05	3.3908E-05	**6.5623E-04**	2.2969E-04	3.5809E-04	2.3582E-04
$Dywp_{2.5}$	2.3595E-04	9.6192E-05	3.3706E-05	**6.5516E-04**	2.2901E-04	3.5715E-04	2.3520E-04

Table B-3 Basic Statistical Quantities for Dispersed Species, by Source and Receptor Exposure Grid[1]

Specie	Mean	Standard Deviation	Minimum	Maximum	Median	90th Percentile	95% UCL of the Median
PT Facility (Hunter/Gatherer Area, Current Exposure Grid, all years, 3840 grid points assessed)							
Cyv	4.8845E-03	2.5966E-03	7.0932E-04	2.0099E-02	5.0591E-03	7.7820E-03	**5.1591E-03**
Cyp_{1}	5.5764E-03	2.7657E-03	9.0804E-04	2.1144E-02	5.8248E-03	8.6927E-03	**5.9261E-03**
$Cyp_{2.5}$	5.3771E-03	2.7129E-03	8.5478E-04	2.0844E-02	5.6171E-03	8.4080E-03	**5.7077E-03**
Dydv	1.7158E-04	8.1325E-05	3.1542E-05	6.2025E-04	1.7613E-04	2.7303E-04	**1.7883E-04**
$Dydp_{1}$	9.7318E-06	4.7949E-06	1.6572E-06	3.8001E-05	1.0022E-05	1.5535E-05	**1.0179E-05**
$Dydp_{2.5}$	3.6477E-05	1.9465E-05	5.7260E-06	1.5974E-04	3.7394E-05	5.7932E-05	**3.7903E-05**
Dywv	1.2840E-04	9.3761E-05	7.6598E-06	5.4453E-04	1.1026E-04	2.5907E-04	**1.1377E-04**
$Dywp_{1}$	5.5025E-05	3.7633E-05	4.3296E-06	2.5437E-04	4.8717E-05	1.0623E-04	**5.0508E-05**
$Dywp_{2.5}$	5.4822E-05	3.7558E-05	4.2943E-06	2.5406E-04	4.8509E-05	1.0594E-04	**5.0253E-05**
LAW Facility (Hunter/Gatherer Area, Current Exposure Grid, all years, 3840 grid points assessed)							
Specie	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**	**Median**	**90th Percentile**	**95% UCL of the Median**
Cyv	5.0733E-03	2.6353E-03	6.8621E-04	1.8603E-02	5.3299E-03	7.9789E-03	**5.4357E-03**
Cyp_{1}	5.7989E-03	2.8048E-03	8.8472E-04	1.9632E-02	6.1295E-03	8.8897E-03	**6.2305E-03**
$Cyp_{2.5}$	5.5887E-03	2.7518E-03	8.3161E-04	1.9340E-02	5.9020E-03	8.5956E-03	**6.0133E-03**
Dydv	1.7724E-04	8.2719E-05	3.1785E-05	5.8499E-04	1.8403E-04	2.7962E-04	**1.8659E-04**
$Dydp_{1}$	1.0095E-05	4.8779E-06	1.6258E-06	3.5866E-05	1.0510E-05	1.5888E-05	**1.0677E-05**
$Dydp_{2.5}$	3.7914E-05	1.9824E-05	5.5765E-06	1.6184E-04	3.9237E-05	5.9143E-05	**3.9925E-05**
Dywv	1.2960E-04	9.4012E-05	8.1439E-06	6.0010E-04	1.1154E-04	2.5884E-04	**1.1558E-04**
$Dywp_{1}$	5.5462E-05	3.7523E-05	4.5623E-06	2.5027E-04	4.8460E-05	1.0611E-04	**5.0909E-05**
$Dywp_{2.5}$	5.5252E-05	3.7444E-05	4.5260E-06	2.4996E-04	4.8260E-05	1.0583E-04	**5.0770E-05**
HLW Facility (Hunter/Gatherer Area, Current Exposure Grid, all years, 3840 grid points assessed)							
Specie	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**	**Median**	**90th Percentile**	**95% UCL of the Median**
Cyv	5.3009E-03	2.7924E-03	6.8584E-04	2.0340E-02	5.5043E-03	8.4871E-03	**5.5930E-03**
Cyp_{1}	6.1157E-03	2.9963E-03	8.9374E-04	2.1533E-02	6.3897E-03	9.5032E-03	**6.4931E-03**
Cyp_{25}	5.8767E-03	2.9315E-03	8.3755E-04	2.1186E-02	6.1300E-03	9.1842E-03	**6.2349E-03**
Dydv	1.8375E-04	8.6568E-05	3.1968E-05	6.3277E-04	1.8880E-04	2.9270E-04	**1.9150E-04**
$Dydp_{1}$	1.0569E-05	5.1442E-06	1.6389E-06	3.8985E-05	1.0876E-05	1.6800E-05	**1.1041E-05**
$Dydp_{25}$	3.9770E-05	2.0898E-05	5.6150E-06	1.5980E-04	4.0683E-05	6.2946E-05	**4.1533E-05**
Dywv	1.3035E-04	9.3241E-05	7.4646E-06	6.1218E-04	1.1164E-04	2.5647E-04	**1.1598E-04**
$Dywp_{1}$	5.6108E-05	3.7268E-05	4.4002E-06	2.6369E-04	4.9606E-05	1.0530E-04	**5.1457E-05**
$Dywp_{25}$	5.5868E-05	3.7180E-05	4.3633E-06	2.6333E-04	4.9225E-05	1.0494E-04	**5.1246E-05**
EMF (Hunter/Gatherer Area, Current Exposure Grid, all years, 3840 grid points assessed)							
Specie	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**	**Median**	**90th Percentile**	**95% UCL of the Median**
Cyv	7.4881E-03	4.8200E-03	8.2865E-04	3.3728E-02	6.8843E-03	1.3571E-02	**7.0381E-03**
Cyp_{1}	9.1450E-03	5.4523E-03	1.1937E-03	3.7666E-02	8.5883E-03	1.6124E-02	**8.7792E-03**
$Cyp_{2.5}$	8.6163E-03	5.2281E-03	1.0844E-03	3.6361E-02	8.0497E-03	1.5255E-02	**8.2292E-03**
Dydv	2.4202E-04	1.3560E-04	3.6796E-05	9.9748E-04	2.3154E-04	4.1033E-04	**2.3676E-04**
$Dydp_{1}$	1.4988E-05	8.6285E-06	2.0798E-06	6.4428E-05	1.4240E-05	2.5770E-05	**1.4515E-05**
$Dydp_{2.5}$	5.7652E-05	3.5855E-05	7.2208E-06	2.4924E-04	5.3234E-05	1.0238E-04	**5.4570E-05**
Dywv	1.3884E-04	9.8282E-05	9.8594E-06	7.1871E-04	1.2111E-04	2.6845E-04	**1.2581E-04**
$Dywp_{1}$	6.0936E-05	3.9799E-05	5.0738E-06	2.8585E-04	5.5614E-05	1.1398E-04	**5.7560E-05**
$Dywp_{2.5}$	6.0493E-05	3.9615E-05	5.0067E-06	2.8439E-04	5.5160E-05	1.1326E-04	**5.7140E-05**

Table B-3 Basic Statistical Quantities for Dispersed Species, by Source and Receptor Exposure Grid[1]

Specie	Mean	Standard Deviation	Minimum	Maximum	Median	90th Percentile	95% UCL of the Median
PT Facility (Hunter/Gatherer Area, Future Exposure Grid, all years, 6900 grid points assessed)							
Cyv	7.9591E-03	6.3403E-03	7.0932E-04	7.0183E-02	6.5709E-03	1.4644E-02	**6.6745E-03**
Cyp_{1}	8.7337E-03	6.4768E-03	9.0804E-04	7.0976E-02	7.4228E-03	1.5565E-02	**7.5168E-03**
$Cyp_{2.5}$	8.5178E-03	6.4448E-03	8.5478E-04	7.0773E-02	7.1723E-03	1.5309E-02	**7.2676E-03**
Dydv	2.8309E-04	2.3367E-04	3.1542E-05	2.7374E-03	2.2410E-04	5.1506E-04	**2.2745E-04**
$Dydp_{1}$	1.6078E-05	1.3660E-05	1.6572E-06	1.8240E-04	1.2801E-05	2.9504E-05	**1.3044E-05**
$Dydp_{2.5}$	6.0441E-05	5.1645E-05	5.7260E-06	5.2788E-04	4.7963E-05	1.1314E-04	**4.8496E-05**
Dywv	2.3886E-04	3.0434E-04	7.6598E-06	5.7496E-03	1.7275E-04	4.6656E-04	**1.7625E-04**
$Dywp_{1}$	9.5564E-05	1.0428E-04	4.3296E-06	1.7834E-03	7.2936E-05	1.8178E-04	**7.4472E-05**
$Dywp_{2.5}$	9.5331E-05	1.0423E-04	4.2943E-06	1.7830E-03	7.2709E-05	1.8140E-04	**7.4223E-05**
LAW Facility (Hunter/Gatherer Area, Future Exposure Grid, all years, 6900 grid points assessed)							
Specie	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**	**Median**	**90th Percentile**	**95% UCL of the Median**
Cyv	8.1017E-03	6.1899E-03	6.8621E-04	6.5464E-02	6.8601E-03	1.4617E-02	**6.9470E-03**
Cyp_{1}	8.9080E-03	6.3245E-03	8.8472E-04	6.6430E-02	7.7633E-03	1.5598E-02	**7.8347E-03**
$Cyp_{2.5}$	8.6824E-03	6.2942E-03	8.3161E-04	6.6172E-02	7.4954E-03	1.5339E-02	**7.5615E-03**
Dydv	2.8784E-04	2.2931E-04	3.1785E-05	2.5489E-03	2.3114E-04	5.1599E-04	**2.3527E-04**
$Dydp_{1}$	1.6368E-05	1.3305E-05	1.6258E-06	1.7386E-04	1.3313E-05	2.9785E-05	**1.3497E-05**
$Dydp_{2.5}$	6.1549E-05	5.0416E-05	5.5765E-06	5.1915E-04	4.9942E-05	1.1391E-04	**5.0518E-05**
Dywv	2.4025E-04	3.0812E-04	8.1439E-06	6.0410E-03	1.7358E-04	4.6471E-04	**1.7676E-04**
$Dywp_{1}$	9.6243E-05	1.0581E-04	4.5623E-06	1.8821E-03	7.4212E-05	1.8088E-04	**7.5466E-05**
$Dywp_{2.5}$	9.6003E-05	1.0575E-04	4.5260E-06	1.8817E-03	7.3955E-05	1.8045E-04	**7.5235E-05**
HLW Facility (Hunter/Gatherer Area, Future Exposure Grid, all years, 6900 grid points assessed)							
Specie	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**	**Median**	**90th Percentile**	**95% UCL of the Median**
Cyv	8.5786E-03	6.5133E-03	6.8584E-04	6.2221E-02	7.1983E-03	1.5726E-02	**7.2886E-03**
Cyp_{1}	9.4957E-03	6.6847E-03	8.9374E-04	6.3308E-02	8.2194E-03	1.6879E-02	**8.3114E-03**
$Cyp_{2.5}$	9.2357E-03	6.6439E-03	8.3755E-04	6.3011E-02	7.9020E-03	1.6566E-02	**7.9921E-03**
Dydv	3.0277E-04	2.4178E-04	3.1968E-05	2.4518E-03	2.4135E-04	5.5127E-04	**2.4557E-04**
$Dydp_{1}$	1.7346E-05	1.3915E-05	1.6389E-06	1.5890E-04	1.4027E-05	3.1760E-05	**1.4230E-05**
$Dydp_{2.5}$	6.5318E-05	5.3057E-05	5.6150E-06	4.7518E-04	5.2653E-05	1.2065E-04	**5.3277E-05**
Dywv	2.4319E-04	3.0519E-04	7.4646E-06	6.3138E-03	1.7714E-04	4.7069E-04	**1.8017E-04**
$Dywp_{1}$	9.7850E-05	1.0555E-04	4.4002E-06	2.0153E-03	7.5363E-05	1.8645E-04	**7.6957E-05**
$Dywp_{2.5}$	9.7574E-05	1.0549E-04	4.3633E-06	2.0148E-03	7.5086E-05	1.8607E-04	**7.6664E-05**
EMF (Hunter/Gatherer Area, Future Exposure Grid, all years, 6900 grid points assessed)							
Specie	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**	**Median**	**90th Percentile**	**95% UCL of the Median**
Cyv	1.3515E-02	1.3135E-02	8.2865E-04	1.8567E-01	1.0486E-02	2.7007E-02	**1.0622E-02**
Cyp_{1}	1.5495E-02	1.3715E-02	1.1937E-03	1.8937E-01	1.2548E-02	2.9840E-02	**1.2753E-02**
$Cyp_{2.5}$	1.4884E-02	1.3544E-02	1.0844E-03	1.8830E-01	1.1888E-02	2.8929E-02	**1.2099E-02**
Dydv	4.4527E-04	4.5578E-04	3.6796E-05	7.0770E-03	3.3315E-04	8.6726E-04	**3.3870E-04**
$Dydp_{1}$	2.6909E-05	2.7407E-05	2.0798E-06	4.7307E-04	2.0539E-05	5.2104E-05	**2.0956E-05**
$Dydp_{2.5}$	1.0359E-04	1.0397E-04	7.2208E-06	1.4665E-03	7.8829E-05	2.0557E-04	**8.0120E-05**
Dywv	2.6490E-04	3.9215E-04	9.8594E-06	8.7459E-03	1.8233E-04	5.0797E-04	**1.8576E-04**
$Dywp_{1}$	1.0806E-04	1.3604E-04	5.0738E-06	3.4295E-03	7.8529E-05	2.0404E-04	**7.9714E-05**
$Dywp_{2.5}$	1.0754E-04	1.3591E-04	5.0067E-06	3.4289E-03	7.8015E-05	2.0340E-04	**7.9193E-05**

[1] Values shown in bold font indicate inputs to the risk assessment. Refer to Sections B.5 and B.6.

Figure B-8 Comparison of Mean Concentration and Deposition Rates

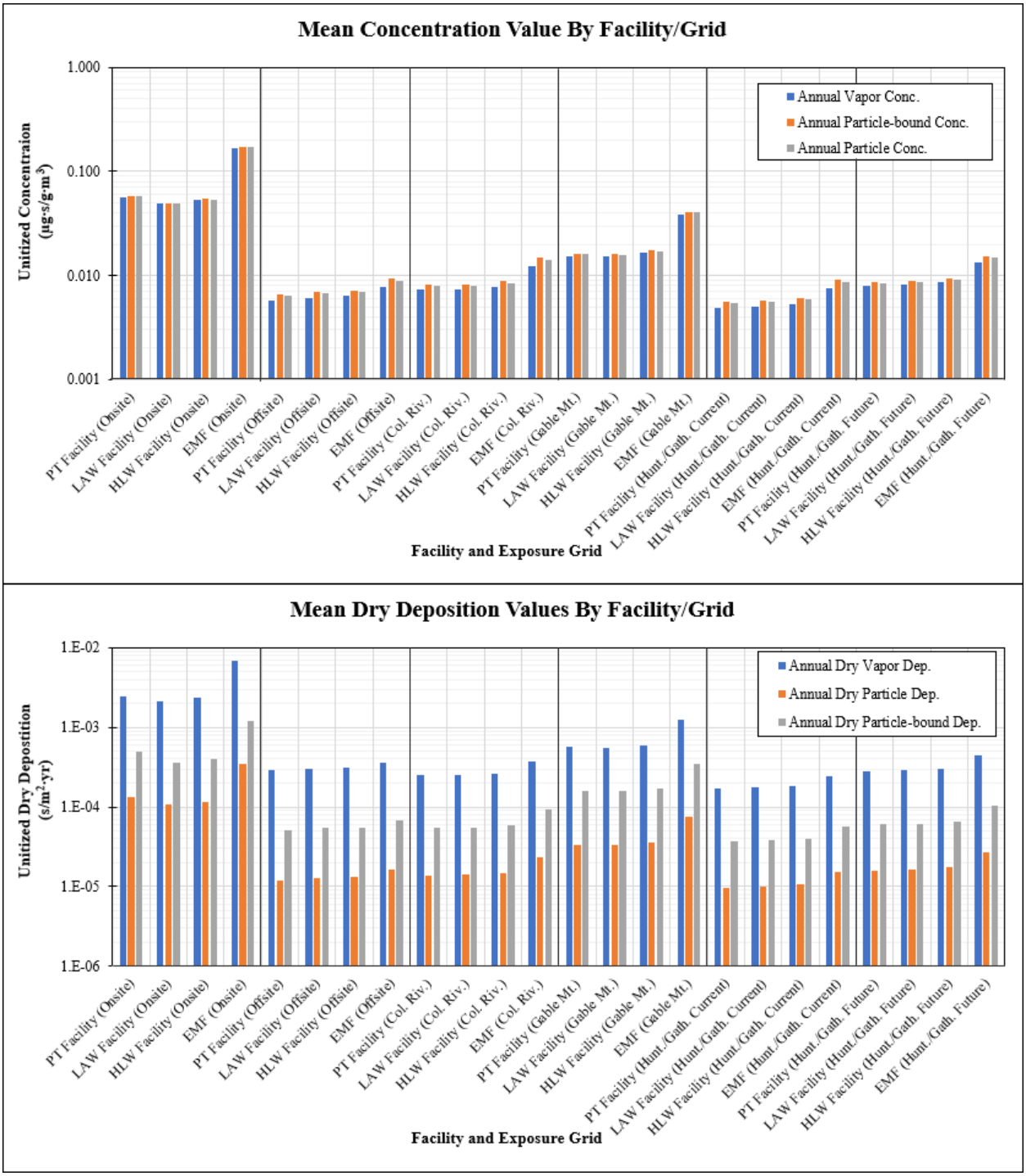
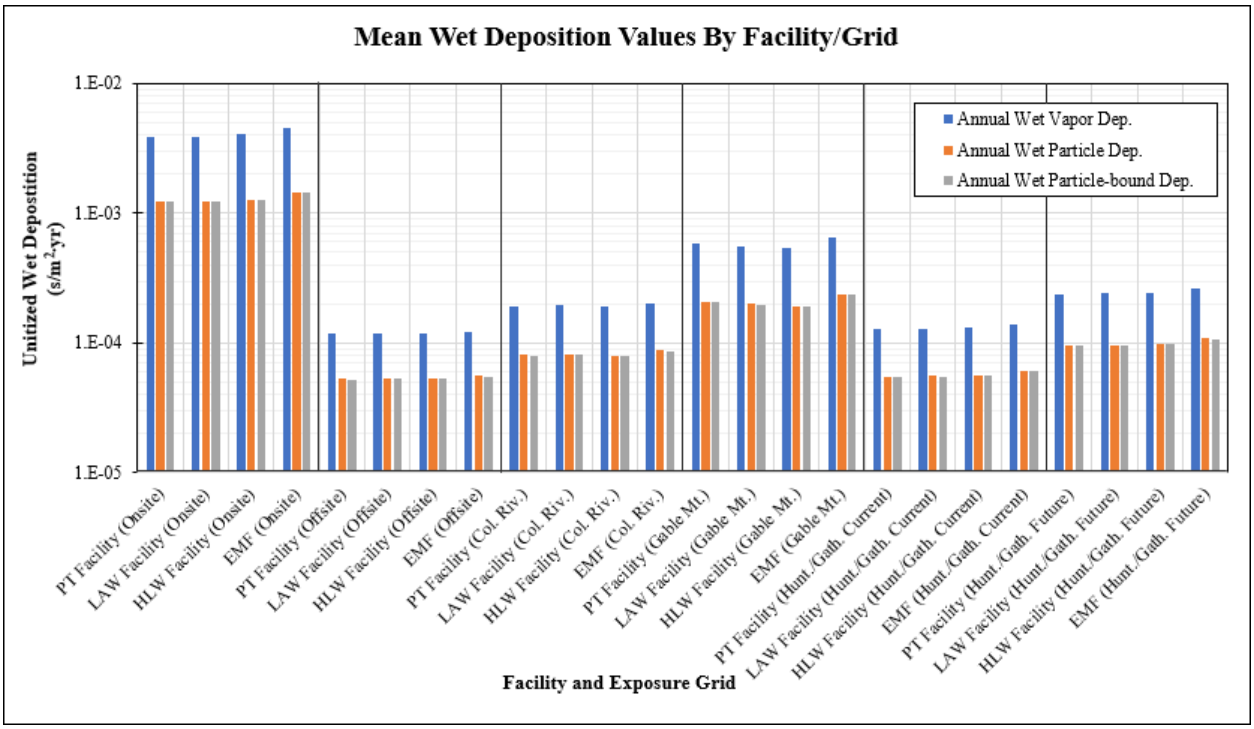


Figure B-8 Comparison of Mean Concentration and Deposition Rates cont.



B.5 Outputs (Unitized Results) Used for Human Health Risk Assessment

Since it is possible for air concentrations of COPCs to significantly exceed the annual average concentration for a brief period of time, resulting in acute effects to receptor populations via inhalation, the data used to assess acute exposure is the highest one-hour average concentration. This includes unitized results for both vapor and particle concentrations.

For chronic exposures (annual average concentration and deposition), as explained above, CALPUFF results indicate a high degree of non-normality in the data distribution with multiple outliers. This is of concern in large receptor exposure grids where the probability of exposure at a single discrete location is less probable than at a smaller, localized receptor grid. Thus, the exposure point concentration values for input to the environmental risk assessment are the 90th percentile values for large grids, namely the offsite receptor grid. For smaller receptor grids (onsite maximum, Columbia River, and Gable Mountain) the maximum discrete values for air concentration and deposition (as applicable to the exposure scenario) are used as a method of bounding exposures at those locations while simplifying data selection. For the very large hunter/gatherer areas (where average exposures are of concern) the distribution-free 95 % upper confidence limit of the median provides a sufficiently conservative estimate of air concentration and deposition. This approach ensures sufficient conservatism without misrepresenting potential exposures due to a highly improbable exposure to extreme deposition and air concentrations.

In summary, the following CALPOST results serve as inputs to the risk assessment for chronic human exposures:

- Onsite maximum, Columbia River, and Gable Mountain receptor grids: maximum discrete air concentration and deposition values (as applicable to the exposure scenario, without regard to multiple locations) of all modeled species (all years/grid points)

- Offsite receptor grid: 90th percentile of the air concentration and deposition values of all modeled species (all years/grid points)
- Hunter/gatherer receptor grids: 95 % upper confidence limit of the median (distribution-free) of air concentration and deposition values of all modeled species (all years/grid points)

Results of the CALPUFF modeling for use in risk assessment are presented below.

B.5.1.1 1-Hr Maximum Acute Air Concentrations

The acute unitized air concentration results, highest one-hour average air concentrations are presented in Table B-4.

Table B-4 Acute Air Hourly Maximum Concentrations (µg·s/g·m^3)

Emissions Source	Vapor Phase, *Chv*	1-micron Particle Phase, Chp_1	2.5-micron Particle Phase, $Chp_{2.5}$
PT Facility	38.699	38.749	38.735
LAW Facility	44.266	44.295	44.288
HLW Facility	34.635	34.637	34.637
EMF	99.100	99.389	99.320

B.5.1.2 Annual Average Air Concentrations

The annual average unitized air concentration results for human health assessment are provided in Table B-5.

Table B-5 Human Health Assessment Unitized Annual Average Air Concentrations (µg·s/g·m^3)

PT Facility			
Exposure Grid	**Vapor Phase, *Cyv***	**1-micron Particle Phase, Cyp_1**	**2.5-micron Particle Phase, $Cyp_{2.5}$**
Onsite	2.0756E-01	2.0837E-01	2.0816E-01
Offsite	8.0438E-03	8.9110E-03	8.6742E-03
Columbia River	9.6760E-03	1.0484E-02	1.0235E-02
Gable Mountain	2.7324E-02	2.8312E-02	2.8109E-02
Hunter/Gatherer Area (current)	5.1591E-03	5.9261E-03	5.7077E-03
Hunter/Gatherer Area (future)	6.6745E-03	7.5168E-03	7.2676E-03
LAW Facility			
Exposure Grid	**Vapor Phase, *Cyv***	**1-micron Particle Phase, Cyp_1**	**2.5-micron Particle Phase, $Cyp_{2.5}$**
Onsite	2.4567E-01	2.4659E-01	2.4641E-01
Offsite	8.5054E-03	9.3819E-03	9.1411E-03
Columbia River	9.5695E-03	1.0442E-02	1.0193E-02
Gable Mountain	2.7028E-02	2.8086E-02	2.7856E-02
Hunter/Gatherer Area (current)	5.4357E-03	6.2305E-03	6.0133E-03
Hunter/Gatherer Area (future)	6.9470E-03	7.8347E-03	7.5615E-03

Table B-5 Human Health Assessment Unitized Annual Average Air Concentrations (µg·s/g·m^3)

HLW Facility			
Exposure Grid	**Vapor Phase, *Cyv***	**1-micron Particle Phase, *Cyp$_1$***	**2.5-micron Particle Phase, *Cyp$_{2.5}$***
Onsite	1.1062E-01	1.1157E-01	1.1137E-01
Offsite	8.9004E-03	9.8893E-03	9.6327E-03
Columbia River	1.0004E-02	1.1012E-02	1.0673E-02
Gable Mountain	3.0122E-02	3.1362E-02	3.1097E-02
Hunter/Gatherer Area (current)	5.5930E-03	6.4931E-03	6.2349E-03
Hunter/Gatherer Area (future)	7.2886E-03	8.3114E-03	7.9921E-03
EMF			
Exposure Grid	**Vapor Phase, *Cyv***	**1-micron Particle Phase, *Cyp$_1$***	**2.5-micron Particle Phase, *Cyp$_{2.5}$***
Onsite	6.0905E-01	6.1215E-01	6.1119E-01
Offsite	1.1426E-02	1.3467E-02	1.2824E-02
Columbia River	2.1600E-02	2.4692E-02	2.3511E-02
Gable Mountain	6.8630E-02	7.1679E-02	7.0777E-02
Hunter/Gatherer Area (current)	7.0381E-03	8.7792E-03	8.2292E-03
Hunter/Gatherer Area (future)	1.0622E-02	1.2753E-02	1.2099E-02

B.5.1.3 Annual Average Dry Deposition Rates

The annual average unitized dry deposition results for human health assessment are provided in Table B-6.

Table B-6 Human Health Assessment Unitized Annual Average Dry Deposition (s/m^2·yr)

PT Facility			
Exposure Grid	**Vapor Phase, *Dydv***	**1-micron Particle Phase, *Dydp$_1$***	**2.5-micron Particle Phase, *Dydp$_{2.5}$***
Onsite	8.1751E-03	6.9035E-04	3.5636E-03
Offsite	3.9865E-04	1.5953E-05	7.7765E-05
Columbia River	3.4131E-04	1.9860E-05	1.0285E-04
Gable Mountain	9.0527E-04	5.1798E-05	5.4746E-04
Hunter/Gatherer Area (current)	1.7883E-04	1.0179E-05	3.7903E-05
Hunter/Gatherer Area (future)	2.2745E-04	1.3044E-05	4.8496E-05
LAW Facility			
Exposure Grid	**Vapor Phase, *Dydv***	**1-micron Particle Phase, *Dydp$_1$***	**2.5-micron Particle Phase, *Dydp$_{2.5}$***
Onsite	9.7437E-03	7.3564E-04	2.2168E-03
Offsite	4.2101E-04	1.6781E-05	8.2243E-05
Columbia River	3.4617E-04	1.9602E-05	1.0627E-04
Gable Mountain	9.0483E-04	5.4712E-05	6.0880E-04
Hunter/Gatherer Area (current)	1.8659E-04	1.0677E-05	3.9925E-05
Hunter/Gatherer Area (future)	2.3527E-04	1.3497E-05	5.0518E-05

Table B-6 Human Health Assessment Unitized Annual Average Dry Deposition (s/m^2·yr)

HLW Facility			
Exposure Grid	**Vapor Phase, *Dydv***	**1-micron Particle Phase, *Dydp$_1$***	**2.5-micron Particle Phase, *Dydp$_{2.5}$***
Onsite	5.0401E-03	2.9668E-04	1.7083E-03
Offsite	4.2618E-04	1.7420E-05	8.4242E-05
Columbia River	3.5601E-04	2.0579E-05	1.0453E-04
Gable Mountain	9.8310E-04	5.8219E-05	6.1688E-04
Hunter/Gatherer Area (current)	1.9150E-04	1.1041E-05	4.1533E-05
Hunter/Gatherer Area (future)	2.4557E-04	1.4230E-05	5.3277E-05
EMF			
Exposure Grid	**Vapor Phase, *Dydv***	**1-micron Particle Phase, *Dydp$_1$***	**2.5-micron Particle Phase, *Dydp$_{2.5}$***
Onsite	1.9957E-02	1.1518E-03	4.3040E-03
Offsite	4.8941E-04	2.2290E-05	1.0107E-04
Columbia River	5.8373E-04	3.9429E-05	1.6751E-04
Gable Mountain	2.0501E-03	1.1597E-04	8.9906E-04
Hunter/Gatherer Area (current)	2.3676E-04	1.4515E-05	5.4570E-05
Hunter/Gatherer Area (future)	3.3870E-04	2.0956E-05	8.0120E-05

B.5.1.4 Annual Average Wet Deposition Rates

The annual average unitized wet deposition results for human health assessment are provided in Table B-7.

Table B-7 Human Health Assessment Unitized Annual Average Wet Deposition (s/m^2·yr)

PT Facility			
Exposure Grid	**Vapor Phase, *Dywv***	**1-micron Particle Phase, *Dywp$_1$***	**2.5-micron Particle Phase, *Dywp$_{2.5}$***
Onsite	3.3463E-02	9.9934E-03	9.9931E-03
Offsite	1.7678E-04	7.9982E-05	7.9676E-05
Columbia River	5.1432E-04	2.6417E-04	2.6386E-04
Gable Mountain	1.6710E-03	5.6894E-04	5.6853E-04
Hunter/Gatherer Area (current)	1.1377E-04	5.0508E-05	5.0253E-05
Hunter/Gatherer Area (future)	1.7625E-04	7.4472E-05	7.4223E-05
LAW Facility			
Exposure Grid	**Vapor Phase, *Dywv***	**1-micron Particle Phase, *Dywp$_1$***	**2.5-micron Particle Phase, *Dywp$_{2.5}$***
Onsite	2.8603E-02	8.7112E-03	8.7109E-03
Offsite	1.8084E-04	8.1347E-05	8.1025E-05
Columbia River	5.2331E-04	2.5282E-04	2.5251E-04
Gable Mountain	1.6601E-03	5.7515E-04	5.7471E-04
Hunter/Gatherer Area (current)	1.1558E-04	5.0909E-05	5.0770E-05
Hunter/Gatherer Area (future)	1.7676E-04	7.5466E-05	7.5235E-05

Table B-7 Human Health Assessment Unitized Annual Average Wet Deposition (s/m^2·yr)

HLW Facility			
Exposure Grid	**Vapor Phase, *Dywv***	**1-micron Particle Phase, *Dywp$_1$***	**2.5-micron Particle Phase, *Dywp$_{2.5}$***
Onsite	3.3274E-02	1.0352E-02	1.0352E-02
Offsite	1.7851E-04	8.0915E-05	8.0552E-05
Columbia River	5.4270E-04	2.6207E-04	2.6170E-04
Gable Mountain	1.7509E-03	6.0451E-04	6.0398E-04
Hunter/Gatherer Area (current)	1.1598E-04	5.1457E-05	5.1246E-05
Hunter/Gatherer Area (future)	1.8017E-04	7.6957E-05	7.6664E-05
EMF			
Exposure Grid	**Vapor Phase, *Dywv***	**1-micron Particle Phase, *Dywp$_1$***	**2.5-micron Particle Phase, *Dywp$_{2.5}$***
Onsite	5.0376E-02	1.5182E-02	1.5181E-02
Offsite	1.8443E-04	8.5254E-05	8.4665E-05
Columbia River	6.2350E-04	2.5967E-04	2.5888E-04
Gable Mountain	1.9504E-03	6.5623E-04	6.5516E-04
Hunter/Gatherer Area (current)	1.2581E-04	5.7560E-05	5.7140E-05
Hunter/Gatherer Area (future)	1.8576E-04	7.9714E-05	7.9193E-05

B.6 Outputs (Unitized Results) Used for Screening-Level Ecological Risk Assessment

The following serve as inputs to the screening level ecological risk assessment:

- Onsite receptor grid (terrestrial receptors): 90th percentile of the air concentration and deposition values of all modeled species (all years/grid points)
- Columbia River receptor grid (aquatic receptors): maximum discrete air concentration and deposition values (as applicable to the exposure scenario, without regard to multiple locations) of all modeled species (all years/grid points)

The terrestrial screening level ecological risk assessment has a “high-end” ecological exposure assessment at the 90th percentile, instead of a “bounding” ecological exposure assessment at the ground maximum. The terrestrial exposure grid consists of a 2.4 km by 2.4 km area directly adjacent to the WTP fence line, and represents an area of approximately 5.2 km^2. Relative to the home range of the trophic level 4 receptors, exposure at a single discrete location is not probable. The high-end approach to assessment is also a reasonable and conservative screening approach, since the terrestrial receptors generally populate the riparian corridor and are generally transient, if present at all, in the Hanford industrial zone in which the onsite exposure grid is located.

Results of the CALPUFF modeling for use in risk assessment are presented below.

B.6.1.1 Central Plateau

The annual average unitized air concentration results for ecological assessment of terrestrial receptors are provided in Table B-8.

Table B-8 Ecological Assessment Annual Average Air Concentrations (µg·s/g·m^3)

Source	Vapor Phase, *Cyv*	1-micron Particle Phase, Cyp_1	2.5-micron Particle Phase, $Cyp_{2.5}$
PT Facility	9.6959E-02	9.7851E-02	9.7630E-02
LAW Facility	8.0695E-02	8.1473E-02	8.1267E-02
HLW Facility	8.7800E-02	8.8838E-02	8.8575E-02
EMF	2.4535E-01	2.4798E-01	2.4733E-01

The annual average unitized dry deposition results for ecological assessment are provided in Table B-9.

Table B-9 Ecological Assessment Annual Average Dry Deposition (s/m^2·yr)

Source	Vapor Phase, *Dydv*	1-micron Particle Phase, $Dydp_1$	2.5-micron Particle Phase, $Dydp_{2.5}$
PT Facility	3.9098E-03	2.4109E-04	9.4179E-04
LAW Facility	3.4206E-03	1.8279E-04	5.7793E-04
HLW Facility	3.9381E-03	1.9668E-04	6.3372E-04
EMF	1.0241E-02	5.1224E-04	1.7753E-03

The annual average unitized wet deposition results for ecological assessment are provided in Table B-10.

Table B-10 Ecological Assessment Annual Average Wet Deposition (s/m^2·yr)

Source	Vapor Phase, *Dwdv*	1-micron Particle Phase, $Dwdp_1$	2.5-micron Particle Phase, $Dwdp_{2.5}$
PT Facility	7.9024E-03	2.4652E-03	2.4649E-03
LAW Facility	7.9691E-03	2.4950E-03	2.4946E-03
HLW Facility	8.2801E-03	2.5833E-03	2.5830E-03
EMF	9.6675E-03	3.0152E-03	3.0147E-03

B.6.1.2 Columbia River

The annual average unitized air concentration results for ecological assessment of aquatic receptors are provided in Table B-11.

Table B-11 Ecological Assessment Annual Average Air Concentrations (µg·s/g·m^3)

Source	Vapor Phase, *Cyv*	1-micron Particle Phase, Cyp_1	2.5-micron Particle Phase, $Cyp_{2.5}$
PT Facility	9.6760E-03	1.0484E-02	1.0235E-02
LAW Facility	9.5695E-03	1.0442E-02	1.0193E-02
HLW Facility	1.0004E-02	1.1012E-02	1.0673E-02
EMF	2.1600E-02	2.4692E-02	2.3511E-02

The annual average unitized dry deposition results for ecological assessment are provided in Table B-12.

Table B-12 Ecological Assessment Annual Average Dry Deposition (s/m^2·yr)

Source	Vapor Phase, *Dydv*	1-micron Particle Phase, $Dydp_1$	2.5-micron Particle Phase, $Dydp_{2.5}$
PT Facility	3.4131E-04	1.9860E-05	1.0285E-04
LAW Facility	3.4617E-04	1.9602E-05	1.0627E-04
HLW Facility	3.5601E-04	2.0579E-05	1.0453E-04
EMF	5.8373E-04	3.9429E-05	1.6751E-04

The annual average unitized wet deposition results for ecological assessment are provided in Table B-13.

Table B-13 Ecological Assessment Annual Average Wet Deposition (s/m^2·yr)

Source	Vapor Phase, *Dwdv*	1-micron Particle Phase, $Dwdp_1$	2.5-micron Particle Phase, $Dwdp_{2.5}$
PT Facility	5.1432E-04	2.6417E-04	2.6386E-04
LAW Facility	5.2331E-04	2.5282E-04	2.5251E-04
HLW Facility	5.4270E-04	2.6207E-04	2.6170E-04
EMF	6.2350E-04	2.5967E-04	2.5888E-04

B.6.2 References

B.6.2.1 Project Documents

CCN 057108, *Discuss and Resolve a Number of Outstanding Risk Assessment Issues in the WTP Risk Assessment Work Plan (RAWP)*. 11 April 2005.

CCN 194345, *Modeling Particle-bound Constituents in CalPuff*. 17 December 2009.

24590-WTP-RPT-ENV-08-001, Rev 3, *Hanford Tank Waste Treatment and Immobilization Plant Risk Assessment Air Quality Modeling Protocol*.

WA7890008967. *Hanford Facility Resource Conservation and Recovery Act (RCRA) Permit, Dangerous Waste Portion for the Treatment, Storage, and Disposal of Dangerous Waste, Part III, Operating Unit 10, (Waste Treatment and Immobilization Plant)*.

B.6.2.2 Codes and Standards

40 CFR 51, *Guideline on Air Quality Models*. Code of Federal Regulations.

B.6.2.3 Other Documents

EPA530-R-05-006. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, Final. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC.

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Appendix C

Exposure Point Concentrations and Levels, and Risks for All Receptors from Risk Drivers

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Acronyms

COPC	constituents of potential concern
DFLAW	direct feed to the LAW Facility
EPC	exposure point concentrations
HHRA	human health risk assessment
LAW	Low-Activity Waste
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyls
RAWP	Risk Assessment Work Plan
SLERA	screening level ecological risk assessment
WTP	Hanford Tank Waste Treatment and Immobilization Plant

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Appendix C
Exposure Point Concentrations and Levels, and Risks for All Receptors from Risk Drivers

This appendix presents exposure and risk estimates for risk drivers identified in the main body of this report for all human and ecological receptors. Risk drivers are those constituents of potential concern (COPC) with risk and hazard quotient values that exceed 10% of a pertinent threshold for one or more exposure scenarios. The risk drivers include dibenz[a,h]anthracene and polychlorinated biphenyls (PCB). However, note that constituents identified as risk drivers only apply to a portion of the receptors assessed, as other receptors are not exposed to as great a degree. This appendix provides exposure point concentrations (EPC) for a risk driver for all pathways, regardless of whether or not a scenario did not present risk above a threshold.

This appendix presents EPCs for the direct feed to the Low-Activity Waste (LAW) Facility (DFLAW) operating configuration first, then the EPCs of the baseline Hanford Tank Waste Treatment and Immobilization Plant (WTP) operating configuration, followed by human health exposure levels of the two operating configurations. The risk characterization is then presented for each operating configuration, including receptor risk by exposure pathway and the individual contribution of risk drivers for each receptor (even if the COPC is not a risk driver for every receptor). Later portions of the appendix present similar data for the ecological assessment performed for each operating configuration, with a presentation of the EPCs, exposure levels and dose to ecological receptors for risk drivers, and risk characterization for ecological risk drivers (even if the COPC is not a risk driver for every receptor).

Results for dibenz[a,h]anthracene (in the DFLAW and baseline WTP operating configurations) and PCBs (in the baseline WTP operating configuration) for all human receptors are presented in Sections C.1 through C.6. Dibenz[a,h]anthracene[1] was above the risk driver threshold (cancer risk ≥ 1.0E-06) for the resident subsistence farmer adult in current exposure scenario, and only from the DFLAW operating configuration. However, the PRA uses a single PAH or the class to develop a risk driver because neither presents an incremental lifetime cancer risk greater than or equal to 1E-06 for any scenario using the latest BaP oral slope factor and inhalation unit risk value. The largest updated cancer risk for the PAH class in the PRA is 2.0E-07 for the adult resident subsistence farmer scenario. If RAWP Section 7.2.2.5 is followed explicitly, this reduces the PAHs to BaP plus six others, the class cancer risk decreases further to 1.9E-07. Therefore, even with a PAH class, there are no risk drivers for the DFLAW operating configuration.

Also provided are the results for the two resident subsistence American Indian exposure scenarios discussed in Appendix D; referred to as Scenario #1 and Scenario #2 (see the Risk Assessment Work Plan [RAWP] for details about the scenarios). For Scenario #2, dibenz[a,h]anthracene was a risk driver for the subsistence American Indian resident adult for the DFLAW and baseline WTP operating configuration (current timeframe). For the baseline WTP operating configuration, PCBs hazards above the non-cancer risk driver threshold (hazard index ≥ 0.025) for the resident subsistence American Indian adult child for both scenarios, while PCBs only exceed the cancer risk driver threshold for the resident subsistence American Indian adult scenario #1 (current timeframe).

Section 4 of the main body presents the applicable *ESQ*s for:

[1] Note that dibenz[a,h]anthracene is a polycyclic aromatic hydrocarbon, and thus related *EC*s and doses for chronic exposures are adjusted by applying a toxicity equivalency factor (TEF) of 0.1 (WAC 173-340-900, see RAWP Section 7.2.2.5). The media EPCs presented below do not reflect concentrations adjusted by the TEF.

- Three risk drivers for the DFLAW operating configuration: benzo(b)fluoranthene, benzo(k)fluoranthene, and benzo(a)anthracene
- Six risk drivers for the baseline WTP operating configuration: PCBs, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)anthracene, 5-methylchrysene, and 4,4'-DDE.

Sections C.7 through C.11 of this appendix present the EPCs corresponding to the Central Plateau and Columbia River, as well as the corresponding daily dose and *ESQ* for all ecological receptors (including those cases for which the COPC is not a risk driver for a particular receptor).

A complete list of exposure levels can be found in the project support files folder. The RAWP should be consulted for details on assumptions and methodologies used in the assessment.

C.1 Human Health Exposure Point Concentrations for the DFLAW Operating Configuration

The discussions which follow provide the EPCs for dibenz[a,h]anthracene for the DFLAW operating configuration. Results are presented for each medium and food item, with values shown as applicable to the receptor's exposure scenario, regardless of whether the COPC was a risk driver for the given scenario.

C.1.1 Air Concentration for Inhalation

One-hour and annual air concentrations are presented for the DFLAW operating configuration in Table C-1. The concentration is used to evaluate both acute and chronic inhalation exposures for each of the worker, resident, farmer, and fisher scenarios. Air inhalation exposures only occur in the current timeframe (i.e., during the DFLAW operating period).

Table C-1 Dibenz[a,h]anthracene—Inhalation EPCs for the DFLAW Operating Configuration

One-Hour *EC* (µg/m^3)	Annual Onsite *EC* (µg/m^3)	Annual Offsite *EC* (µg/m^3)	Annual Gable Mt. *EC* (µg/m^3)
5.5E-03	3.1E-05	1.1E-06	3.5E-06

C.1.2 Soil Exposure

Current and future EPCs for the DFLAW operating configuration are presented for soil in Table C-2 and Table C-3, respectively. The EPCs vary depending on (1) the exposure duration and exposure location, (2) the depth of the soil, and (3) the timing of the exposure with respect to facility operation.

- For carcinogenic COPCs like dibenz(a,h)anthracene, the soil concentration (*Cs*) for the child is higher than the concentration for the adult because the child has a shorter exposure duration over which *Cs* is averaged (6 years versus 20 to 70 years). Since DFLAW operates for 10 years, the child exposure occurs entirely during plant operations, whereas the adult exposures occur primarily during years of non-operations.
- Different soil EPCs are used for different pathways, so *Cs* depends on the soil depth over which the concentration is averaged; therefore, the surface soil *Cs* (averaged over 2 cm) is greater than

the untilled soil *Cs* (averaged over 15 cm); *Cs* for tilled soil (averaged over 20 cm) is the lowest of the three.

- EPCs for the current land use are greater than those for the future land use, which begins after the operation of the WTP (either DFLAW or baseline configuration) ceases. At this point, deposition of COPCs to the soil ends but COPC loss from the soil (e.g., chemical degradation) continues, so *Cs* averaged over exposure during the future land use is lower.

Table C-2 Dibenz[a,h]anthracene, Current Soil EPCs for the DFLAW Operating Configuration

Receptor	Location	Surface Soil (2 cm) (mg/kg)	Untilled Soil (15 cm) (mg/kg)	Tilled Soil (20 cm) (mg/kg)
Hanford Site Industrial Worker - on site/workday	Onsite	1.1E-04	n/a	n/a
Hanford Site Industrial Worker - off site	Offsite	1.6E-06	2.1E-07	1.6E-07
Hanford Site Industrial Worker - off site/retired	Offsite	2.1E-06	2.9E-07	2.1E-07
Resident Adult Resident Subsistence Fisher Adult	Offsite	1.1E-06	1.5E-07	1.1E-07
Resident Subsistence Farmer Adult	Offsite	8.2E-07	1.1E-07	8.2E-08
Resident Child Resident Subsistence Farmer Child Resident Subsistence Fisher Child Resident Subsistence American Indian Child #1 Resident Subsistence American Indian Child #2	Offsite	2.7E-06	3.6E-07	2.7E-07
Resident Subsistence American Indian Adult #1 Resident Subsistence American Indian Adult #2	Offsite	4.7E-07	6.3E-08	4.7E-08
Resident Subsistence American Indian Adult #1	Gable Mt.	3.2E-06	n/a	n/a
Resident Subsistence American Indian Child #1	Gable Mt.	1.8E-05	n/a	n/a

"n/a" indicates value is not applicable at the location or for the receptor shown.

Table C-3 Dibenz[a,h]anthracene, Future Soil EPCs for the DFLAW Operating Configuration

Receptor	Location	Surface Soil (2 cm) (mg/kg)	Untilled Soil (15 cm) (mg/kg)	Tilled Soil (20 cm) (mg/kg)
Resident Subsistence American Indian Adult #1 Resident Subsistence American Indian Adult #2	Offsite	1.6E-07	2.2E-08	1.6E-08
Resident Subsistence Farmer Adult	Offsite	2.8E-07	3.8E-08	2.9E-08
Resident Adult, Resident Subsistence Fisher Adult	Offsite	3.8E-07	5.1E-08	3.8E-08
Hanford Site Industrial Worker - off site	Offsite	5.7E-07	7.6E-08	5.7E-08
Hanford Site Industrial Worker - off site/retired	Offsite	1.1E-06	1.4E-07	1.1E-07
Resident Child Resident Subsistence American Indian Child #1 Resident Subsistence American Indian Child #2 Resident Subsistence Farmer Child, Resident Subsistence Fisher Child	Offsite	1.5E-06	2.0E-07	1.5E-07
Resident Subsistence American Indian Adult #1	Gable Mt.	1.1E-06	n/a	n/a
Resident Subsistence American Indian Child #1	Gable Mt.	1.0E-05	n/a	n/a

Table C-3 Dibenz[a,h]anthracene, Future Soil EPCs for the DFLAW Operating Configuration

Receptor	Location	Surface Soil (2 cm) (mg/kg)	Untilled Soil (15 cm) (mg/kg)	Tilled Soil (20 cm) (mg/kg)
Hanford Site Industrial Worker - on site/workday	Onsite	3.8E-05	n/a	n/a

n/a indicates value is not applicable at the location or for the receptor shown.

C.1.3 Plant Exposure

EPCs are presented for produce in Table C-4 and Table C-5 for the current and future land uses, respectively. Domestic produce is evaluated assuming it grows in tilled soil at the offsite location (e.g., homegrown produce) that is 20 cm deep. Wild produce from the hunter/gatherer area is presumed to grow in untilled soil that is 15 cm deep. Since produce EPCs are dependent upon the COPC concentration in the air, COPC deposition flux, and the concentration in the soil, the EPCs vary by receptor scenario from the combination of different exposure durations, location, and timing. The EPCs presented below are organized by applicable receptor scenarios.

- Produce EPCs for children are higher than adults due to higher soil EPCs, as explained in Section C.1.2.
- Belowground produce concentrations are lower because the plant is not exposed to vapors and depositions from the atmosphere.
- EPCs for the future land use are lower because facility emissions have ended and therefore there are no contributions from vapor and deposition from the air, just uptake from soil.

Table C-4 Dibenz[a,h]anthracene, Current Produce EPCs for the DFLAW Operating Configuration

Receptor	Location	Aboveground (mg/kg)	Belowground (mg/kg)
Hanford Site Industrial Worker – off site	Offsite	1.1E-09	6.5E-11
Hanford Site Industrial Worker – off site/retired	Offsite	1.5E-09	8.7E-11
Resident Adult Resident Subsistence Fisher Adult	Offsite	7.4E-10	4.4E-11
Resident Subsistence Adult Farmer	Offsite	5.6E-10	3.3E-11
Resident Child Resident Subsistence Farmer Child Resident Subsistence Fisher Child Resident Subsistence American Indian Child #2	Offsite	1.9E-09	1.1E-10
Resident Subsistence American Indian Adult #2	Offsite	3.2E-10	1.9E-11
Resident Subsistence American Indian Adult #1 Resident Subsistence American Indian Adult #2	Hunter/ Gatherer Area	2.3E-10	1.4E-11
Resident Subsistence American Indian Child #1 Resident Subsistence American Indian Child #2	Hunter/ Gatherer Area	1.3E-09	8.1E-11

Table C-5 Dibenz[a,h]anthracene, Future Produce EPCs for the DFLAW Operating Configuration

Receptor	Location	Aboveground (mg/kg)	Belowground (mg/kg)
Resident Adult Resident Subsistence Fisher Adult	Offsite	2.6E-10	1.5E-11
Resident Subsistence Adult Farmer	Offsite	1.9E-10	1.2E-11
Resident Child Resident Subsistence Farmer Child Resident Subsistence Fisher Child Resident Subsistence American Indian Child #2	Offsite	1.0E-09	6.2E-11
Resident Subsistence American Indian Adult #2	Offsite	1.1E-10	6.6E-12
Resident Subsistence American Indian Adult #1 Resident Subsistence American Indian Adult #2	Hunter/Gatherer Area	1.1E-10	6.6E-12
Resident Subsistence American Indian Child #1 Resident Subsistence American Indian Child #2	Hunter/Gatherer Area	1.0E-09	6.2E-11

"n/a" indicates value is not applicable at the location or for the receptor shown.

C.1.4 Livestock and Game Exposure

Table C-6 presents EPCs for food consumed in the resident subsistence farmer scenario (i.e., beef, pork, chicken, eggs, and milk) and the resident subsistence American Indian scenarios (i.e., wild game, wild fowl, and wild eggs) for the current land use. Table C-7 presents EPCs for the same scenarios in future land uses. Livestock and game EPCs are dependent upon the concentrations in the silage, forage, grain, and wild plants consumed, plus a fraction attributed to incidental soil ingestion.

- Like other EPCs, the dibenzo(a,h)anthracene values vary by receptor due to the combination of exposure duration and location, and the values for uptake factors used to estimate the concentrations in each food item.
- For fowl and eggs, child EPCs are higher than adult EPCs due to higher produce EPCs that stem from higher concentrations in soil over the child exposure duration.
- EPCs for the future land use are lower because facility emissions have ended and therefore concentrations in plant material consumed by livestock and wild game solely stem from root transfer from soil.

Table C-6 Dibenz[a,h]anthracene, Current Livestock & Game EPCs for the DFLAW Operating Configuration

Receptor	Beef (mg/kg)	Milk (mg/kg)	Pork (mg/kg)	Chicken (mg/kg)	Egg (mg/kg)
Resident Subsistence Farmer Adult	4.7E-04	1.5E-04	3.9E-05	4.2E-10	2.4E-10
Resident Subsistence Farmer Child	4.7E-04	1.5E-04	3.9E-05	1.4E-09	7.9E-10

Receptor	Game (mg/kg) (a)	Wild Fowl (mg/kg)	Egg (mg/kg)
Resident Subsistence American Indian Adult #1	4.3E-05	1.3E-10	7.4E-11
Resident Subsistence American Indian Child #1	4.3E-05	7.6E-10	4.3E-10

Table C-6 Dibenz[a,h]anthracene, Current Livestock & Game EPCs for the DFLAW Operating Configuration

Receptor	Beef (mg/kg)	Chicken (mg/kg)	Game (mg/kg)	Wild Fowl (mg/kg)
Resident Subsistence American Indian Adult #2	4.7E-04	2.4E-10	4.3E-05	1.3E-10
Resident Subsistence American Indian Child #2	4.7E-04	1.4E-09	4.3E-05	7.6E-10

[(a)] Game organ concentration is 10× the value shown and accounts for 10% of the total game consumed by the resident subsistence American Indian, scenario 1 (refer to RAWP Table 7-7).

Table C-7 Dibenz[a,h]anthracene, Future Livestock & Game EPCs for the DFLAW Operating Configuration

Receptor	Beef (mg/kg)	Milk (mg/kg)	Pork (mg/kg)	Chicken (mg/kg)	Egg (mg/kg)
Resident Subsistence Farmer Adult	4.5E-09	7.7E-10	4.0E-09	1.4E-10	8.2E-11
Resident Subsistence Farmer Child	2.4E-08	4.1E-09	2.1E-08	7.7E-10	4.4E-10

Receptor	Game (mg/kg) [(a)]	Wild Fowl (mg/kg)	Egg (mg/kg)
Resident Subsistence American Indian Adult #1	5.0E-12	6.2E-11	3.6E-11
Resident Subsistence American Indian Child #1	4.7E-11	5.8E-10	3.3E-10

Receptor	Beef (mg/kg)	Chicken (mg/kg)	Game (mg/kg) [(a)]	Wild Fowl (mg/kg)
Resident Subsistence American Indian Adult #2	2.6E-09	8.2E-11	5.0E-12	6.2E-11
Resident Subsistence American Indian Child #2	2.4E-08	7.7E-10	4.7E-11	5.8E-10

[(a)] Game organ concentration is 10× the value shown and accounts for 10% of the total game consumed by the resident subsistence American Indian, scenario 1 (refer to RAWP Table 7-7).

C.1.5 Water and Fish Exposure

Table C-8 presents the water and fish EPCs. The water EPC represents the concentration of dibenz[a,h]anthracene in Columbia River water ingested by receptors and ingested by wild game consumed in the American Indian scenarios. The current timeframe is the only applicable timeframe because in the future timeframe emissions have ceased. Fish-related EPCs are solely related to the water concentration, which in turn is related to water loading due to diffusion and deposition. Sediment concentration is not relevant because fish tissue concentration is modeled based on the concentration in the dissolved phase water for organics other than dioxins, furans, and PCBs.

Table C-8 Dibenz[a,h]anthracene, Water and Fish EPC for the DFLAW Operating Configuration

Receptor	Water (mg/L)
All receptors	7.3E-12

Receptor	Fish (mg/kg)
Resident Subsistence Fisher Adult & Child Resident Subsistence American Indian Adult & Child #1 [(a)] Resident Subsistence American Indian Adult & Child #2	3.6E-06

[(a)] Fish organ concentration is 10× the value shown and accounts for 10% of the total game consumed by the resident subsistence American Indian, scenario 1 (refer to RAWP Table 7-7).

C.2 Human Health Exposure Point Concentrations for the Baseline WTP Operating Configuration

The discussions below provide the EPCs for PCBs and dibenz[a,h]anthracene associated with the baseline WTP operating configuration. Results are presented for each medium and food item, with values shown as applicable to the receptor's exposure scenario, regardless of whether the COPC was a risk driver for the given scenario.

C.2.1 Air Concentration for Inhalation

One-hour and annual air concentration for PCBs are presented for the baseline WTP operating configuration in Table C-9 and Table C-10. The concentration is used to evaluate the acute inhalation exposure and chronic inhalation exposures for the worker, resident, farmer, and fisher scenarios, respectively. Air inhalation exposures only occur in the current timeframe during the period of WTP operation.

Table C-9 PCBs, Inhalation EPCs for the Baseline WTP Operating Configuration

One-Hour Acute *EC* (µg/m^3)	Annual Onsite *EC* (µg/m^3)	Annual Offsite *EC* (µg/m^3)	Annual Gable Mt. *EC* (µg/m^3)
1.0E-03	2.2E-04	8.8E-06	3.0E-05

Table C-10 Dibenz[a,h]anthracene, Inhalation EPCs for the Baseline WTP Operating Configuration

One-Hour Acute *EC* (µg/m^3)	Annual Onsite *EC* (µg/m^3)	Annual Offsite *EC* (µg/m^3)	Annual Gable Mt. *EC* (µg/m^3)
4.1E-03	2.3E-05	8.5E-07	2.6E-06

C.2.2 Soil Exposure

Table C-11 and Table C-12 present the soil EPCs associated with carcinogenic effect of PCBs, assessed as described in Section 3 of the main report. Table C-13 and Table C-14 present the corresponding EPCs for dibenzo[a,h]anthracene. Since the health risk from exposure to a carcinogen is defined in terms of probability (e.g., the likelihood of a carcinogenic response in an individual that receives a given dose of a particular compound), they are dependent upon the exposure duration of the receptor as well as the location and timeframe of the exposure. As explained in Section C.1.2, for carcinogens, soil EPCs for children are generally higher than those of adults due to the child's shorter exposure duration. The pattern repeats in subsequent EPCs tied back to soil concentrations.

Table C-11 PCBs, Carcinogenic Assessment, Current Soil EPCs for the Baseline WTP Operating Configuration

Receptor	Location	Surface Soil (2 cm) (mg/kg)	Untilled Soil (15 cm) (mg/kg)	Tilled Soil (20 cm) (mg/kg)
Hanford Site Industrial Worker - on site/workday	Onsite	8.7E-04	n/a	n/a
Hanford Site Industrial Worker - off site	Offsite	1.2E-05	4.3E-05	3.8E-05
Hanford Site Industrial Worker - off site/retired	Offsite	1.2E-05	4.5E-05	4.1E-05
Resident Adult Resident Subsistence Fisher Adult	Offsite	1.2E-05	3.9E-05	3.4E-05

Table C-11 PCBs, Carcinogenic Assessment, Current Soil EPCs for the Baseline WTP Operating Configuration

Receptor	Location	Surface Soil (2 cm) (mg/kg)	Untilled Soil (15 cm) (mg/kg)	Tilled Soil (20 cm) (mg/kg)
Resident Subsistence Farmer Adult	Offsite	1.2E-05	3.2E-05	2.8E-05
Resident Child Resident Subsistence Farmer Child Resident Subsistence Fisher Child Resident Subsistence American Indian Child #2	Offsite	1.2E-05	4.6E-05	4.2E-05
Resident Subsistence American Indian Adult #1	Offsite	6.9E-06	n/a	n/a
Resident Subsistence American Indian Adult #2	Offsite	6.9E-06	2.8E-05	2.6E-05
Resident Subsistence American Indian Child #1	Offsite	1.2E-05	n/a	n/a
Resident Subsistence American Indian Adult #1	Gable Mt.	3.1E-05	n/a	n/a
Resident Subsistence American Indian Child #1	Gable Mt.	5.4E-05	n/a	n/a
Resident Subsistence American Indian Adult #1 Resident Subsistence American Indian Adult #2	Hunter/Gatherer Area	n/a	1.4E-05	n/a
Resident Subsistence American Indian Child #1 Resident Subsistence American Indian Child #2	Hunter/Gatherer Area	n/a	2.4E-05	n/a

"n/a" indicates value is not applicable at the location or for the receptor shown.

Table C-12 PCBs, Carcinogenic Assessment, Future Soil EPCs for the Baseline WTP Operating Configuration

Receptor	Location	Surface Soil (2 cm) (mg/kg)	Untilled Soil (15 cm) (mg/kg)	Tilled Soil (20 cm) (mg/kg)
Hanford Site Industrial Worker - on site/workday	Onsite	2.2E-05	n/a	n/a
Hanford Site Industrial Worker - off site	Offsite	3.1E-07	2.7E-05	2.8E-05
Hanford Site Industrial Worker - off site/retired	Offsite	6.1E-07	3.5E-05	3.4E-05
Resident Adult, Resident Subsistence Fisher Adult	Offsite	2.0E-07	2.1E-05	2.3E-05
Resident Subsistence Farmer Adult	Offsite	1.5E-07	1.7E-05	1.9E-05
Resident Child Resident Subsistence Farmer Child Resident Subsistence Fisher Child Resident Subsistence American Indian Child #2	Offsite	1.0E-06	3.9E-05	3.8E-05
Resident Subsistence American Indian Adult #1	Offsite	8.8E-08	n/a	n/a
Resident Subsistence American Indian Adult #2	Offsite	8.8E-08	1.1E-05	1.3E-05
Resident Subsistence American Indian Child #1	Offsite	1.0E-06	n/a	n/a
Resident Subsistence American Indian Adult #1	Gable Mt.	3.9E-07	n/a	n/a
Resident Subsistence American Indian Child #1	Gable Mt.	4.6E-06	n/a	n/a
Resident Subsistence American Indian Adult #1 Resident Subsistence American Indian Adult #2	Hunter/Gatherer Area	n/a	7.5E-06	n/a
Resident Subsistence American Indian Child #1 Resident Subsistence American Indian Child #2	Hunter/Gatherer Area	n/a	2.8E-05	n/a

"n/a" indicates value is not applicable at the location or for the receptor shown.

Table C-13 Dibenzo[a,h]anthracene, Carcinogenic Assessment, Current Soil EPCs for the Baseline WTP Operating Configuration

Receptor	Location	Surface Soil (2 cm) (mg/kg)	Untilled Soil (15 cm) (mg/kg)	Tilled Soil (20 cm) (mg/kg)
Hanford Site Industrial Worker - on site/workday	Onsite	1.7E-04	n/a	n/a
Hanford Site Industrial Worker - off site	Offsite	2.5E-06	3.3E-07	2.5E-07
Hanford Site Industrial Worker - off site/retired	Offsite	2.5E-06	3.3E-07	2.5E-07
Resident Adult Resident Subsistence Fisher Adult	Offsite	2.5E-06	3.3E-07	2.5E-07
Resident Subsistence Farmer Adult	Offsite	2.3E-06	3.0E-07	2.3E-07
Resident Child Resident Subsistence Farmer Child Resident Subsistence Fisher Child Resident Subsistence American Indian Child #2	Offsite	2.5E-06	3.3E-07	2.5E-07
Resident Subsistence American Indian Adult #1	Offsite	1.4E-06	n/a	n/a
Resident Subsistence American Indian Adult #2	Offsite	1.4E-06	1.9E-07	1.4E-07
Resident Subsistence American Indian Child #1	Offsite	2.5E-06	n/a	n/a
Resident Subsistence American Indian Adult #1	Gable Mt.	9.6E-06	n/a	n/a
Resident Subsistence American Indian Child #1	Gable Mt.	1.7E-05	n/a	n/a
Resident Subsistence American Indian Adult #1 Resident Subsistence American Indian Adult #2	Hunter/Gatherer Area	n/a	1.0E-07	n/a
Resident Subsistence American Indian Child #1 Resident Subsistence American Indian Child #2	Hunter/Gatherer Area	n/a	1.8E-07	n/a

"n/a" indicates value is not applicable at the location or for the receptor shown.

Table C-14 Dibenzo[a,h]anthracene, Carcinogenic Assessment, Future Soil EPCs for the Baseline WTP Operating Configuration

Receptor	Location	Surface Soil (2 cm) (mg/kg)	Untilled Soil (15 cm) (mg/kg)	Tilled Soil (20 cm) (mg/kg)
Hanford Site Industrial Worker - on site/workday	Onsite	3.1E-05	n/a	n/a
Hanford Site Industrial Worker - off site	Offsite	4.6E-07	6.2E-08	4.6E-08
Hanford Site Industrial Worker - off site/retired	Offsite	8.6E-07	1.2E-07	8.6E-08
Resident Adult, Resident Subsistence Fisher Adult	Offsite	3.1E-07	4.1E-08	3.1E-08
Resident Subsistence Farmer Adult	Offsite	2.3E-07	3.1E-08	2.3E-08
Resident Child Resident Subsistence Farmer Child Resident Subsistence Fisher Child Resident Subsistence American Indian Child #2	Offsite	1.2E-06	1.7E-07	1.2E-07
Resident Subsistence American Indian Adult #1	Offsite	1.3E-07	n/a	n/a
Resident Subsistence American Indian Adult #2	Offsite	1.3E-07	1.8E-08	1.3E-08
Resident Subsistence American Indian Child #1	Offsite	1.2E-06	n/a	n/a
Resident Subsistence American Indian Adult #1	Gable Mt.	8.9E-07	n/a	n/a
Resident Subsistence American Indian Child #1	Gable Mt.	8.3E-06	n/a	n/a
Resident Subsistence American Indian Adult #1 Resident Subsistence American Indian Adult #2	Hunter/Gatherer Area	n/a	1.3E-08	n/a

Table C-14 Dibenzo[a,h]anthracene, Carcinogenic Assessment, Future Soil EPCs for the Baseline WTP Operating Configuration

Receptor	Location	Surface Soil (2 cm) (mg/kg)	Untilled Soil (15 cm) (mg/kg)	Tilled Soil (20 cm) (mg/kg)
Resident Subsistence American Indian Child #1 Resident Subsistence American Indian Child #2	Hunter/Gatherer Area	n/a	1.2E-07	n/a

"n/a" indicates value is not applicable at the location or for the receptor shown.

Table C-15 presents the soil EPCs estimated for evaluating the non-cancer risk of PCBs. Since non-cancer risks are compared to threshold-related reference values, they are assessed at the time of maximum accumulation (e.g., at the conclusion of plant operations when soil accumulation has reached its maximum). The difference in the EPCs for the current and future hunter/gatherer areas is attributed to the difference in location (e.g., the future grid includes interior portions of the Hanford site that are not in the current grid). For noncarcinogenic COPCs, adult and child EPCs in soil are equal because the EPCs are based on the time of maximum accumulation and not dependent upon receptor exposure duration.

Table C-15 PCBs, Non-cancer Assessment, Soil EPCs for the Baseline WTP Operating Configuration

Location	Surface Soil Conc. (2 cm) (mg/kg)	Untilled Soil Conc. (15 cm) (mg/kg)	Tilled Soil Conc. (20 cm) (mg/kg)
Onsite	8.7E-04	n/a	n/a
Offsite	1.2E-05	4.7E-05	4.3E-05
Gable Mt.	5.4E-05	n/a	n/a
Hunter/Gather Area (current timeframe)	n/a	2.4E-05	n/a
Hunter/Gather Area (future timeframe)	n/a	3.3E-05	n/a

"n/a" indicates value is not applicable at the location or for the receptor shown.

C.2.3 Plant Exposure

EPCs for the carcinogenic assessment of PCBs are presented for produce in Table C-16 and Table C-17 for the current and future timeframes, respectively. Table C-18 and Table C-19 present the corresponding EPCs for dibenzo[a,h]anthracene. Since produce EPCs are dependent upon air concentration, deposition, and soil concentration, they vary by receptor due to the combination of exposure duration and location (see Section C.1.3). The EPCs presented below are organized by applicable receptors and location.

Table C-16 PCBs, Carcinogenic Assessment, Current Produce EPCs for the Baseline WTP Operating Configuration

Receptor	Location	Aboveground (mg/kg)	Belowground (mg/kg)
Hanford Site Industrial Worker – off site	Offsite	1.1E-07	1.1E-06
Hanford Site Industrial Worker – off site/retired	Offsite	1.2E-07	1.1E-06
Resident Adult Resident Subsistence Fisher Adult	Offsite	9.9E-08	9.4E-07
Resident Subsistence Adult Farmer	Offsite	8.2E-08	7.8E-07

Table C-16 PCBs, Carcinogenic Assessment, Current Produce EPCs for the Baseline WTP Operating Configuration

Receptor	Location	Aboveground (mg/kg)	Belowground (mg/kg)
Resident Child Resident Subsistence Farmer Child Resident Subsistence Fisher Child Resident Subsistence American Indian Child #2	Offsite	1.2E-07	1.2E-06
Resident Subsistence American Indian Adult #2	Offsite	7.6E-08	7.2E-07
Resident Subsistence American Indian Adult #1 Resident Subsistence American Indian Adult #2	Hunter/ Gatherer Area	4.1E-08	2.9E-07
Resident Subsistence American Indian Child #1 Resident Subsistence American Indian Child #2	Hunter/ Gatherer Area	6.9E-08	4.9E-07

Table C-17 PCBs, Carcinogenic Assessment, Future Produce EPCs for the Baseline WTP Operating Configuration

Receptor	Location	Aboveground (mg/kg)	Belowground (mg/kg)
Hanford Site Industrial Worker - off site	Offsite	8.2E-08	7.8E-07
Hanford Site Industrial Worker - off site/retired	Offsite	1.0E-07	9.6E-07
Resident Adult Resident Subsistence Fisher Adult	Offsite	6.8E-08	6.4E-07
Resident Subsistence Adult Farmer	Offsite	5.7E-08	5.4E-07
Resident Child Resident Subsistence Farmer Child Resident Subsistence Fisher Child Resident Subsistence American Indian Child #2	Offsite	1.1E-07	1.0E-06
Resident Subsistence American Indian Adult #2	Offsite	3.7E-08	3.5E-07
Resident Subsistence American Indian Adult #1 Resident Subsistence American Indian Adult #2	Hunter/Gatherer Area	2.2E-08	1.6E-07
Resident Subsistence American Indian Child #1 Resident Subsistence American Indian Child #2	Hunter/Gatherer Area	8.1E-08	5.7E-07

Table C-18 Dibenzo[a,h]anthracene, Carcinogenic Assessment, Current Produce EPCs for the Baseline WTP Operating Configuration

Receptor	Location	Aboveground (mg/kg)	Belowground (mg/kg)
Hanford Site Industrial Worker – off site	Offsite	1.1E-07	1.1E-06
Hanford Site Industrial Worker – off site/retired	Offsite	1.2E-07	1.1E-06
Resident Adult Resident Subsistence Fisher Adult	Offsite	9.9E-08	9.4E-07
Resident Subsistence Adult Farmer	Offsite	8.2E-08	7.8E-07
Resident Child Resident Subsistence Farmer Child Resident Subsistence Fisher Child Resident Subsistence American Indian Child #2	Offsite	1.2E-07	1.2E-06
Resident Subsistence American Indian Adult #2	Offsite	7.6E-08	7.2E-07
Resident Subsistence American Indian Adult #1 Resident Subsistence American Indian Adult #2	Hunter/ Gatherer Area	4.1E-08	2.9E-07

Table C-18 Dibenzo[a,h]anthracene, Carcinogenic Assessment, Current Produce EPCs for the Baseline WTP Operating Configuration

Receptor	Location	Aboveground (mg/kg)	Belowground (mg/kg)
Resident Subsistence American Indian Child #1 Resident Subsistence American Indian Child #2	Hunter/ Gatherer Area	6.9E-08	4.9E-07

Table C-19 Dibenzo[a,h]anthracene, Carcinogenic Assessment, Future Produce EPCs for the Baseline WTP Operating Configuration

Receptor	Location	Aboveground (mg/kg)	Belowground (mg/kg)
Hanford Site Industrial Worker - off site	Offsite	8.2E-08	7.8E-07
Hanford Site Industrial Worker - off site/retired	Offsite	1.0E-07	9.6E-07
Resident Adult Resident Subsistence Fisher Adult	Offsite	6.8E-08	6.4E-07
Resident Subsistence Adult Farmer	Offsite	5.7E-08	5.4E-07
Resident Child Resident Subsistence Farmer Child Resident Subsistence Fisher Child Resident Subsistence American Indian Child #2	Offsite	1.1E-07	1.0E-06
Resident Subsistence American Indian Adult #2	Offsite	3.7E-08	3.5E-07
Resident Subsistence American Indian Adult #1 Resident Subsistence American Indian Adult #2	Hunter/Gatherer Area	2.2E-08	1.6E-07
Resident Subsistence American Indian Child #1 Resident Subsistence American Indian Child #2	Hunter/Gatherer Area	8.1E-08	5.7E-07

Table C-20 presents the produce EPCs associated with the non-cancer assessment of PCBs. These values represent the maximum produce concentration at the end of WTP operations. The difference in the EPCs for the current and future hunter/gatherer areas is attributed to the difference in location (e.g., the future grid includes interior portions of the Hanford site that are not in the current grid).

Table C-20 PCBs, Non-cancer Assessment, Plant Accumulation for the Baseline WTP Operating Configuration

Location (exposure grid)	from Vapor (mg/kg) [(a)]	from Deposition (mg/kg)	Aboveground (mg/kg)	Belowground (mg/kg)
Offsite	1.1E-07	0.0E+00 [(b)]	1.3E-07	1.2E-06
Hunter/Gatherer Area (current timeframe)	6.9E-08	0.0E+00 [(b)]	7.0E-08	5.0E-07
Hunter/Gatherer Area (future timeframe)	0.0E+00 [(a)]	0.0E+00 [(b)]	9.7E-08	6.9E-07

[(a)] In the future timeframe, the concentration in produce due to vapor drops to zero due to cessation of emissions after plant shutdown.

[(b)] There is no deposition transfer for this COPC because it has a vapor fraction (F_v) of 1

C.2.4 Livestock and Game Exposure

Carcinogenic EPCs for PCBs are presented for livestock and game consumption in Table C-21 and Table C-22 for the current and future timeframes, respectively. Table C-23 and Table C-24 present the corresponding EPCs for dibenzo[a,h]anthracene. As previously explained (Section C.1.4), livestock and game EPCs are dependent upon the concentration in the silage, forage, and grain they consume, plus a fraction attributed to incidental soil ingestion. Like other EPCs, they vary by receptor due to the combination of exposure duration and location. For fowl and eggs, child EPCs are generally higher than

adult EPCs due to exposure duration differences, consumption rates, and the impact of soil concentration (chicken and fowl soil consumption accounts for a greater portion of their diet relative to cattle, swine, and game diets). The EPCs presented below are organized by applicable receptors.

Table C-21 PCBs, Carcinogenic Assessment, Current Livestock & Game EPCs for the Baseline WTP Operating Configuration

Receptor	Beef (mg/kg)	Milk (mg/kg)	Pork (mg/kg)	Chicken (mg/kg)	Egg (mg/kg)
Resident Subsistence Farmer Adult	3.6E-05	5.9E-06	5.1E-07	7.0E-09	4.1E-09
Resident Subsistence Farmer Child	3.6E-05	5.9E-06	5.2E-07	7.3E-09	4.2E-09

Receptor	Game (mg/kg) [(a)]	Wild Fowl (mg/kg)	Egg (mg/kg)
Resident Subsistence American Indian Adult #1	3.2E-06	2.2E-09	1.2E-09
Resident Subsistence American Indian Child #1	3.2E-06	3.8E-09	2.1E-09

Receptor	Beef (mg/kg)	Chicken (mg/kg)	Game (mg/kg)	Wild Fowl (mg/kg)
Resident Subsistence American Indian Adult #2	3.5E-05	4.2E-09	3.2E-06	2.2E-09
Resident Subsistence American Indian Child #2	3.6E-05	7.3E-09	3.2E-06	3.8E-09

[(a)] Game organ concentration is 10× the value shown and accounts for 10% of the total game consumed by the resident subsistence American Indian, scenario 1 (refer to RAWP Table 7-7).

Table C-22 PCBs, Carcinogenic Assessment, Future Livestock & Game EPCs for the Baseline WTP Operating Configuration

Receptor	Beef (mg/kg)	Milk (mg/kg)	Pork (mg/kg)	Chicken (mg/kg)	Egg (mg/kg)
Resident Subsistence Farmer Adult	2.2E-07	3.9E-08	1.3E-08	3.7E-10	2.1E-10
Resident Subsistence Farmer Child	5.8E-07	9.4E-08	3.7E-08	1.1E-09	6.4E-10

Receptor	Game (mg/kg) [(a)]	Wild Fowl (mg/kg)	Egg (mg/kg)
Resident Subsistence American Indian Adult #1	1.0E-08	1.4E-10	8.2E-11
Resident Subsistence American Indian Child #1	3.7E-08	8.0E-10	4.6E-10

Receptor	Beef (mg/kg)	Chicken (mg/kg)	Game (mg/kg)	Wild Fowl (mg/kg)
Resident Subsistence American Indian Adult #2	1.3E-07	2.3E-10	1.0E-08	1.4E-10
Resident Subsistence American Indian Child #2	5.8E-07	1.1E-09	3.7E-08	8.0E-10

[(a)] Game organ concentration is 10× the value shown and accounts for 10% of the total game consumed by the resident subsistence American Indian, scenario 1 (refer to RAWP Table 7-7).

Table C-23 Dibenzo[a,h]anthracene, Carcinogenic Assessment, Current Livestock & Game EPCs for the Baseline WTP Operating Configuration

Receptor	Beef (mg/kg)	Milk (mg/kg)	Pork (mg/kg)	Chicken (mg/kg)	Egg (mg/kg)
Resident Subsistence Farmer Adult	3.5E-04	1.1E-04	3.0E-05	1.1E-09	6.5E-10
Resident Subsistence Farmer Child	3.5E-04	1.1E-04	3.0E-05	1.3E-09	7.2E-10

Table C-23 Dibenzo[a,h]anthracene, Carcinogenic Assessment, Current Livestock & Game EPCs for the Baseline WTP Operating Configuration

Receptor	Game (mg/kg) [(a)]	Wild Fowl (mg/kg)	Egg (mg/kg)
Resident Subsistence American Indian Adult #1	3.3E-05	3.9E-10	2.3E-10
Resident Subsistence American Indian Child #1	3.3E-05	6.9E-10	3.9E-10

Receptor	Beef (mg/kg)	Chicken (mg/kg)	Game (mg/kg)	Wild Fowl (mg/kg)
Resident Subsistence American Indian Adult #2	3.5E-04	7.2E-10	3.3E-05	3.9E-10
Resident Subsistence American Indian Child #2	3.5E-04	1.3E-09	3.3E-05	6.9E-10

[(a)] Game organ concentration is 10× the value shown and accounts for 10% of the total game consumed by the resident subsistence American Indian, scenario 1 (refer to RAWP Table 7-7).

Table C-24 Dibenzo[a,h]anthracene, Carcinogenic Assessment, Future Livestock & Game EPCs for the Baseline WTP Operating Configuration

Receptor	Beef (mg/kg)	Milk (mg/kg)	Pork (mg/kg)	Chicken (mg/kg)	Egg (mg/kg)
Resident Subsistence Farmer Adult	3.7E-09	6.3E-10	3.2E-09	1.2E-10	6.7E-11
Resident Subsistence Farmer Child	2.0E-08	3.4E-09	1.7E-08	6.3E-10	3.6E-10

Receptor	Game (mg/kg) [(a)]	Wild Fowl (mg/kg)	Egg (mg/kg)
Resident Subsistence American Indian Adult #1	4.1E-11	5.1E-11	2.9E-11
Resident Subsistence American Indian Child #1	3.8E-10	4.7E-10	2.7E-10

Receptor	Beef (mg/kg)	Chicken (mg/kg)	Game (mg/kg)	Wild Fowl (mg/kg)
Resident Subsistence American Indian Adult #2	2.1E-09	6.7E-11	4.1E-11	5.1E-11
Resident Subsistence American Indian Child #2	2.0E-08	6.3E-10	3.8E-10	4.7E-10

[(a)] Game organ concentration is 10× the value shown and accounts for 10% of the total game consumed by the resident subsistence American Indian, scenario 1 (refer to RAWP Table 7-7).

EPCs used for the assessment of non-cancer risks from livestock and game consumption are presented in Table C-25 and Table C-26 for the current and future timeframes, respectively. Livestock and game EPCs are dependent upon the concentration in the silage, forage, and grain they consume, plus a fraction attributed to incidental soil ingestion. For non-cancer assessment, timeframe plays a role, as the silage and forage consumed by livestock and game in the future timeframe do not have any uptake from air concentration. Livestock and game EPCs vary by receptor due to the exposure location, but are the same for adults and children of the same receptor since the associated soil and produce EPCs are based on the time of maximum accumulation.

Table C-25 PCBs, Non-cancer Assessment, Current Livestock & Game EPCs for the Baseline WTP Operating Configuration

Receptor	Beef (mg/kg)	Milk (mg/kg)	Pork (mg/kg)	Chicken (mg/kg)	Egg (mg/kg)
Resident Subsistence Farmer Adult & Child	3.6E-05	5.9E-06	5.2E-07	7.3E-09	4.2E-09

Table C-25 PCBs, Non-cancer Assessment, Current Livestock & Game EPCs for the Baseline WTP Operating Configuration

Receptor	Game (mg/kg) [(a)]	Wild Fowl (mg/kg)	Egg (mg/kg)
Resident Subsistence American Indian Adult & Child #1	3.2E-06	3.8E-09	2.1E-09

Receptor	Beef (mg/kg)	Chicken (mg/kg)	Game (mg/kg)	Wild Fowl (mg/kg)
Resident Subsistence American Indian Adult & Child #2	3.6E-05	7.3E-09	3.2E-06	3.8E-09

[(a)] Game organ concentration is 10× the value shown and accounts for 10% of the total game consumed by the resident subsistence American Indian, scenario 1 (refer to RAWP Table 7-7).

Table C-26 PCBs, Non-cancer Assessment, Future Livestock & Game EPCs for the Baseline WTP Operating Configuration

Receptor	Beef (mg/kg)	Milk (mg/kg)	Pork (mg/kg)	Chicken (mg/kg)	Egg (mg/kg)
Resident Subsistence Farmer Adult & Child	2.4E-06	2.6E-07	2.1E-07	7.3E-09	4.2E-09

Receptor	Game (mg/kg) [(a)]	Wild Fowl (mg/kg)	Egg (mg/kg)
Resident Subsistence American Indian Adult & Child #1	4.5E-08	5.2E-09	3.0E-09

Receptor	Beef (mg/kg)	Chicken (mg/kg)	Game (mg/kg)	Wild Fowl (mg/kg)
Resident Subsistence American Indian Adult & Child #2	2.4E-06	7.3E-09	4.5E-08	5.2E-09

[(a)] Game organ concentration is 10× the value shown and accounts for 10% of the total game consumed by the resident subsistence American Indian, scenario 1 (refer to RAWP Table 7-7).

C.2.5 Water and Fish Exposure

Table C-27 presents the water and fish EPC for PCBs. Table C-28 presents the corresponding EPCs for dibenzo[a,h]anthracene. The current timeframe is the only applicable timeframe because in the future timeframe, emissions have ceased. Fish-related EPCs are solely related to the water concentration, which in turn is related to water loading due to diffusion and deposition. Loading due to diffusion and deposition is constant during the period of emissions, making fish EPCs not time-dependent (i.e., receptor exposure duration does not play a role). The EPC for fish is therefore the same for both the carcinogenic and noncarcinogenic evaluation of PCBs.

Table C-27 PCBs, Water and Fish EPC for the Baseline WTP Operating Configuration

Receptor	Water (mg/L)
All receptors	3.4E-10

Receptor	Fish (mg/kg)[(a)]
Resident Subsistence Fisher Adult & Child Resident Subsistence American Indian Adult & Child #1 [(a)] Resident Subsistence American Indian Adult & Child #2	5.6E-05

[(a)] Fish organ concentration is 10× the value shown and accounts for 10% of the total game consumed by the resident subsistence American Indian, scenario 1 (refer to RAWP Table 7-7).

Table C-28 Dibenzo[a,h]anthracene, Water and Fish EPC for the Baseline WTP Operating Configuration

Receptor	Water (mg/L)
All receptors	5.5E-12

Receptor	Fish (mg/kg)[(a)]
Resident Subsistence Fisher Adult & Child Resident Subsistence American Indian Adult & Child #1 [(a)] Resident Subsistence American Indian Adult & Child #2	2.8E-06

[(a)] Fish organ concentration is 10× the value shown and accounts for 10% of the total game consumed by the resident subsistence American Indian, scenario 1 (refer to RAWP Table 7-7).

C.3 Human Health Exposure Levels for Risk Drivers for the DFLAW Operating Configuration

The discussions below provide the exposure concentrations (*EC*) and lifetime average daily dose (*LADD*) associated with dibenz[a,h]anthracene emissions for the DFLAW operating configuration. Data are presented for each human receptor, with values shown for pathways applicable to the receptor's exposure scenario.

C.3.1 Hanford Site Industrial Worker

As shown in Table C-29, air inhalation dominates current inhalation exposures for dibenz[a,h]anthracene for the Hanford Site Industrial Worker. In the ingestion pathway, soil ingestion is the dominant exposure route.

Table C-29 Worker Dibenz[a,h]anthracene *EC* and *LADD* for the DFLAW Operating Configuration

Timeframe	Air Inhalation *EC* (µg/m^3)	Soil Ingestion *LADD* (mg/(kg·day))	Soil Inhalation *EC* (µg/m^3)	Produce Ingestion *LADD* (mg/(kg·day))	Drinking Water Ingestion *LADD* (mg/(kg·day))
Current	1.8E-11	2.1E-12	2.8E-15	2.0E-10	6.7E-15
Future	n/a	7.4E-13	1.0E-15	1.9E-14	n/a

"n/a" indicates not applicable.

C.3.2 Resident Adult and Child

Table C-30 shows produce ingestion as the dominant pathway for the adult and child resident in the current timeframe, and air inhalation being the largest inhalation pathway. In future exposure scenarios for the resident adult and child, soil ingestion is the dominant ingestion exposure.

Table C-30 Resident Adult and Child Dibenz[a,h]anthracene *EC* and *LADD* for the DFLAW Operating Configuration

Receptor	Timeframe	Air Inhalation *EC* (µg/m³)	Soil Ingestion *LADD* (mg/(kg·day))	Soil Inhalation *EC* (µg/m³)	Produce Ingestion *LADD* (mg/(kg·day))	Drinking Water Ingestion *LADD* (mg/(kg·day))
Adult	Current	1.5E-11	6.4E-14	5.9E-16	2.0E-10	2.9E-15
Child		9.2E-12	3.0E-13	3.0E-16	9.6E-11	4.0E-15
Adult	Future	n/a	2.2E-14	2.1E-16	9.9E-15	n/a
Child		n/a	1.7E-13	1.6E-16	1.9E-14	n/a

"n/a" indicates not applicable.

C.3.3 Resident Subsistence Farmer Adult and Child

Table C-31 summarizes the exposures for the resident subsistence farmer. The air inhalation exposure is the largest of the inhalation routes in the adult and child in the current timeframe. Milk ingestion is the largest adult and child ingestion route for both the current and future timeframes.

Table C-31 Resident Subsistence Farmer Adult and Child Dibenz[a,h]anthracene *EC* and *LADD* for the DFLAW Operating Configuration

Receptor	Timeframe	Air Inhalation *EC* (µg/m³)	Soil Ingestion *LADD* (mg/(kg·day))	Soil Inhalation *EC* (µg/m³)	Produce Ingestion *LADD* (mg/(kg·day))	Beef Ingestion *LADD* (mg/(kg·day))
Adult	Current	1.5E-11	6.4E-14	5.9E-16	3.9E-10	3.1E-08
Child		9.2E-12	3.0E-13	3.0E-16	1.4E-10	2.9E-09
Adult	Future	n/a	2.2E-14	2.1E-16	1.2E-14	3.0E-13
Child		n/a	1.7E-13	1.6E-16	2.3E-14	1.5E-13
Receptor	**Timeframe**	**Milk Ingestion *LADD* (mg/(kg·day))**	**Chicken Ingestion *LADD* (mg/(kg·day))**	**Egg Ingestion *LADD* (mg/(kg·day))**	**Pork Ingestion *LADD* (mg/(kg·day))**	**Drinking Water Ingestion *LADD* (mg/(kg·day))**
Adult	Current	1.1E-07	1.5E-14	9.7E-15	1.2E-09	2.9E-15
Child		2.8E-08	5.1E-15	3.5E-15	1.4E-10	4.0E-15
Adult	Future	5.8E-13	5.2E-15	3.4E-15	1.2E-13	n/a
Child		7.7E-13	2.8E-15	1.9E-15	7.3E-14	n/a

"n/a" indicates not applicable.

C.3.4 Resident Subsistence Fisher Adult and Child

Table C-32 summarizes the exposures for the resident subsistence fisher. The air inhalation exposure is the largest of the inhalation routes for the adult and child in the current timeframe. Produce ingestion is the dominant ingestion route for the adult and child in the current timeframe, while soil ingestion is the dominant route in the future timeframe.

Table C-32 Resident Subsistence Fisher Adult and Child Dibenz[a,h]anthracene *EC* and *LADD* for the DFLAW Operating Configuration

Receptor	Timeframe	Air Inhalation *EC* (µg/m^3)	Soil Ingestion *LADD* (mg/(kg·day))	Soil Inhalation *EC* (µg/m^3)
Adult	Current	1.5E-11	6.4E-14	5.9E-16
Child		9.2E-12	3.0E-13	3.0E-16
Adult	Future	n/a	2.2E-14	2.1E-16
Child		n/a	1.7E-13	1.6E-16
Receptor	**Timeframe**	**Produce Ingestion *LADD* (mg/(kg·day))**	**Fish Ingestion *LADD* (mg/(kg·day))**	**Drinking Water Ingestion *LADD* (mg/(kg·day))**
Adult	Current	2.0E-10	6.2E-11	2.9E-15
Child		9.6E-11	2.6E-11	4.0E-15
Adult	Future	9.9E-15	n/a	n/a
Child		1.9E-14	n/a	n/a

"n/a" indicates not applicable.

C.3.5 Resident Subsistence American Indian Adult and Child #1

Table C-33 summarizes the exposures for the resident subsistence American Indian, scenario #1. The air inhalation exposure is the largest of the inhalation routes in the adult and child in the current timeframe. Game ingestion is the largest ingestion route for the adult and child current timeframe while in the future timeframe, soil ingestion is the largest contributor in the adult and child ingestion route.

Table C-33 Resident Subsistence American Indian Adult and Child (#1) Dibenz[a,h]anthracene *EC* and *LADD* for the DFLAW Operating Configuration

Receptor	Timeframe	Air Inhalation *EC* (µg/m^3)	Soil Ingestion *LADD* (mg/(kg·day))	Soil Inhalation *EC* (µg/m^3)	Produce Ingestion *LADD* (mg/(kg·day))	Game Ingestion *LADD* (mg/(kg·day))
Adult	Current	2.4E-12	3.2E-13	7.4E-16	4.6E-09	1.5E-08
Child		8.8E-13	7.4E-13	3.1E-17	1.3E-09	3.9E-09
Adult	Future	n/a	1.1E-13	2.6E-16	5.8E-14	1.7E-15
Child		n/a	4.1E-13	1.8E-17	1.5E-13	4.3E-15
Receptor	**Timeframe**	**Wild Fowl and Egg Ingestion *LADD* (1) (mg/(kg·day))**	**Fish Ingestion *LADD* (mg/(kg·day))**	**Drinking Water Ingestion *LADD* (mg/(kg·day))**	**Sweat Lodge Adsorb. *LADD* (mg/(kg·day))**	**Sweat Lodge Inhalation *EC* (µg/m^3)**
Adult	Current	1.2E-14	8.7E-10	6.0E-15	2.4E-17	4.1E-15
Child		1.9E-14	1.6E-09	8.3E-15	1.9E-17	1.7E-15
Adult	Future	5.5E-15	n/a	n/a	n/a	n/a
Child		1.5E-14	n/a	n/a	n/a	n/a

(1) The consumption rate of wild fowl and eggs was reported as a combined value, therefore, the *LADD* shown is specific to wild fowl consumption. This is a conservative approach since the wild fowl EPC is consistently higher than the egg EPC for this receptor (refer to Table C-6 and Table C-7).

C.3.6 Resident Subsistence American Indian Adult and Child #2

Table C-34 summarizes the exposures for the resident subsistence American Indian, scenario #2. The air inhalation exposure is the largest of the inhalation routes in the adult and child in the current timeframe. Beef ingestion is the largest ingestion route for the adult and child in both the current and future timeframe.

Table C-34 Resident Subsistence American Indian Adult and Child (#2) Dibenz[a,h]anthracene *EC* and *LADD* for the DFLAW Operating Configuration

Receptor	Time-frame	Air Inhalation *EC* (µg/m³)	Soil Ingestion *LADD* (mg/(kg·day))	Soil Inhalation *EC* (µg/m³)	Produce Ingestion *LADD* (mg/(kg·day))	Beef Ingestion *LADD* (mg/(kg·day))	Chicken Ingestion *LADD* (mg/(kg·day))
Adult	Current	1.6E-11	1.3E-13	6.2E-16	1.7E-08	1.9E-07	4.7E-14
Child		9.6E-12	5.9E-13	3.1E-16	1.5E-09	2.1E-08	3.1E-14
Adult	Future	n/a	4.6E-14	2.1E-16	1.6E-13	1.0E-12	1.6E-14
Child		n/a	3.3E-13	1.7E-16	1.2E-13	1.1E-12	1.7E-14

Receptor	Time-frame	Game Ingestion *LADD* (mg/(kg·day))	Wild Fowl Ingestion *LADD* (mg/(kg·day))	Fish Ingestion *LADD* (mg/(kg·day))	Drinking Water Ingestion *LADD* (mg/(kg·day))	Sweat Lodge Adsorb. *LADD* (mg/(kg·day))	Sweat Lodge Inhalation *EC* (µg/m³)
Adult	Current	1.2E-08	1.7E-14	3.8E-10	6.0E-15	1.7E-16	2.9E-14
Child		1.3E-09	1.1E-14	7.0E-10	7.8E-15	1.3E-17	1.2E-15
Adult	Future	1.4E-15	8.3E-15	n/a	n/a	n/a	n/a
Child		1.4E-15	8.7E-15	n/a	n/a	n/a	n/a

C.4 Human Health Exposure Levels for Risk Drivers for the Baseline WTP Operating Configuration

The discussions which follow provide the *EC*s, *LADD*, and average daily dose (*ADD*) associated with PCB emissions for the baseline WTP operating configuration. While no risk drivers were identified for the standard set of human health risk assessment (HHRA) scenarios, PCBs were identified as risk drivers (>10% of their threshold) in the American Indian scenarios, and dibenzo[a,h]anthracene for the resident subsistence American Indian #2. PCB emissions can have carcinogenic effects and can pose a health hazard. Data presented summarizes PCB exposure concentration and daily dose in both its carcinogenic and noncarcinogenic form for each human receptor, with values shown for pathways applicable to the receptor's exposure scenario.

C.4.1 Hanford Site Industrial Worker

Table C-35 provides the *EC* and *LADD* associated with the carcinogenic effect of PCBs. As shown in Table C-35, inhalation in the current timeframe dominates exposures for the Hanford Site Industrial Worker. Produce contributes to the largest ingestion exposure.

Table C-35 Worker PCB Carcinogenic *EC* and *LADD* for the Baseline WTP Operating Configuration

Timeframe	Air Inhalation *EC* (µg/m^3)	Soil Ingestion *LADD* (mg/(kg·day))	Soil Inhalation *EC* (µg/m^3)	Produce Ingestion *LADD* (mg/(kg·day))	Drinking Water Ingestion *LADD* (mg/(kg·day))
Current	4.8E-09	1.7E-10	2.3E-13	1.2E-10	4.9E-12
Future	n/a	4.3E-12	5.8E-15	8.2E-11	n/a

"n/a" indicates not applicable.

Table C-36 provides the *EC* and *LADD* associated with the carcinogenic effect of dibenz[a,h]anthracene. As shown in Table C-36, produce contributes to the largest ingestion exposure, with air inhalation being the next largest contributor in the current timeframe. Future worker exposures to dibenz[a,h]anthracene are dominated by incidental soil ingestion.

Table C-36 Worker Dibenz[a,h]anthracene Carcinogenic *EC* and *LADD* for the Baseline WTP Operating Configuration

Timeframe	Air Inhalation *EC* (µg/m^3)	Soil Ingestion *LADD* (mg/(kg·day))	Soil Inhalation *EC* (µg/m^3)	Produce Ingestion *LADD* (mg/(kg·day))	Drinking Water Ingestion *LADD* (mg/(kg·day))
Current	4.9E-11	3.2E-12	4.3E-15	1.5E-10	8.1E-15
Future	n/a	6.0E-13	8.1E-16	1.6E-14	n/a

"n/a" indicates not applicable.

Table C-37 provides the *EC* and *ADD* associated with the hazard (non-cancer) exposure to PCBs. As shown in Table C-37, inhalation in the current timeframe dominates current exposures for the Hanford Site Industrial Worker. The produce and incidental soil ingestion pathways contribute almost the same amount to the receptor dose.

Table C-37 Worker PCB Hazardous *EC* and *ADD* for the Baseline WTP Operating Configuration

Timeframe	Air Inhalation *EC* (µg/m^3)	Soil Ingestion *ADD* (mg/(kg·day))	Soil Inhalation *EC* (µg/m^3)	Produce Ingestion *ADD* (mg/(kg·day))	Drinking Water Ingestion *ADD* (mg/(kg·day))
Current	4.1E-08	6.0E-10	1.9E-12	6.1E-10	2.2E-11
Future	n/a	6.0E-10	1.9E-12	5.5E-10	n/a

"n/a" indicates not applicable.

C.4.2 Resident Adult and Child

Table C-46 provides the *EC* and *LADD* associated with the carcinogenic effect of PCBs. As shown in Table C-46, inhalation dominates current inhalation exposures for the resident adult and child. Produce contributes to the largest ingestion exposure.

Table C-38 Resident Adult and Child PCB Carcinogenic *EC* and *LADD* for the Baseline WTP Operating Configuration

Receptor	Timeframe	Air Inhalation *EC* (µg/m³)	Soil Ingestion *LADD* (mg/(kg·day))	Soil Inhalation *EC* (µg/m³)	Produce Ingestion *LADD* (mg/(kg·day))	Drinking Water Ingestion *LADD* (mg/(kg·day))
Adult	Current	3.6E-09	7.1E-12	6.6E-14	1.1E-10	4.0E-12
Child		7.2E-10	1.3E-11	1.3E-14	5.2E-11	1.9E-12
Adult	Future	n/a	1.2E-13	1.1E-15	6.3E-11	n/a
Child		n/a	1.1E-12	1.1E-15	4.0E-11	n/a

"n/a" indicates not applicable.

Table C-39 provides the *EC* and *LADD* associated with the carcinogenic effect of dibenz[a,h]anthracene. As shown in Table C-39, in the current timeframe, inhalation dominates current inhalation exposures for risk drivers for the resident adult and child, and produce contributes to the largest ingestion exposure. Incidental soil ingestion is the greatest contributor to future resident dibenz[a,h]anthracene exposures.

Table C-39 Resident Adult and Child Dibenz[a,h]anthracene Carcinogenic *EC* and *LADD* for the Baseline WTP Operating Configuration

Receptor	Timeframe	Air Inhalation *EC* (µg/m³)	Soil Ingestion *LADD* (mg/(kg·day))	Soil Inhalation *EC* (µg/m³)	Produce Ingestion *LADD* (mg/(kg·day))	Drinking Water Ingestion *LADD* (mg/(kg·day))
Adult	Current	3.5E-11	1.5E-13	1.3E-15	1.5E-10	6.5E-15
Child		7.0E-12	2.7E-13	2.7E-16	7.2E-11	3.0E-15
Adult	Future	n/a	1.8E-14	1.7E-16	8.1E-15	n/a
Child		n/a	1.4E-13	1.3E-16	1.6E-14	n/a

"n/a" indicates not applicable.

Table C-40 summarizes the *EC* and *ADD* associated with PCB emissions. Table C-40 shows air inhalation as the dominant inhalation pathway for the adult and child resident in the current timeframe. Produce ingestion is the largest ingestion pathway for both current and future timeframes.

Table C-40 Resident Adult and Child PCB Hazardous *EC* and *ADD* for the Baseline WTP Operating Configuration

Receptor	Timeframe	Air Inhalation *EC* (µg/m³)	Soil Ingestion *ADD* (mg/(kg·day))	Soil Inhalation *EC* (µg/m³)	Produce Ingestion *ADD* (mg/(kg·day))	Drinking Water Ingestion *ADD* (mg/(kg·day))
Adult	Current	8.4E-09	1.7E-11	1.5E-13	3.1E-10	9.3E-12
Child		8.4E-09	1.6E-10	1.5E-13	6.2E-10	2.2E-11
Adult	Future	n/a	1.7E-11	1.5E-13	2.7E-10	n/a
Child		n/a	1.6E-10	1.5E-13	5.4E-10	n/a

"n/a" indicates not applicable.

C.4.3 Resident Subsistence Farmer Adult and Child

Table C-41 presents the PCB carcinogenic *EC* and *LADD* for the resident subsistence farmer adult and child. Milk ingestion provides the greatest degree of exposure.

Table C-41 Resident Subsistence Farmer Adult and Child PCB Carcinogenic *EC* and *LADD* for the Baseline WTP Operating Configuration

Receptor	Timeframe	Air Inhalation *EC* (µg/m³)	Soil Ingestion *LADD* (mg/(kg·day))	Soil Inhalation *EC* (µg/m³)	Produce Ingestion *LADD* (mg/(kg·day))	Beef Ingestion *LADD* (mg/(kg·day))
Adult	Current	4.8E-09	9.4E-12	8.7E-14	1.5E-10	2.4E-08
Child		7.2E-10	1.3E-11	1.3E-14	6.4E-11	2.2E-09
Adult	Future	n/a	1.2E-13	1.1E-15	8.5E-11	1.5E-10
Child		n/a	1.1E-12	1.1E-15	4.9E-11	3.6E-11
Receptor	**Timeframe**	**Milk Ingestion *LADD* (mg/(kg·day))**	**Chicken Ingestion *LADD* (mg/(kg·day))**	**Egg Ingestion *LADD* (mg/(kg·day))**	**Pork Ingestion *LADD* (mg/(kg·day))**	**Drinking Water Ingestion *LADD* (mg/(kg·day))**
Adult	Current	4.4E-08	2.5E-12	1.7E-12	1.5E-10	5.3E-12
Child		1.1E-08	2.7E-13	1.9E-13	1.8E-11	1.9E-12
Adult	Future	2.9E-10	1.3E-13	8.7E-14	4.0E-12	n/a
Child		1.7E-10	4.1E-14	2.8E-14	1.3E-12	n/a

"n/a" indicates not applicable.

Table C-42 presents the dibenz[a,h]anthracene carcinogenic *EC* and *LADD* for the resident subsistence farmer adult and child. As with PCBs, milk ingestion provides the greatest degree of exposure to dibenz[a,h]anthracene.

Table C-42 Resident Subsistence Farmer Adult and Child Dibenz[a,h]anthracene Carcinogenic *EC* and *LADD* for the Baseline WTP Operating Configuration

Receptor	Timeframe	Air Inhalation *EC* (µg/m³)	Soil Ingestion *LADD* (mg/(kg·day))	Soil Inhalation *EC* (µg/m³)	Produce Ingestion *LADD* (mg/(kg·day))	Beef Ingestion *LADD* (mg/(kg·day))
Adult	Current	4.8E-09	9.4E-12	8.7E-14	1.5E-10	2.4E-08
Child		7.2E-10	1.3E-11	1.3E-14	6.4E-11	2.2E-09
Adult	Future	n/a	1.2E-13	1.1E-15	8.5E-11	1.5E-10
Child		n/a	1.1E-12	1.1E-15	4.9E-11	3.6E-11
Receptor	**Timeframe**	**Milk Ingestion *LADD* (mg/(kg·day))**	**Chicken Ingestion *LADD* (mg/(kg·day))**	**Egg Ingestion *LADD* (mg/(kg·day))**	**Pork Ingestion *LADD* (mg/(kg·day))**	**Drinking Water Ingestion *LADD* (mg/(kg·day))**
Adult	Current	4.4E-08	2.5E-12	1.7E-12	1.5E-10	5.3E-12
Child		1.1E-08	2.7E-13	1.9E-13	1.8E-11	1.9E-12
Adult	Future	2.9E-10	1.3E-13	8.7E-14	4.0E-12	n/a
Child		1.7E-10	4.1E-14	2.8E-14	1.3E-12	n/a

"n/a" indicates not applicable.

Table C-43 summarizes the noncancer exposures for the resident subsistence farmer. The air inhalation exposure is the largest of the inhalation routes in the adult and child current timeframe. Milk ingestion is the largest adult and child ingestion route for both the current and future timeframes.

Table C-43 Resident Subsistence Farmer Adult and Child PCB Hazardous *EC* and *ADD* for the Baseline WTP Operating Configuration

Receptor	Timeframe	Air Inhalation *EC* (µg/m³)	Soil Ingestion *ADD* (mg/(kg·day))	Soil Inhalation *EC* (µg/m³)	Produce Ingestion *ADD* (mg/(kg·day))	Beef Ingestion *ADD* (mg/(kg·day))
Adult	Current	8.4E-09	1.7E-11	1.5E-13	3.8E-10	4.3E-08
Child		8.4E-09	1.6E-10	1.5E-13	7.7E-10	2.6E-08
Adult	Future	n/a	1.7E-11	1.5E-13	3.3E-10	2.8E-09
Child		n/a	1.6E-10	1.5E-13	6.5E-10	1.7E-09
Receptor	**Timeframe**	**Milk Ingestion *ADD* (mg/(kg·day))**	**Chicken Ingestion *ADD* (mg/(kg·day))**	**Egg Ingestion *ADD* (mg/(kg·day))**	**Pork Ingestion *ADD* (mg/(kg·day))**	**Drinking Water Ingestion *ADD* (mg/(kg·day))**
Adult	Current	7.7E-08	4.6E-12	3.0E-12	2.7E-10	9.3E-12
Child		1.3E-07	3.2E-12	2.2E-12	2.1E-10	2.2E-11
Adult	Future	3.4E-09	4.6E-12	3.0E-12	1.1E-10	n/a
Child		5.7E-09	3.2E-12	2.2E-12	8.4E-11	n/a

"n/a" indicates not applicable.

C.4.4 Resident Subsistence Fisher Adult and Child

Table C-44 presents the carcinogenic *EC* and *LADD* for the resident subsistence fisher adult and child. Fish consumption in the current timeframe dominates the exposure pathways. In the future timeframe, produce ingestion contributes the largest carcinogenic dose.

Table C-44 Resident Subsistence Fisher Adult and Child PCB Carcinogenic *EC* and *LADD* for the Baseline WTP Operating Configuration

Receptor	Timeframe	Air Inhalation *EC* (µg/m³)	Soil Ingestion *LADD* (mg/(kg·day))	Soil Inhalation *EC* (µg/m³)
Adult	Current	3.6E-09	7.1E-12	6.6E-14
Child		7.2E-10	1.3E-11	1.3E-14
Adult	Future	n/a	1.2E-13	1.1E-15
Child		n/a	1.1E-12	1.1E-15
Receptor	**Timeframe**	**Produce Ingestion *LADD* (mg/(kg·day))**	**Fish Ingestion *LADD* (mg/(kg·day))**	**Drinking Water Ingestion *LADD* (mg/(kg·day))**
Adult	Current	1.1E-10	2.9E-08	4.0E-12
Child		5.2E-11	4.0E-09	1.9E-12
Adult	Future	6.3E-11	n/a	n/a
Child		4.0E-11	n/a	n/a

"n/a" indicates not applicable.

Table C-45 provides the *EC* and *LADD* associated with the carcinogenic effect of dibenz[a,h]anthracene. As shown in Table C-45, produce contributes to the largest ingestion exposure, with air inhalation being the next largest contributor in the current timeframe. Future worker exposures to dibenz[a,h]anthracene are dominated by incidental soil ingestion.

Table C-45 Resident Subsistence Fisher Adult and Child Dibenz[a,h]anthracene Carcinogenic *EC* and *LADD* for the Baseline WTP Operating Configuration

Receptor	Timeframe	Air Inhalation *EC* (µg/m^3)	Soil Ingestion *LADD* (mg/(kg·day))	Soil Inhalation *EC* (µg/m^3)
Adult	Current	3.5E-11	1.5E-13	1.3E-15
Child		7.0E-12	2.7E-13	2.7E-16
Adult	Future	n/a	1.8E-14	1.7E-16
Child		n/a	1.4E-13	1.3E-16
Receptor	**Timeframe**	**Produce Ingestion *LADD* (mg/(kg·day))**	**Fish Ingestion *LADD* (mg/(kg·day))**	**Drinking Water Ingestion *LADD* (mg/(kg·day))**
Adult	Current	1.5E-10	1.4E-10	6.5E-15
Child		7.2E-11	2.0E-11	3.0E-15
Adult	Future	8.1E-15	n/a	n/a
Child		1.6E-14	n/a	n/a

"n/a" indicates not applicable.

Table C-46 summarizes the noncancer exposures for the subsistence fisher. The air inhalation exposure is the largest of the inhalation routes in the adult and child current timeframe. Fish ingestion is the dominant ingestion route for the adult and child in the current timeframe. In the future timeframe, produce ingestion is the largest adult and child ingestion route.

Table C-46 Resident Subsistence Fisher Adult and Child PCB Hazardous *EC* and *ADD* for the Baseline WTP Operating Configuration

Receptor	Timeframe	Air Inhalation *EC* (µg/m^3)	Soil Ingestion *ADD* (mg/(kg·day))	Soil Inhalation *EC* (µg/m^3)
Adult	Current	8.4E-09	1.7E-11	1.5E-13
Child		8.4E-09	1.6E-10	1.5E-13
Adult	Future	n/a	1.7E-11	1.5E-13
Child		n/a	1.6E-10	1.5E-13
Receptor	**Timeframe**	**Produce Ingestion *ADD* (mg/(kg·day))**	**Fish Ingestion *ADD* (mg/(kg·day))**	**Drinking Water Ingestion *ADD* (mg/(kg·day))**
Adult	Current	3.1E-10	6.7E-08	9.3E-12
Child		6.2E-10	4.7E-08	2.2E-11
Adult	Future	2.7E-10	n/a	n/a
Child		5.4E-10	n/a	n/a

"n/a" indicates not applicable.

C.4.5 Resident Subsistence American Indian Adult and Child #1

Table C-47 presents the carcinogenic *EC*s and *LADD* of the resident subsistence American Indian adult and child, scenario #1, associated with PCB exposure. As with the hazardous effects (Table C-49), fish ingestion is the largest ingestion route for the adult and child current timeframe, while in the future timeframe, produce ingestion is the largest contributor in the adult and child ingestion route.

Table C-47 Resident Subsistence American Indian Adult and Child (#1) PCB Carcinogenic *EC* and *LADD* for the Baseline WTP Operating Configuration

Receptor	Timeframe	Air Inhalation *EC* (µg/m³)	Soil Ingestion *LADD* (mg/(kg·day))	Soil Inhalation *EC* (µg/m³)	Produce Ingestion *LADD* (mg/(kg·day))	Game Ingestion *LADD* (mg/(kg·day))
Adult	Current	3.1E-09	4.4E-11	1.0E-13	2.4E-09	1.1E-08
Child		6.9E-11	3.1E-11	1.3E-15	1.1E-09	2.9E-09
Adult	Future	n/a	5.6E-13	1.3E-15	1.1E-09	3.4E-11
Child		n/a	2.6E-12	1.1E-16	1.1E-09	3.4E-11
Receptor	**Timeframe**	**Wild Fowl and Egg Ingestion *LADD* [(a)] (mg/(kg·day))**	**Fish Ingestion *LADD* (mg/(kg·day))**	**Drinking Water Ingestion *ADD* (mg/(kg·day))**	**Sweat Lodge Adsorb. *LADD* (mg/(kg·day))**	**Sweat Lodge Inhalation *EC* (µg/m³)**
Adult	Current	1.9E-12	5.4E-07	1.1E-11	2.6E-14	7.7E-12
Child		9.4E-13	2.5E-07	3.9E-12	5.1E-15	7.7E-13
Adult	Future	1.3E-13	n/a	n/a	n/a	n/a
Child		2.0E-13	n/a	n/a	n/a	n/a

[(a)] The consumption rate of wild fowl and eggs was reported as a combined value, therefore, the *LADD* shown is specific to wild fowl consumption. This is a conservative approach since the wild fowl EPC is consistently higher than the egg EPC for this receptor (refer to Table C-25 and Table C-26).

"n/a" indicates not applicable.

Table C-48 presents the carcinogenic *EC*s and *LADD* of the resident subsistence American Indian adult and child, scenario #1, associated with dibenz[a,h]anthracene exposure. The pattern is similar to that of PCBs in which fish ingestion is the largest ingestion route for the adult and child current timeframe, and produce ingestion is the largest contributor in the adult and child ingestion route in the future timeframe.

Table C-48 Resident Subsistence American Indian Adult and Child (#1) Dibenz[a,h]anthracene Carcinogenic *EC* and *LADD* for the Baseline WTP Operating Configuration

Receptor	Timeframe	Air Inhalation *EC* (µg/m³)	Soil Ingestion *LADD* (mg/(kg·day))	Soil Inhalation *EC* (µg/m³)	Produce Ingestion *LADD* (mg/(kg·day))	Game Ingestion *LADD* (mg/(kg·day))
Adult	Current	3.0E-11	9.7E-13	2.2E-15	3.5E-09	1.1E-08
Child		6.7E-13	6.8E-13	2.9E-17	1.0E-09	3.0E-09
Adult	Future	n/a	9.0E-14	2.1E-16	4.7E-14	1.4E-15
Child		n/a	3.4E-13	1.4E-17	1.3E-13	3.5E-15

Table C-48 Resident Subsistence American Indian Adult and Child (#1) Dibenz[a,h]anthracene Carcinogenic *EC* and *LADD* for the Baseline WTP Operating Configuration

Receptor	Timeframe	Wild Fowl and Egg Ingestion *LADD* [(a)] (mg/(kg·day))	Fish Ingestion *LADD* (mg/(kg·day))	Drinking Water Ingestion *ADD* (mg/(kg·day))	Sweat Lodge Adsorb. *LADD* (mg/(kg·day))	Sweat Lodge Inhalation *EC* (µg/m^3)
Adult	Current	3.5E-14	2.6E-09	1.8E-14	7.4E-17	1.3E-14
Child		1.7E-14	1.2E-09	6.3E-15	1.5E-17	1.3E-15
Adult	Future	4.5E-15	n/a	n/a	n/a	n/a
Child		1.2E-14	n/a	n/a	n/a	n/a

[(a)] The consumption rate of wild fowl and eggs was reported as a combined value, therefore, the *LADD* shown is specific to wild fowl consumption. This is a conservative approach since the wild fowl EPC is consistently higher than the egg EPC for this receptor (refer to Table C-25 and Table C-26).

"n/a" indicates not applicable.

Table C-47 summarizes the hazard exposures for the resident subsistence American Indian, scenario #1. The air inhalation exposure is the largest of the inhalation routes in the adult and child current timeframe. Fish ingestion is the largest ingestion route for the adult and child current timeframe, while in the future timeframe, produce ingestion is the largest contributor in the adult and child ingestion routes.

Table C-49 Resident Subsistence American Indian Adult and Child (#1) PCB Hazardous *EC* and *ADD* for the Baseline WTP Operating Configuration

Receptor	Timeframe	Air Inhalation *EC* (µg/m^3)	Soil Ingestion *ADD* (mg/(kg·day))	Soil Inhalation *EC* (µg/m^3)	Produce Ingestion *ADD* (mg/(kg·day))	Game Ingestion *ADD* (mg/(kg·day))
Adult	Current	9.5E-09	7.7E-11	1.8E-13	3.8E-09	1.1E-08
Child		9.5E-09	3.6E-10	1.8E-13	1.3E-08	3.4E-08
Adult	Future	n/a	7.7E-11	1.8E-13	4.8E-09	1.5E-10
Child		n/a	3.6E-10	1.8E-13	1.6E-08	4.7E-10

Receptor	Timeframe	Wild Fowl and Egg Ingestion *ADD* [(a)] (mg/(kg·day))	Fish Ingestion *ADD* (mg/(kg·day))	Drinking Water Ingestion *ADD* (mg/(kg·day))	Sweat Lodge Adsorb. *ADD* (mg/(kg·day))	Sweat Lodge Inhalation *EC* (µg/m^3)
Adult	Current	3.3E-12	9.4E-07	1.9E-11	4.6E-14	1.4E-11
Child		1.1E-11	2.9E-06	4.5E-11	9.0E-14	1.4E-11
Adult	Future	4.6E-12	n/a	n/a	n/a	n/a
Child		1.5E-11	n/a	n/a	n/a	n/a

[(a)] The consumption rate of wild fowl and eggs was reported as a combined value, therefore, the *ADD* shown is specific to wild fowl consumption. This is a conservative approach since the wild fowl EPC is consistently higher than the egg EPC for this receptor (refer to Table C-25 and Table C-26).

"n/a" indicates not applicable.

C.4.6 Resident Subsistence American Indian Adult and Child #2

Table C-50 summarizes the PCB carcinogenic exposures for the resident subsistence American Indian, scenario #2. The air inhalation exposure is the largest of the inhalation routes in the adult and child in the current timeframe. Fish ingestion is the largest ingestion route for the adult and child in the current timeframe, followed by beef. Produce ingestion is the primary ingestion pathway in the future timeframe.

Table C-50 Resident Subsistence American Indian Adult and Child (#2) PCB Carcinogenic *EC* and *LADD* for the Baseline WTP Operating Configuration

Receptor	Time-frame	Air Inhalation *EC* (µg/m³)	Soil Ingestion *LADD* (mg/(kg·day))	Soil Inhalation *EC* (µg/m³)	Produce Ingestion *LADD* (mg/(kg·day))	Beef Ingestion *LADD* (mg/(kg·day))	Chicken Ingestion *LADD* (mg/(kg·day))
Adult	Current	5.0E-09	2.0E-11	9.2E-14	3.9E-09	1.4E-07	8.4E-12
Child		7.5E-10	2.6E-11	1.4E-14	4.7E-10	1.7E-08	1.6E-12
Adult	Future	n/a	2.5E-13	1.2E-15	1.4E-09	5.4E-10	4.6E-13
Child		n/a	2.2E-12	1.2E-15	4.1E-10	2.7E-10	2.5E-13
Receptor	**Time-frame**	**Game Ingestion *LADD* (mg/(kg·day))**	**Wild Fowl Ingestion *LADD* (mg/(kg·day))**	**Fish Ingestion *LADD* (mg/(kg·day))**	**Drinking Water Ingestion *LADD* (mg/(kg·day))**	**Sweat Lodge Adsorb. *LADD* (mg/(kg·day))**	**Sweat Lodge Inhalation *EC* (µg/m³)**
Adult	Current	8.6E-09	2.9E-12	2.4E-07	1.1E-11	1.8E-13	5.4E-11
Child		9.7E-10	5.6E-13	1.1E-06	3.6E-12	3.4E-15	5.5E-13
Adult	Future	2.7E-11	1.9E-13	n/a	n/a	n/a	n/a
Child		1.1E-11	1.2E-13	n/a	n/a	n/a	n/a

"n/a" indicates not applicable.

Table C-51 presents the dibenz[a,h]anthracene carcinogenic exposures for the resident subsistence American Indian, scenario #2. The air inhalation exposure is the largest of the inhalation routes in the adult and child in the current timeframe. Beef ingestion is the largest ingestion route for the adult and child, followed by produce in the future both the current and future timeframe.

Table C-51 Resident Subsistence American Indian Adult and Child (#2) Dibenz[a,h]anthracene Carcinogenic *EC* and *LADD* for the Baseline WTP Operating Configuration

Receptor	Time-frame	Air Inhalation *EC* (µg/m³)	Soil Ingestion *LADD* (mg/(kg·day))	Soil Inhalation *EC* (µg/m³)	Produce Ingestion *LADD* (mg/(kg·day))	Beef Ingestion *LADD* (mg/(kg·day))	Chicken Ingestion *LADD* (mg/(kg·day))
Adult	Current	4.9E-11	4.1E-13	1.9E-15	1.3E-08	1.4E-07	1.4E-13
Child		7.3E-12	5.3E-13	2.8E-16	1.1E-09	1.6E-08	2.8E-14
Adult	Future	n/a	3.8E-14	1.7E-16	1.3E-13	8.5E-13	1.3E-14
Child		n/a	2.7E-13	1.4E-16	1.0E-13	8.9E-13	1.4E-14
Receptor	**Time-frame**	**Game Ingestion *LADD* (mg/(kg·day))**	**Wild Fowl Ingestion *LADD* (mg/(kg·day))**	**Fish Ingestion *LADD* (mg/(kg·day))**	**Drinking Water Ingestion *LADD* (mg/(kg·day))**	**Sweat Lodge Adsorb. *LADD* (mg/(kg·day))**	**Sweat Lodge Inhalation *EC* (µg/m³)**
Adult	Current	2.0E-13	5.2E-14	1.2E-09	1.8E-14	5.2E-16	8.8E-14
Child		3.9E-14	1.0E-14	5.4E-10	5.9E-15	9.8E-18	9.0E-16
Adult	Future	2.0E-14	6.7E-15	n/a	n/a	n/a	n/a
Child		2.1E-14	7.1E-15	n/a	n/a	n/a	n/a

"n/a" indicates not applicable.

Table C-52 summarizes the noncancer exposures for the resident subsistence American Indian, scenario 2. The air inhalation exposure is the largest of the inhalation routes in the adult and child in the

current timeframe. Fish ingestion is the largest ingestion route for the adult and child in the current timeframe, followed by beef. Beef ingestion is the primary ingestion pathway in the future timeframe.

Table C-52 Resident Subsistence American Indian Adult and Child (#2) PCB Hazardous *EC* and *ADD* for the Baseline WTP Operating Configuration

Receptor	Time-frame	Air Inhalation *EC* (µg/m³)	Soil Ingestion *ADD* (mg/(kg·day))	Soil Inhalation *EC* (µg/m³)	Produce Ingestion *ADD* (mg/(kg·day))	Beef Ingestion *ADD* (mg/(kg·day))	Chicken Ingestion *ADD* (mg/(kg·day))
Adult	Current	8.8E-09	3.5E-11	1.6E-13	5.7E-09	1.5E-07	1.5E-11
Child		8.8E-09	3.0E-10	1.6E-13	5.5E-09	1.9E-07	1.9E-11
Adult	Future	n/a	3.5E-11	1.6E-13	5.8E-09	9.8E-09	1.5E-11
Child		n/a	3.0E-10	1.6E-13	5.7E-09	1.3E-08	1.9E-11

Receptor	Time-frame	Game Ingestion *ADD* (mg/(kg·day))	Wild Fowl Ingestion *ADD* (mg/(kg·day))	Fish Ingestion *ADD* (mg/(kg·day))	Drinking Water Ingestion *ADD* (mg/(kg·day))	Sweat Lodge Adsorb. *ADD* (mg/(kg·day))	Sweat Lodge Inhalation *EC* (µg/m³)
Adult	Current	8.6E-09	5.0E-12	4.1E-07	1.9E-11	3.2E-13	9.5E-11
Child		1.1E-08	6.6E-12	1.3E-06	4.3E-11	6.0E-14	9.7E-12
Adult	Future	1.2E-10	6.9E-12	n/a	n/a	n/a	n/a
Child		1.6E-10	9.1E-12	n/a	n/a	n/a	n/a

"n/a" indicates not applicable.

C.5 Human Health Risk Characterization for the DFLAW Operating Configuration

This section presents the tabulation of each human receptor's total cancer risk and hazard index by pathway, followed by a presentation of risk-driver cancer risk and hazard quotient, relative to total cancer risk and hazard index of the receptor. Data presented are specific to the DFLAW operating configuration.

In no case was the cancer risk threshold value of 1.0E-05 exceeded, nor was the hazard index threshold of 0.25 exceeded.

C.5.1 Incremental Lifetime Cancer Risk by Pathway for the DFLAW Operating Configuration

Table C-53 provides the total cancer risk from chemicals (summation of cancer risk associated with exposures to organics and inorganics) by pathway for the DFLAW operating configuration for the current timeframe. The table shows that for the worker and the resident, the largest contributing pathway is through produce ingestion. For the resident subsistent farmer, it is through livestock consumption, and through fish consumption for the resident subsistent fisher. For resident subsistent American Indians, food ingestion dominates exposures, with the proportion risk spread between food sources according to receptor intake. Water ingestion, soil inhalation, and dermal exposures (through sweat lodge activities) make up a much smaller contribution to the total cancer risk, and in some cases, are lower by several orders of magnitude.

Table C-53 Incremental Lifetime Cancer Risk by Pathway, for Chemical Exposures, Current Timeframe, for the DFLAW Operating Configuration

Pathway or Exposure Route	Hanford Site Industrial Worker	Resident Adult	Resident Child	Resident Subsistence Farmer Adult	Resident Subsistence Farmer Child
Air inhalation	1.4E-09	8.4E-10	5.0E-10	8.4E-10	5.0E-10
Soil ingestion	6.3E-10	1.6E-11	6.8E-11	1.7E-11	6.8E-11
Resuspended soil inhalation	1.4E-13	2.5E-14	1.1E-14	2.7E-14	1.1E-14
Produce ingestion	4.2E-09	3.9E-09	2.2E-09	7.2E-09	3.1E-09
Livestock and/or game ingestion	n/a	n/a	n/a	1.6E-06	3.4E-07
Fish ingestion	n/a	n/a	n/a	n/a	n/a
Water ingestion	9.7E-12	4.1E-12	5.8E-12	4.1E-12	5.8E-12
Sweat lodge inhalation & dermal adsorption	n/a	n/a	n/a	n/a	n/a
Total for all exposure pathways	6.2E-09	4.7E-09	2.8E-09	1.6E-06	3.5E-07

Pathway or Exposure Route	Resident Subsistence Fisher Adult	Resident Subsistence Fisher Child	Resident Subsistence American Indian Adult #1	Resident Subsistence American Indian Child #1	Resident Subsistence American Indian Adult #2	Resident Subsistence American Indian Child #2
Air inhalation	8.4E-10	5.0E-10	1.4E-10	5.0E-11	8.7E-10	5.2E-10
Soil ingestion	1.6E-11	6.8E-11	9.7E-11	1.6E-10	4.2E-11	1.3E-10
Resuspended soil inhalation	2.5E-14	1.1E-14	3.9E-14	1.1E-15	3.4E-14	1.1E-14
Produce ingestion	3.9E-09	2.2E-09	8.0E-08	2.7E-08	2.9E-07	2.7E-08
Livestock and/or game ingestion	n/a	n/a	1.7E-07	4.6E-08	2.4E-06	2.7E-07
Fish ingestion	7.4E-09	3.1E-09	1.0E-07	1.9E-07	4.6E-08	8.4E-08
Water ingestion	4.1E-12	5.8E-12	8.6E-12	1.2E-11	8.6E-12	1.1E-11
Sweat lodge inhalation & dermal adsorption	n/a	n/a	2.1E-12	1.3E-12	1.5E-11	8.6E-13
Total for all exposure pathways	1.2E-08	5.9E-09	3.6E-07	2.7E-07	2.7E-06	3.8E-07

"n/a" indicates not applicable.

Incremental lifetime cancer risk health threshold value is 1.0E-5.

Table C-54 provides the total cancer risk from chemicals (summation of cancer risk associated with exposures to organics and inorganics) by pathway for the DFLAW operating configuration. The data shown reflect exposures assessed for the future timeframe, following operations. The table shows that the dominant exposure pathways are still those associated with ingestion; however, soil ingestion is now a contributing pathway for the Hanford Site Worker as well.

Table C-54 Incremental Lifetime Cancer Risk by Pathway, for Chemical Exposures, Future Timeframe, for the DFLAW Operating Configuration

Pathway or Exposure Route	Hanford Site Industrial Worker	Resident Adult	Resident Child	Resident Subsistence Farmer Adult	Resident Subsistence Farmer Child
Soil Ingestion	2.9E-10	7.5E-12	3.6E-11	8.5E-12	3.6E-11
Resuspended Soil Inhalation	8.3E-14	1.6E-14	6.2E-15	2.1E-14	6.2E-15
Produce Ingestion	4.6E-10	3.9E-10	2.8E-10	5.9E-10	3.4E-10
Livestock and/or Game Ingestion	n/a	n/a	n/a	2.6E-09	5.8E-10
Total for all exposure pathways:	7.5E-10	4.0E-10	3.2E-10	3.2E-09	9.5E-10

Pathway or Exposure Route	Resident Subsistence Fisher Adult	Resident Subsistence Fisher Child	Resident Subsistence American Indian Adult #1	Resident Subsistence American Indian Child #1	Resident Subsistence American Indian Adult #2	Resident Subsistence American Indian Child #2
Soil Ingestion	7.5E-12	3.6E-11	5.4E-11	8.7E-11	2.3E-11	7.0E-11
Resuspended Soil Inhalation	1.6E-14	6.2E-15	4.6E-14	6.5E-16	3.9E-14	6.5E-15
Produce Ingestion	3.9E-10	2.8E-10	7.6E-09	3.5E-09	1.3E-08	1.9E-09
Livestock and/or Game Ingestion	n/a	n/a	9.7E-12	8.8E-12	1.1E-08	1.6E-09
Total for all exposure pathways:	4.0E-10	3.2E-10	7.6E-09	3.6E-09	2.4E-08	3.5E-09

"n/a" indicates not applicable.
Incremental lifetime cancer risk health threshold value is 1.0E-5.

Table C-55 provides the total radionuclide cancer risk (summation of cancer risk associated with exposures to radionuclides) by pathway for the DFLAW operating configuration in the current timeframe. With the exception of the Hanford Site worker, food ingestion pathways dominate the exposures in the current timeframe. However, for the Hanford Site worker, ingestion of soil is the dominant exposure route for the current timeframe. Water ingestion and external radiation play only small roles in any receptor's overall exposure.

Table C-55 Incremental Lifetime Cancer Risk by Pathway, for Radiological Exposures, Current Timeframe, for the DFLAW Operating Configuration

Pathway or Exposure Route	Hanford Site Industrial Worker	Resident Adult	Resident Child	Resident Subsistence Farmer Adult	Resident Subsistence Farmer Child
Air Inhalation	1.3E-09	9.2E-11	2.8E-11	9.2E-11	2.8E-11
External Air Exposure	3.8E-14	3.0E-15	2.2E-15	4.5E-15	2.7E-15
Soil Ingestion	1.8E-08	9.7E-10	3.3E-10	1.4E-09	3.3E-10
Resuspended Soil Inhalation	1.1E-10	6.2E-12	5.2E-13	8.7E-12	5.2E-13
External Soil Exposure	7.2E-10	5.8E-11	1.1E-11	1.0E-10	1.2E-11
Produce Ingestion	1.0E-08	5.2E-09	1.5E-09	6.3E-09	1.8E-09
Livestock and/or Game Ingestion	n/a	n/a	n/a	1.3E-07	5.7E-09
Fish Ingestion	n/a	n/a	n/a	n/a	n/a
Water Ingestion	1.3E-11	5.6E-12	1.7E-12	5.6E-12	1.7E-12
Sweat Lodge Inhalation & Dermal Adsorption	n/a	n/a	n/a	n/a	n/a
Total for all exposure pathways:	3.1E-08	6.3E-09	1.9E-09	1.4E-07	7.9E-09

Pathway or Exposure Route	Resident Subsistence Fisher Adult	Resident Subsistence Fisher Child	Resident Subsistence American Indian Adult #1	Resident Subsistence American Indian Child #1	Resident Subsistence American Indian Adult #2	Resident Subsistence American Indian Child #2
Air Inhalation	9.2E-11	2.8E-11	1.3E-10	4.6E-11	1.2E-10	4.6E-11
External Air Exposure	4.5E-15	2.7E-15	5.4E-15	3.2E-15	4.1E-15	2.5E-15
Soil Ingestion	9.7E-10	3.3E-10	1.2E-08	7.5E-10	5.2E-09	6.8E-10
Resuspended Soil Inhalation	6.2E-12	5.2E-13	2.3E-11	9.1E-13	2.2E-11	8.7E-13
External Soil Exposure	7.1E-11	1.2E-11	2.2E-10	1.4E-11	1.8E-10	1.2E-11
Produce Ingestion	5.2E-09	1.5E-09	3.7E-08	1.5E-08	8.2E-08	1.0E-08
Livestock and/or Game Ingestion	n/a	n/a	3.4E-09	2.0E-10	1.3E-07	2.9E-09
Fish Ingestion	1.5E-08	1.4E-09	2.1E-07	8.4E-08	9.4E-08	3.9E-08
Water Ingestion	5.6E-12	1.7E-12	1.2E-11	3.5E-12	1.2E-11	3.5E-12
Sweat Lodge Inhalation & Dermal Adsorption	n/a	n/a	1.8E-13	4.2E-14	1.3E-12	3.2E-14
Total for all exposure pathways:	2.1E-08	3.3E-09	2.6E-07	1.0E-07	3.1E-07	5.3E-08

"n/a" indicates not applicable.
Incremental lifetime cancer risk health threshold value is 1.0E-5.

Table C-56 presents the total radionuclide cancer risk (summation of cancer risk associated with exposures to radionuclides) by pathway for the DFLAW operating configuration for the future timeframe. With the exception of the resident subsistence farmer and the resident subsistence American Indian #2, the incidental ingestion of soil is the dominant exposure route. For the resident subsistence farmer and the resident subsistence American Indian #2, however, exposure is primary attributed to livestock and game consumption.

Table C-56 Incremental Lifetime Cancer Risk by Pathway, for Radiological Exposures, Future Timeframe, for the DFLAW Operating Configuration

Pathway or Exposure Route	Hanford Site Industrial Worker	Resident Adult	Resident Child	Resident Subsistence Farmer Adult	Resident Subsistence Farmer Child
Soil Ingestion	2.4E-08	1.2E-09	4.6E-10	1.5E-09	4.6E-10
Resuspended Soil Inhalation	1.4E-10	7.5E-12	7.5E-13	9.9E-12	7.5E-13
External Soil Exposure	9.6E-10	7.0E-11	1.5E-11	1.1E-10	1.7E-11
Produce Ingestion	1.7E-10	1.7E-10	1.8E-11	2.8E-10	2.1E-11
Livestock and/or Game Ingestion	n/a	n/a	n/a	7.0E-08	3.2E-09
Total for all exposure pathways:	2.6E-08	1.4E-09	5.0E-10	7.1E-08	3.7E-09

Pathway or Exposure Route	Resident Subsistence Fisher Adult	Resident Subsistence Fisher Child	Resident Subsistence American Indian Adult #1	Resident Subsistence American Indian Child #1	Resident Subsistence American Indian Adult #2	Resident Subsistence American Indian Child #2
Soil Ingestion	1.2E-09	4.6E-10	1.2E-08	1.1E-09	5.6E-09	9.7E-10
Resuspended Soil Inhalation	7.5E-12	7.5E-13	2.5E-11	1.3E-12	2.4E-11	1.2E-12
External Soil Exposure	8.5E-11	1.7E-11	2.4E-10	2.1E-11	1.9E-10	1.7E-11
Produce Ingestion	1.7E-10	1.8E-11	2.9E-09	1.7E-10	6.7E-09	1.3E-10
Livestock and/or Game Ingestion	n/a	n/a	5.0E-11	3.0E-12	8.6E-08	2.2E-09
Total for all exposure pathways:	1.4E-09	5.0E-10	1.6E-08	1.3E-09	9.8E-08	3.3E-09

"n/a" indicates not applicable.
Incremental lifetime cancer risk health threshold value is 1.0E-5.

C.5.2 Hazard Index by Pathway for the DFLAW Operating Configuration

Table C-57 provides the hazard indices for the summation of hazard quotients for organics and inorganics, for the DFLAW operating configuration, current timeframe. The dominant pathway is air inhalation for all but the American Indian receptors, where fish and produce consumption provide the most dominant exposure pathway.

Table C-57 Total Hazard Index by Pathway, Current Timeframe, for the DFLAW Operating Configuration

Pathway or Exposure Route	Hanford Site Industrial Worker	Resident Adult	Resident Child	Resident Subsistence Farmer Adult	Resident Subsistence Farmer Child
Air Inhalation	1.2E-03	4.0E-04	4.0E-04	4.0E-04	4.0E-04
Soil Ingestion	4.1E-06	1.0E-07	9.3E-07	1.0E-07	9.3E-07
Resuspended Soil Inhalation	1.3E-06	1.1E-07	1.1E-07	1.1E-07	1.1E-07
Produce Ingestion	1.9E-04	9.5E-05	2.3E-04	1.1E-04	2.8E-04
Livestock and/or Game Ingestion	n/a	n/a	n/a	3.4E-04	4.4E-04
Fish Ingestion	n/a	n/a	n/a	n/a	n/a
Water Ingestion	1.2E-06	5.3E-07	1.2E-06	5.3E-07	1.2E-06
Sweat Lodge Inhalation & Dermal Adsorption	n/a	n/a	n/a	n/a	n/a
Total for all exposure pathways:	1.4E-03	4.9E-04	6.3E-04	8.5E-04	1.1E-03

Pathway or Exposure Route	Resident Subsistence Fisher Adult	Resident Subsistence Fisher Child	Resident Subsistence American Indian Adult #1	Resident Subsistence American Indian Child #1	Resident Subsistence American Indian Adult #2	Resident Subsistence American Indian Child #2
Air Inhalation	4.0E-04	4.0E-04	4.5E-04	4.5E-04	4.2E-04	4.2E-04
Soil Ingestion	1.0E-07	9.3E-07	4.7E-07	2.2E-06	2.1E-07	1.8E-06
Resuspended Soil Inhalation	1.1E-07	1.1E-07	1.3E-07	1.3E-07	1.2E-07	1.2E-07
Produce Ingestion	9.5E-05	2.3E-04	3.7E-04	1.2E-03	1.3E-03	1.3E-03
Livestock and/or Game Ingestion	n/a	n/a	2.9E-05	9.0E-05	4.2E-04	5.6E-04
Fish Ingestion	1.9E-04	1.4E-04	2.7E-03	8.4E-03	1.2E-03	3.7E-03
Water Ingestion	5.3E-07	1.2E-06	1.1E-06	2.6E-06	1.1E-06	2.4E-06
Sweat Lodge Inhalation & Dermal Adsorption	n/a	n/a	7.2E-07	7.2E-07	5.1E-06	5.2E-07
Total for all exposure pathways:	6.9E-04	7.7E-04	3.6E-03	1.0E-02	3.3E-03	5.9E-03

"n/a" indicates not applicable.
Hazard index health threshold is 2.5E-01.

Table C-58 provides the hazard indices for the summation of hazard quotients for organics and inorganics, for the DFLAW operating configuration, in the future timeframe. Produce consumption is the dominant pathway for all receptors in the future timeframe. Soil ingestion and inhalation pathways present the same hazard in the current and future timeframes (since soil concentration is assessed at its maximum in both timeframes). Produce and other food ingestion pathways contribute less in the future timeframe than during the current scenarios because of the absence of vapor-to-plant uptake and its impact to livestock and game, as well as the receptors which consume them.

Table C-58 Total Hazard Index by Pathway, Future Timeframe, for the DFLAW Operating Configuration

Pathway or Exposure Route	Hanford Site Industrial Worker	Resident Adult	Resident Child	Resident Subsistence Farmer Adult	Resident Subsistence Farmer Child
Soil Ingestion	4.1E-06	1.0E-07	9.3E-07	1.0E-07	9.3E-07
Resuspended Soil Inhalation	1.3E-06	1.1E-07	1.1E-07	1.1E-07	1.1E-07
Produce Ingestion	1.9E-04	9.3E-05	2.3E-04	1.1E-04	2.7E-04
Livestock and/or Game Ingestion	n/a	n/a	n/a	1.3E-05	1.5E-05
Total for all exposure pathways:	1.9E-04	9.4E-05	2.3E-04	1.2E-04	2.9E-04

Pathway or Exposure Route	Resident Subsistence Fisher Adult	Resident Subsistence Fisher Child	Resident Subsistence American Indian Adult #1	Resident Subsistence American Indian Child #1	Resident Subsistence American Indian Adult #2	Resident Subsistence American Indian Child #2
Soil Ingestion	1.0E-07	9.3E-07	4.7E-07	2.2E-06	2.1E-07	1.8E-06
Resuspended Soil Inhalation	1.1E-07	1.1E-07	1.3E-07	1.3E-07	1.2E-07	1.2E-07
Produce Ingestion	9.3E-05	2.3E-04	4.9E-04	1.6E-03	1.4E-03	1.4E-03
Livestock and/or Game Ingestion	n/a	n/a	2.5E-07	7.9E-07	2.0E-05	2.7E-05
Total for all exposure pathways:	9.4E-05	2.3E-04	4.9E-04	1.6E-03	1.4E-03	1.4E-03

"n/a" indicates not applicable.
Hazard index health threshold is 2.5E-01.

C.5.3 Characterization of Risk Driving COPCs for all Human Receptors for the DFLAW Operating Configuration

No inorganics presented a cancer risk or hazard quotient that would cause them to be considered risk drivers for human receptors. Likewise, no radionuclides presented a corresponding cancer risk that would cause them to be considered risk drivers for human receptors. No risk drivers were identified for exposures in the future timeframe. Only dibenz[a,h]anthracene was identified as a risk driver, associated with chronic exposure and cancer risk in the current timeframe for the resident subsistence adult farmer and the resident subsistence American Indian adult (scenario #2). Table C-59 presents the dibenz[a,h]anthracene results for all human receptors. Data displayed in the table shows the COPC-specific cancer risk (summed across all applicable exposure pathways), the total cancer risk due to all organics (summation of receptor COPC-specific cancer risks for organics), and the percentage of that total due solely to the risk driver indicated.

Table C-59 Incremental Lifetime Cancer Risk Results for Dibenz[a,h]anthracene for the DFLAW Operating Configuration

Receptor	COPC-specific Incremental Lifetime Cancer Risk	Total Incremental Lifetime Cancer Risk due to Organics	Contribution (%)
Hanford Site Industrial Worker	1.5E-09	6.2E-09	24
Resident Adult	1.5E-09	4.7E-09	31
Resident Child	7.1E-10	2.8E-09	25
Resident Subsistence Farmer Adult	1.1E-06*	1.6E-06	65
Resident Subsistence Farmer Child	2.3E-07	3.5E-07	65
Resident Subsistence Fisher Adult	1.9E-09	1.2E-08	16
Resident Subsistence Fisher Child	9.0E-10	5.9E-09	15
Resident Subsistence American Indian Adult #1	1.5E-07	3.6E-07	41
Resident Subsistence American Indian Child #1	5.0E-08	2.7E-07	19
Resident Subsistence American Indian Adult #2	1.6E-06*	2.7E-06	59
Resident Subsistence American Indian Child #2	1.8E-07	3.8E-07	48

Values shown are summed across all applicable exposure pathways.
"*" indicates risk driver (COPC cancer risk ≥ 1E-06 or 10 percent of 1.0E-05).

All exposure scenarios were below the health criterion of 1E-05.

C.6 Human Health Risk Characterization for the Baseline WTP Operating Configuration

This section presents the tabulation of each human receptor's total cancer risk and hazard index by pathway, followed by a presentation of risk-driver cancer risk and hazard quotient, relative to total cancer risk and hazard index. Data presented are specific to the baseline WTP operating configuration. The pathways with the highest contributions for this operating configuration are similar to those of the DFLAW operating configuration, with minor exceptions as described.

In no case was the cancer risk threshold value of 1.0E-05 exceeded, or the hazard index threshold of 0.25 exceeded.

C.6.1 Incremental Lifetime Cancer Risk by Pathway for the Baseline WTP Operating Configuration

Table C-60 provides the total cancer risk from chemicals (summation of cancer risk associated with exposures to organics and inorganics) by pathway for the baseline WTP operating configuration for the current timeframe. The table shows that for the worker and the resident, the largest contributing pathway is through produce ingestion, followed closely by air inhalation. For the resident subsistent farmer, the dominant pathway is through livestock consumption, and through fish consumption for the resident subsistent fisher. For resident subsistent American Indians, food ingestion dominates exposures, with the proportion risk spread between food sources according to receptor intake. Water ingestion and dermal exposures (through sweat lodge activities) make up a much smaller contribution to the total cancer risk, and in some cases, are lower than food ingestions and air inhalation by several orders of magnitude.

Table C-60 Incremental Lifetime Cancer Risk by Pathway, for Chemical Exposures, Current Timeframe, for the Baseline WTP Operating Configuration

Pathway or Exposure Route	Hanford Site Industrial Worker	Resident Adult	Resident Child	Resident Subsistence Farmer Adult	Resident Subsistence Farmer Child
Air Inhalation	1.8E-08	1.4E-08	2.8E-09	1.9E-08	2.8E-09
Soil Ingestion	6.6E-09	2.5E-10	5.1E-10	2.9E-10	5.1E-10
Resuspended Soil Inhalation	1.7E-12	4.4E-13	9.8E-14	5.2E-13	9.8E-14
Produce Ingestion	2.0E-08	2.0E-08	9.4E-09	3.2E-08	1.2E-08
Livestock and/or Game Ingestion	n/a	n/a	n/a	2.5E-06	5.4E-07
Fish Ingestion	n/a	n/a	n/a	n/a	n/a
Water Ingestion	7.2E-11	5.8E-11	2.7E-11	7.7E-11	2.7E-11
Sweat Lodge Inhalation & Dermal Adsorption	n/a	n/a	n/a	n/a	n/a
Total for all exposure pathways:	4.5E-08	3.4E-08	1.3E-08	2.6E-06	5.5E-07

Pathway or Exposure Route	Resident Subsistence Fisher Adult	Resident Subsistence Fisher Child	Resident Subsistence American Indian Adult #1	Resident Subsistence American Indian Child #1	Resident Subsistence American Indian Adult #2	Resident Subsistence American Indian Child #2
Air Inhalation	1.4E-08	2.8E-09	1.2E-08	2.7E-10	2.0E-08	2.9E-09
Soil Ingestion	2.5E-10	5.1E-10	1.8E-09	1.2E-09	8.1E-10	9.9E-10
Resuspended Soil Inhalation	4.4E-13	9.8E-14	8.2E-13	9.9E-15	7.3E-13	1.0E-13
Produce Ingestion	2.0E-08	9.4E-09	2.2E-07	8.6E-08	6.2E-07	6.8E-08
Livestock and/or Game Ingestion	n/a	n/a	2.6E-07	7.1E-08	3.7E-06	4.3E-07
Fish Ingestion	8.8E-08	1.2E-08	1.6E-06	7.6E-07	7.2E-07	3.3E-07
Water Ingestion	5.8E-11	2.7E-11	1.6E-10	5.6E-11	1.6E-10	5.3E-11
Sweat Lodge Inhalation & Dermal Adsorption	n/a	n/a	4.9E-11	6.7E-12	3.4E-10	4.6E-12
Total for all exposure pathways:	1.2E-07	2.5E-08	2.1E-06	9.2E-07	5.1E-06	8.3E-07

"n/a" indicates not applicable.
Incremental lifetime cancer risk health threshold value is 1.0E-5.

Table C-61 provides the total cancer risk from chemicals (summation of cancer risk associated with exposures to organics and inorganics) by pathway for the baseline WTP operating configuration. The data shown reflect exposures assessed for the future timeframe, subsequent to operations. The table shows that the dominant exposure pathways are still those associated with ingestion; however, soil ingestion is now a contributing pathway for the Hanford Site Worker as well.

Table C-61 Incremental Lifetime Cancer Risk by Pathway, for Chemical Exposures, Future Timeframe, for the Baseline WTP Operating Configuration

Pathway or Exposure Route	Hanford Site Industrial Worker	Resident Adult	Resident Child	Resident Subsistence Farmer Adult	Resident Subsistence Farmer Child
Soil Ingestion	3.2E-09	9.8E-11	3.2E-10	1.2E-10	3.2E-10
Resuspended Soil Inhalation	9.0E-13	1.9E-13	6.3E-14	2.4E-13	6.3E-14
Produce Ingestion	3.4E-09	2.6E-09	2.5E-09	3.8E-09	3.0E-09
Livestock and/or Game Ingestion	n/a	n/a	n/a	4.7E-08	8.2E-09
Total for all exposure pathways:	6.6E-09	2.7E-09	2.8E-09	5.1E-08	1.1E-08

Pathway or Exposure Route	Resident Subsistence Fisher Adult	Resident Subsistence Fisher Child	Resident Subsistence American Indian Adult #1	Resident Subsistence American Indian Child #1	Resident Subsistence American Indian Adult #2	Resident Subsistence American Indian Child #2
Soil Ingestion	9.8E-11	3.2E-10	8.2E-10	7.7E-10	3.5E-10	6.3E-10
Resuspended Soil Inhalation	1.9E-13	6.3E-14	4.2E-13	6.4E-15	3.7E-13	6.6E-14
Produce Ingestion	2.6E-09	2.5E-09	4.1E-08	2.5E-08	7.5E-08	1.4E-08
Livestock and/or Game Ingestion	n/a	n/a	2.0E-10	1.4E-10	2.1E-07	2.6E-08
Total for all exposure pathways:	2.7E-09	2.8E-09	4.2E-08	2.5E-08	2.9E-07	4.1E-08

"n/a" indicates not applicable.
Incremental lifetime cancer risk health threshold value is 1.0E-5.

Table C-62 provides the total radionuclide cancer risk (summation of cancer risk associated with exposures to radionuclides) by pathway for the baseline WTP operating configuration in the current timeframe. With the exception of the Hanford Site worker, food ingestion pathways dominate the exposures in the current timeframe. For the Hanford Site worker, ingestion of soil is the dominant exposure route for the current timeframe. As with the DFLAW operating configuration, water ingestion and external radiation play only small roles in any receptor's overall exposure.

Table C-62 Incremental Lifetime Cancer Risk by Pathway, for Radiological Exposures, Current Timeframe, for the Baseline WTP Operating Configuration

Pathway or Exposure Route	Hanford Site Industrial Worker	Resident Adult	Resident Child	Resident Subsistence Farmer Adult	Resident Subsistence Farmer Child
Air Inhalation	3.1E-09	5.2E-10	5.2E-11	6.9E-10	5.2E-11
External Air Exposure	3.6E-13	5.4E-14	1.3E-14	1.1E-13	1.6E-14
Soil Ingestion	4.7E-08	1.8E-09	1.1E-09	2.0E-09	1.1E-09
Resuspended Soil Inhalation	2.5E-10	1.1E-11	1.6E-12	1.2E-11	1.6E-12
External Soil Exposure	2.6E-09	1.6E-10	5.1E-11	2.0E-10	5.7E-11
Produce Ingestion	1.0E-08	9.8E-09	1.0E-09	1.5E-08	1.2E-09
Livestock and/or Game Ingestion	n/a	n/a	n/a	1.4E-07	1.0E-08
Fish Ingestion	n/a	n/a	n/a	n/a	n/a
Water Ingestion	1.3E-11	1.1E-11	1.1E-12	1.4E-11	1.1E-12
Sweat Lodge Inhalation & Dermal Adsorption	n/a	n/a	n/a	n/a	n/a
Total for all exposure pathways:	6.3E-08	1.2E-08	2.2E-09	1.6E-07	1.3E-08

Pathway or Exposure Route	Resident Subsistence Fisher Adult	Resident Subsistence Fisher Child	Resident Subsistence American Indian Adult #1	Resident Subsistence American Indian Child #1	Resident Subsistence American Indian Adult #2	Resident Subsistence American Indian Child #2
Air Inhalation	5.2E-10	5.2E-11	9.7E-10	8.7E-11	9.4E-10	8.6E-11
External Air Exposure	8.1E-14	1.6E-14	1.3E-13	2.0E-14	1.0E-13	1.5E-14
Soil Ingestion	1.8E-09	1.1E-09	2.3E-08	2.5E-09	1.0E-08	2.3E-09
Resuspended Soil Inhalation	1.1E-11	1.6E-12	4.3E-11	2.8E-12	4.0E-11	2.7E-12
External Soil Exposure	1.9E-10	5.7E-11	6.2E-10	6.9E-11	5.0E-10	5.5E-11
Produce Ingestion	9.8E-09	1.0E-09	9.4E-08	9.7E-09	2.1E-07	6.8E-09
Livestock and/or Game Ingestion	n/a	n/a	2.2E-09	1.3E-10	1.8E-07	5.8E-09
Fish Ingestion	2.7E-08	8.1E-10	5.0E-07	5.0E-08	2.2E-07	2.3E-08
Water Ingestion	1.1E-11	1.1E-12	3.0E-11	2.2E-12	3.0E-11	2.2E-12
Sweat Lodge Inhalation & Dermal Adsorption	n/a	n/a	1.0E-12	6.1E-14	7.3E-12	4.6E-14
Total for all exposure pathways:	3.9E-08	3.0E-09	6.2E-07	6.2E-08	6.3E-07	3.8E-08

"n/a" indicates not applicable.
Incremental lifetime cancer risk health threshold value is 1.0E-5.

Table C-63 presents the total radionuclide cancer risk (summation of cancer risk associated with exposures to radionuclides) by pathway for the baseline WTP operating configuration for the future timeframe. With the exception of the resident subsistence farmer and the American Indian exposure scenario #2, the incidental ingestion of soil is the dominant exposure route. For the resident subsistence farmer and the American Indian exposure scenario #2, exposure is primary attributed to livestock and game consumption. The DFLAW operating configuration results exhibited a similar pattern of dominant exposure pathways for radionuclides in the future timeframe.

Table C-63 Incremental Lifetime Cancer Risk by Pathway, for Radiological Exposures, Future Timeframe, for the Baseline WTP Operating Configuration

Pathway or Exposure Route	Hanford Site Industrial Worker	Resident Adult	Resident Child	Resident Subsistence Farmer Adult	Resident Subsistence Farmer Child
Soil Ingestion	6.2E-08	2.9E-09	1.2E-09	3.9E-09	1.2E-09
Resuspended Soil Inhalation	3.4E-10	1.8E-11	1.8E-12	2.4E-11	1.8E-12
External Soil Exposure	3.4E-09	2.5E-10	5.5E-11	4.1E-10	6.1E-11
Produce Ingestion	1.3E-09	1.3E-09	1.4E-10	2.1E-09	1.6E-10
Livestock and/or Game Ingestion	n/a	n/a	n/a	2.0E-07	9.0E-09
Total for all exposure pathways:	6.7E-08	4.5E-09	1.4E-09	2.0E-07	1.0E-08

Pathway or Exposure Route	Resident Subsistence Fisher Adult	Resident Subsistence Fisher Child	Resident Subsistence American Indian Adult #1	Resident Subsistence American Indian Child #1	Resident Subsistence American Indian Adult #2	Resident Subsistence American Indian Child #2
Soil Ingestion	2.9E-09	1.2E-09	3.2E-08	2.7E-09	1.4E-08	2.5E-09
Resuspended Soil Inhalation	1.8E-11	1.8E-12	5.9E-11	3.1E-12	5.6E-11	3.0E-12
External Soil Exposure	3.1E-10	6.1E-11	8.6E-10	7.4E-11	7.0E-10	6.0E-11
Produce Ingestion	1.3E-09	1.4E-10	2.2E-08	1.4E-09	5.2E-08	9.9E-10
Livestock and/or Game Ingestion	n/a	n/a	4.2E-10	2.7E-11	2.1E-07	5.4E-09
Total for all exposure pathways:	4.6E-09	1.4E-09	5.5E-08	4.2E-09	2.7E-07	8.9E-09

"n/a" indicates not applicable.
Incremental lifetime cancer risk health threshold value is 1.0E-5.

C.6.2 Hazard Index by Pathway for the Baseline WTP Operating Configuration

Table C-64 provides the hazard indices for the summation of hazard quotients for organics and inorganics for the baseline WTP operating configuration, current timeframe. The highest exposure pathways vary by receptor. The air inhalation pathway is the highest for the Hanford Site worker (and second highest for the resident). The dominant pathway for the resident is produce, while it is livestock for the resident subsistent farmer. For the resident subsistent fisher and American Indian receptors, fish consumption provides the most dominant exposure pathway. Water ingestion and inhalation of resuspended soil are only minor contributors to all receptors, along with sweat lodge exposures for the American Indian scenarios.

Table C-64 Total Hazard Index by Pathway, Current Timeframe, for the Baseline WTP Operating Configuration

Pathway or Exposure Route	Hanford Site Industrial Worker	Resident Adult	Resident Child	Resident Subsistence Farmer Adult	Resident Subsistence Farmer Child
Air Inhalation	1.7E-03	3.4E-04	3.4E-04	3.4E-04	3.4E-04
Soil Ingestion	4.6E-05	1.3E-06	1.2E-05	1.3E-06	1.2E-05
Resuspended Soil Inhalation	4.3E-06	3.9E-07	3.9E-07	3.9E-07	3.9E-07
Produce Ingestion	9.6E-04	4.8E-04	1.2E-03	5.7E-04	1.4E-03
Livestock and/or Game Ingestion	n/a	n/a	n/a	6.2E-03	8.1E-03
Fish Ingestion	n/a	n/a	n/a	n/a	n/a
Water Ingestion	2.1E-06	8.7E-07	2.0E-06	8.7E-07	2.0E-06
Sweat Lodge Inhalation & Dermal Adsorption	n/a	n/a	n/a	n/a	n/a
Total for all exposure pathways:	2.7E-03	8.2E-04	1.5E-03	7.2E-03	9.8E-03

Pathway or Exposure Route	Resident Subsistence Fisher Adult	Resident Subsistence Fisher Child	Resident Subsistence American Indian Adult #1	Resident Subsistence American Indian Child #1	Resident Subsistence American Indian Adult #2	Resident Subsistence American Indian Child #2
Air Inhalation	3.4E-04	3.4E-04	3.8E-04	3.8E-04	3.5E-04	3.5E-04
Soil Ingestion	1.3E-06	1.2E-05	6.2E-06	2.9E-05	2.8E-06	2.4E-05
Resuspended Soil Inhalation	3.9E-07	3.9E-07	4.5E-07	4.5E-07	4.1E-07	4.1E-07
Produce Ingestion	4.8E-04	1.2E-03	1.9E-03	6.4E-03	6.5E-03	6.3E-03
Livestock and/or Game Ingestion	n/a	n/a	5.6E-04	1.7E-03	8.0E-03	1.1E-02
Fish Ingestion	3.3E-03	2.4E-03	4.7E-02	1.5E-01	2.1E-02	6.3E-02
Water Ingestion	8.7E-07	2.0E-06	1.8E-06	4.3E-06	1.8E-06	4.0E-06
Sweat Lodge Inhalation & Dermal Adsorption	n/a	n/a	6.1E-07	6.1E-07	4.3E-06	4.4E-07
Total for all exposure pathways:	4.2E-03	3.9E-03	5.0E-02	1.5E-01	3.6E-02	8.0E-02

"n/a" indicates not applicable.
Hazard index health threshold is 2.5E-01.

In the future exposure scenarios, as shown in Table C-65, produce ingestion is the dominant exposure route in all receptors. As with the DFLAW operating configuration, soil ingestion and inhalation exposures are the same for the current and future timeframe.

Table C-65 Total Hazard Index by Pathway, Future Timeframe, for the Baseline WTP Operating Configuration

Pathway or Exposure Route	Hanford Site Industrial Worker	Resident Adult	Resident Child	Resident Subsistence Farmer Adult	Resident Subsistence Farmer Child
Soil Ingestion	4.6E-05	1.3E-06	1.2E-05	1.3E-06	1.2E-05
Resuspended Soil Inhalation	4.3E-06	3.9E-07	3.9E-07	3.9E-07	3.9E-07
Produce Ingestion	9.5E-04	4.7E-04	1.1E-03	5.7E-04	1.4E-03
Livestock and/or Game Ingestion	n/a	n/a	n/a	3.2E-04	3.8E-04
Total for all exposure pathways:	1.0E-03	4.8E-04	1.2E-03	8.9E-04	1.8E-03

Pathway or Exposure Route	Resident Subsistence Fisher Adult	Resident Subsistence Fisher Child	Resident Subsistence American Indian Adult #1	Resident Subsistence American Indian Child #1	Resident Subsistence American Indian Adult #2	Resident Subsistence American Indian Child #2
Soil Ingestion	1.3E-06	1.2E-05	6.2E-06	2.9E-05	2.8E-06	2.4E-05
Resuspended Soil Inhalation	3.9E-07	3.9E-07	4.5E-07	4.5E-07	4.1E-07	4.1E-07
Produce Ingestion	4.7E-04	1.1E-03	2.6E-03	8.6E-03	7.3E-03	7.0E-03
Livestock and/or Game Ingestion	n/a	n/a	8.1E-06	2.5E-05	5.0E-04	6.6E-04
Total for all exposure pathways:	4.8E-04	1.2E-03	2.6E-03	8.6E-03	7.8E-03	7.7E-03

"n/a" indicates not applicable.
Hazard index health threshold is 2.5E-01.

C.6.3 Characterization of Risk Driving COPCs for all Human Receptors for the Baseline WTP Operating Configuration

No inorganics presented a cancer risk or hazard quotient that would cause them to be considered risk drivers for human receptors. Likewise, no radionuclides presented a corresponding cancer risk that would cause them to be considered risk drivers for human receptors. No risk drivers were identified for exposures in the future timeframe. Total PCBs were identified as a risk driver, associated with chronic exposure, noncancer, and cancer risk in the current timeframe for the resident subsistence American Indian adult and child. Dibenz[a,h]anthracene was identified as a cancer risk driver for the adult resident subsistence American Indian, scenario #2.

Table C-66 presents the polychlorinated biphenyls cancer risk results for all human receptors, and Table C-67 presents the dibenz[a,h]anthracene cancer risk results for all human receptors. Data displayed in the table shows the COPC-specific cancer risk (summed across all applicable exposure pathways), the cancer risk due to all organics (summation of receptor COPC-specific cancer risks for organics), and the percentage of that total due solely to the risk driver indicated.

Table C-66 Incremental Lifetime Cancer Risk Results for PCBs for the Baseline WTP Operating Configuration

Receptor	COPC-specific	Total due to Organics	Contribution (%)
Hanford Site Industrial Worker	3.3E-09	4.5E-08	7
Resident Adult	2.3E-09	3.4E-08	7
Resident Child	5.4E-10	1.3E-08	4
Resident Subsistence Farmer Adult	1.4E-07	2.6E-06	5
Resident Subsistence Farmer Child	2.7E-08	5.5E-07	5
Resident Subsistence Fisher Adult	6.0E-08	1.2E-07	49
Resident Subsistence Fisher Child	8.6E-09	2.5E-08	34
Resident Subsistence American Indian Adult #1	1.1E-06*	2.1E-06	52
Resident Subsistence American Indian Child #1	5.1E-07	9.2E-07	55
Resident Subsistence American Indian Adult #2	7.9E-07	5.1E-06	15
Resident Subsistence American Indian Child #2	2.5E-07	8.3E-07	30

Values shown are summed across all applicable exposure pathways.

"*" indicates risk driver (COPC cancer risk ≥ 1E-06 or 10 percent of 1.0E-05).

Table C-67 Incremental Lifetime Cancer Risk Results for Dibenz[a,h]anthracene for the Baseline WTP Operating Configuration

Receptor	COPC-specific	Total due to Organics	Contribution (%)
Hanford Site Industrial Worker	1.2E-09	4.5E-08	3
Resident Adult	1.1E-09	3.4E-08	3
Resident Child	5.4E-10	1.3E-08	4
Resident Subsistence Farmer Adult	8.0E-07	2.6E-06	31
Resident Subsistence Farmer Child	1.7E-07	5.5E-07	31
Resident Subsistence Fisher Adult	2.2E-09	1.2E-07	2
Resident Subsistence Fisher Child	6.8E-10	2.5E-08	3
Resident Subsistence American Indian Adult #1	1.3E-07	2.1E-06	6
Resident Subsistence American Indian Child #1	3.8E-08	9.2E-07	4
Resident Subsistence American Indian Adult #2	1.2E-06*	5.1E-06	24
Resident Subsistence American Indian Child #2	1.4E-07	8.3E-07	16

Values shown are summed across all applicable exposure pathways.

"*" indicates risk driver (COPC cancer risk ≥ 1E-06 or 10 percent of 1.0E-05).

All human exposure scenarios were below the health criterion of 1.0E-05.

Table C-68 presents the PCBs hazard indices for all human receptors (hazard quotients summed across all applicable exposure pathways), the hazard index due to all organics (summation of receptor COPC-specific hazard quotients for organics), and the percentage of that total due solely to PCBs.

Table C-68 Hazard Index Results for PCBs for the Baseline WTP Operating Configuration

Receptor	COPC-specific	Total due to Organics	Contribution (%)
Hanford Site Industrial Worker	6.2E-05	4.3E-04	14
Resident Adult	1.7E-05	1.0E-04	16
Resident Child	4.0E-05	1.6E-04	26
Resident Subsistence Farmer Adult	6.0E-03	6.4E-03	95
Resident Subsistence Farmer Child	7.8E-03	8.2E-03	94
Resident Subsistence Fisher Adult	3.4E-03	3.4E-03	98
Resident Subsistence Fisher Child	2.4E-03	2.5E-03	95
Resident Subsistence American Indian Adult #1	4.8E-02*	4.8E-02	99
Resident Subsistence American Indian Child #1	1.5E-01*	1.5E-01	100
Resident Subsistence American Indian Adult #2	2.9E-02*	2.9E-02	98
Resident Subsistence American Indian Child #2	7.4E-02*	7.4E-02	99

Values shown are summed across all applicable exposure pathways.

"*" indicates risk driver (COPC hazard quotient ≥ 0.025 or 10 percent of 0.25).

All are below the noncarcinogen health criterion of 2.5E-01.

C.7 Ecological Exposure Point Concentrations

Data are presented for COPCs determined to be risk drivers (e.g., have an *ESQ* greater than 0.025 for at least one receptor), as determined from modeling the refined feed vector described in Appendix A. Ecological EPCs are based on the time of maximum accumulation and not dependent upon receptor or

exposure duration. Since maxima occur simultaneously at the end of WTP operations and the beginning of post-WTP use of the site by ecological receptors, the analysis did not distinguish between "current" and "future" timeframes, as was done for the HHRA. The risk drivers for the DFLAW operating configuration include three polycyclic aromatic hydrocarbons (PAH). The risk drivers for the baseline WTP operating configuration include PCBs, four PAHs, and 4'4-DDE.

C.7.1 Media Exposure Point Concentrations

Table C-69 through Table C-72 present the EPCs for soil, plants, and water, which were computed in the screening-level ecological risk assessment (SLERA) to evaluate mammal and bird uptake of COPCs from ingested media. Selected media EPCs also represent concentrations used as exposure levels for terrestrial invertebrates, terrestrial plants, aquatic life, and benthic (sediment-dwelling) invertebrates.

Table C-69 presents the terrestrial EPCs for the DFLAW operating configuration, while Table C-70 presents the aquatic EPCs.

Table C-69 Terrestrial Media EPCs for the DFLAW Operating Configuration

CASRN	Constituent	Surface Soil (mg/kg) [(a)]	Root Zone Soil (mg/kg)	Plant Tissue from Deposition (mg/kg)	Plant Tissue from Root Uptake (mg/kg)	Plant Tissue from Air Transfer (mg/kg)	Plant (mg/kg) [(b)]
205-99-2	Benzo(b)fluoranthene	3.6E-04	4.9E-05	2.8E-08	5.9E-08	6.9E-08	1.6E-07
207-08-9	Benzo(k)fluoranthene	2.4E-04	3.2E-05	3.4E-07	3.9E-08	1.1E-06	1.5E-06
56-55-3	Benzo(a)anthracene	4.0E-05	5.4E-06	6.7E-08	1.3E-08	7.0E-08	1.5E-07

[(a)] Exposure levels for terrestrial invertebrate and plant communities
[(b)] Total plant concentration used to estimate COPC uptake by herbivorous and omnivorous mammals and birds in terrestrial food web

Table C-70 Aquatic Media EPCs for the DFLAW Operating Configuration

CASRN	Constituent	Total Water Column (mg/L) [(a)]	Dissolved Phase Water (mg/L)	Sediment (mg/kg) [(b)]	Aquatic Plant Tissue (mg/kg) [(c)]	Total Water Body (mg/L)
205-99-2	Benzo(b)fluoranthene	1.2E-10	6.6E-11	2.8E-06	2.8E-08	6.6E-11
207-08-9	Benzo(k)fluoranthene	3.9E-11	2.2E-11	8.8E-07	8.9E-09	2.2E-11
56-55-3	Benzo(a)anthracene	1.3E-11	1.0E-11	1.5E-07	2.9E-09	1.0E-11

[(a)] Exposure level for aquatic life and water concentration used to estimate COPC uptake by herbivorous and omnivorous mammals and birds in terrestrial and aquatic food webs.
[(b)] Exposure level for benthic invertebrate community
[(c)] Plant concentration used to estimate COPC uptake by herbivorous and omnivorous mammals and birds in aquatic food web

Table C-71 presents the terrestrial EPCs, and Table C-72 presents the aquatic EPCs for the baseline WTP operating configuration.

Table C-71 Terrestrial Media EPCs for the Baseline WTP Operating Configuration

CASRN	Constituent	Surface Soil (mg/kg) [(a)]	Root Zone Soil (mg/kg)	Plant Tissue from Deposition (mg/kg)	Plant Tissue from Root Uptake (mg/kg)	Plant Tissue from Air Transfer (mg/kg)	Plant (mg/kg) [(b)]
1336-36-3	PCBs	4.6E-05	1.8E-04	n/a	1.9E-07	2.8E-08	2.2E-07
205-99-2	Benzo(b)fluoranthene	2.5E-04	3.3E-05	2.0E-08	4.0E-08	3.4E-08	9.5E-08
207-08-9	Benzo(k)fluoranthene	2.9E-04	3.9E-05	2.9E-07	4.8E-08	8.2E-07	1.2E-06
3697-24-3	5-Methylchrysene	3.0E-04	4.1E-05	9.0E-08	5.8E-08	1.1E-08	1.6E-07
56-55-3	Benzo(a)anthracene	4.4E-05	5.9E-06	7.8E-08	1.4E-08	5.1E-08	1.4E-07
72-55-9	4,4'-DDE	5.3E-03	7.0E-04	2.8E-08	7.9E-07	1.8E-07	1.0E-06

"n/a" indicates not applicable, there is no deposition transfer for PCBs because it has a vapor fraction (F_v) of 1.
[(a)] Exposure levels for terrestrial invertebrate and plant communities
[(b)] Total plant concentration used to estimate COPC uptake by herbivorous and omnivorous mammals and birds in terrestrial food web

Table C-72 Aquatic Media EPCs for the Baseline WTP Operating Configuration

CASRN	Constituent	Total Water Column (mg/L) [(a)]	Dissolved Phase Water (mg/L)	Sediment (mg/kg) [(b)]	Aquatic Plant Tissue (mg/kg) [(c)]	Total Water Body (mg/L)
1336-36-3	PCBs	6.6E-11	6.2E-11	1.9E-07	1.7E-09	6.2E-11
205-99-2	Benzo(b)fluoranthene	8.4E-11	4.7E-11	2.0E-06	2.0E-08	4.7E-11
207-08-9	Benzo(k)fluoranthene	3.3E-11	1.9E-11	7.6E-07	7.7E-09	1.9E-11
3697-24-3	5-Methylchrysene	6.7E-11	5.1E-11	8.2E-07	9.9E-09	7.0E-11
56-55-3	Benzo(a)anthracene	1.5E-11	1.2E-11	1.7E-07	3.4E-09	1.2E-11
72-55-9	4,4'-DDE	2.4E-10	2.2E-10	7.7E-07	7.2E-09	2.2E-10

[(a)] Exposure level for aquatic life
[(b)] Exposure level for benthic invertebrate community
[(c)] Plant concentration used to estimate COPC uptake by herbivorous and omnivorous mammals and birds in aquatic food web

C.7.2 Biota Exposure Point Concentrations

The RAWP, Section 8, provides the methodology and assumptions for using media EPCs to derive tissue concentrations in animal forage (invertebrates) and prey. Only tissue concentrations relevant to the risk drivers are discussed.

The risk drivers for the DFLAW operating configuration are relevant to the coyote, burrowing owl, and red-tailed hawk. These predators prey on the great basin pocket mouse and western meadowlark, both of which have an exclusive diet of terrestrial invertebrates (refer to the RAWP, Section 8.2.1). Table C-73 presents biota EPCs (COPC tissue concentrations) for terrestrial receptors for the DFLAW operating configuration.

Table C-73 Terrestrial Biota EPCs for the DFLAW Operating Configuration

CASRN	Constituent	Terrestrial Invertebrate (mg/kg)	Great Basin Pocket Mouse (mg/kg)	Western Meadowlark (mg/kg)
205-99-2	Benzo(b)fluoranthene	4.9E-05	5.9E-04	5.9E-04
207-08-9	Benzo(k)fluoranthene	9.7E-05	1.2E-03	1.2E-03
56-55-3	Benzo(a)anthracene	4.1E-05	3.3E-04	3.3E-04

In the aquatic receptor food chain, benthic invertebrates are consumed by the spotted sandpiper and the great blue heron. A portion of the great blue heron diet also includes consumption of planktivorous and omnivorous fish. The mink is assumed to consume omnivorous fish, and the bald eagle consumes carnivorous fish (salmon and salmonids). Table C-74 presents biota EPCs (COPC tissue concentrations) for aquatic receptors for the DFLAW operating configuration. Note that no aquatic receptor exposures were associated with risk drivers; information below is presented for completeness.

Table C-74 Aquatic Biota EPCs for the DFLAW Operating Configuration

CASRN	Constituent	Benthic Invertebrate (mg/kg)	Planktivorous Fish (mg/kg)	Omnivorous Fish (mg/kg)	Salmon (mg/kg)
205-99-2	Benzo(b)fluoranthene	3.1E-07	3.3E-08	4.0E-07	6.6E-07
207-08-9	Benzo(k)fluoranthene	2.9E-07	1.1E-08	1.3E-07	2.2E-07
56-55-3	Benzo(a)anthracene	1.2E-07	5.1E-09	4.1E-08	5.1E-08

Table C-75 presents biota EPCs for terrestrial receptors for the baseline WTP operating configuration.

Table C-75 Terrestrial Biota EPCs for the Baseline WTP Operating Configuration

CASRN	Constituent	Terrestrial Invertebrate (mg/kg)	Great Basin Pocket Mouse (mg/kg)	Western Meadowlark (mg/kg)
1336-36-3	PCBs	2.8E-03	3.7E-02	3.7E-02
205-99-2	Benzo(b)fluoranthene	3.4E-05	4.0E-04	4.0E-04
207-08-9	Benzo(k)fluoranthene	1.2E-04	1.4E-03	1.4E-03
3697-24-3	5-Methylchrysene	2.1E-04	2.3E-03	2.3E-03
56-55-3	Benzo(a)anthracene	4.6E-05	3.7E-04	3.7E-04
72-55-9	4,4’-DDE	2.2E-02	1.8E-01	1.8E-01

Table C-76 presents biota EPCs for aquatic receptors for the baseline WTP operating configuration. As with the DFLAW operating configuration, no aquatic exposures were associated with risk drivers; information below is presented for completeness.

Table C-76 Aquatic Biota EPCs for the Baseline WTP Operating Configuration

CASRN	Constituent	Benthic Invertebrate (mg/kg)	Planktivorous Fish (mg/kg)	Omnivorous Fish (mg/kg)	Salmon (mg/kg)
1336-36-3	PCBs	3.4E-07	1.0E-06	1.3E-05	2.2E-05
205-99-2	Benzo(b)fluoranthene	2.2E-07	2.3E-08	2.8E-07	4.7E-07
207-08-9	Benzo(k)fluoranthene	2.5E-07	9.6E-09	1.1E-07	1.9E-07
3697-24-3	5-Methylchrysene	4.7E-07	8.8E-07	9.7E-06	1.6E-05
56-55-3	Benzo(a)anthracene	1.4E-07	5.8E-09	4.7E-08	5.8E-08
72-55-9	4,4’-DDE	2.6E-06	5.6E-06	4.5E-05	5.6E-05

C.8 Estimated Exposure Levels and Daily Doses for the DFLAW Operating Configuration

The EPCs in Table C-69 and Table C-70 were used to compute the media concentrations for community-level receptors and daily doses for mammals and bird guilds. The biota tissue concentrations in Table C-73 and Table C-74 were used to determine the dose contribution to their respective predators from the consumption of prey. Results are presented for COPCs determined to be risk drivers (e.g., COPCs with an *ESQ* greater than 0.025 for at least one receptor). Receptor dose is dependent on trophic level and diet, which can include the consumption of soil, plant matter, forage, water, and prey (refer to the RAWP, Section 8). The subsections below present the dose to terrestrial receptors at the Central Plateau and aquatic receptors at the Columbia River, for the DFLAW operating configuration.

C.8.1 Terrestrial Receptors

A terrestrial receptor dose is attributed to the consumption of soil, plant matter, forage, and prey associated with the Central Plateau and the consumption of water from the Columbia River. A dose is the product of the food and media consumption rates, fraction of the food source that is contaminated, and the EPC (including prey tissue concentration, if applicable) associated with the food source. Since the dose is dependent upon diet, it is receptor specific.

Table C-77 presents the estimated exposure level for plants and invertebrates, and daily doses for terrestrial mammals and birds evaluated in the SLERA for the DFLAW operating configuration.

Table C-77 Terrestrial Receptor Estimated Exposure Levels and Daily Doses for the DFLAW Operating Configuration

CASRN	Constituent	Plants Exposure Level (mg/kg)	Terrestrial Invertebrate Exposure Level (mg/kg)	Mule Deer Dose (mg/kg/d)	Mourning Dove Dose (mg/kg/d)	Great Basin Pocket Mouse Dose (mg/kg/d)
205-99-2	Benzo(b)fluoranthene	4.9E-05	4.9E-05	2.6E-07	7.0E-06	1.5E-05
207-08-9	Benzo(k)fluoranthene	3.2E-05	3.2E-05	2.2E-07	4.9E-06	2.8E-05
56-55-3	Benzo(a)anthracene	5.4E-06	5.4E-06	3.3E-08	8.0E-07	1.2E-05

CASRN	Constituent	Western Meadowlark Dose (mg/kg/d)	Coyote Dose (mg/kg/d)	Burrowing Owl Dose (mg/kg/d)	Red-Tailed Hawk Dose (mg/kg/d)
205-99-2	Benzo(b)fluoranthene	1.8E-06	1.1E-05	2.6E-05	6.2E-05
207-08-9	Benzo(k)fluoranthene	3.0E-06	2.1E-05	5.0E-05	1.2E-04
56-55-3	Benzo(a)anthracene	1.2E-06	6.0E-06	1.4E-05	3.5E-05

C.8.2 Aquatic Receptors

Aquatic receptor dose is attributed to consumption of sediment, plants, water, and prey associated with the Columbia River. As with the terrestrial receptors, it is related to receptor diet and is therefore receptor specific.

Table C-78 presents the ecological exposure level for plants, biota, invertebrates, and fish, and daily dose to aquatic mammals and birds for the DFLAW operating configuration.

Table C-78 Aquatic Receptor Estimated Exposure Levels and Daily Dose due to the DFLAW Operating Configuration

Exposure Levels							
CASRN	Constituent	Aquatic Plant (mg/kg)	Aquatic Biota (mg/kg/d)	Benthic Invertebrate (mg/L)	Planktivorous Fish (mg/L)	Omnivorous Fish (mg/L)	Chinook Salmon (mg/L)
205-99-2	Benzo(b)fluoranthene	2.8E-06	6.6E-11	2.8E-06	6.6E-11	6.6E-11	6.6E-11
207-08-9	Benzo(k)fluoranthene	8.8E-07	2.2E-11	8.8E-07	2.2E-11	2.2E-11	2.2E-11
56-55-3	Benzo(a)anthracene	1.5E-07	1.0E-11	1.5E-07	1.0E-11	1.0E-11	1.0E-11

Daily Dose						
CASRN	Constituent	Canada Goose (mg/kg/d)	Spotted Sandpiper (mg/kg/d)	Great Blue Heron (mg/kg/d)	Bald Eagle (mg/kg/d)	Mink (mg/kg/d)
205-99-2	Benzo(b)fluoranthene	1.8E-08	3.6E-07	6.7E-08	4.8E-08	5.6E-08
207-08-9	Benzo(k)fluoranthene	5.8E-09	2.8E-07	2.5E-08	1.6E-08	1.9E-08
56-55-3	Benzo(a)anthracene	2.1E-09	1.1E-07	7.9E-09	4.9E-09	5.7E-09

C.9 Estimated Exposure Levels and Daily Doses for the Baseline WTP Operating Configuration

The EPCs in Table C-71 and Table C-72 were used to compute the media concentrations and mammal and bird receptor doses associated with the baseline WTP operating configuration. The biota tissue concentrations in Table C-75 and Table C-76 were used to determine the dose contribution to their respective predators from the consumption of prey. Results are presented for COPCs determined to be risk drivers (e.g., COPCs with an *ESQ* greater than 0.025 for at least one receptor). The sections which follow present the COPC *EELs* and daily doses for terrestrial receptors of the Central Plateau, and aquatic receptors at the Columbia River.

C.9.1 Terrestrial Receptors

Table C-79 presents the *EEL*s for terrestrial plants and invertebrates, and *DD* for terrestrial mammals and birds for the baseline WTP operating configuration.

Table C-79 Terrestrial Receptor Estimated Exposure Levels and Daily Doses for the Baseline WTP Operating Configuration

CASRN	Constituent	Plants Exposure Level (mg/kg)	Terrestrial Invertebrate Exposure Level (mg/kg)	Mule Deer Dose (mg/kg/d)	Mourning Dove Dose (mg/kg/d)	Great Basin Pocket Mouse Dose (mg/kg/d)
1336-36-3	PCBs	1.8E-04	1.8E-04	3.9E-08	9.2E-07	8.1E-04
205-99-2	Benzo(b)fluoranthene	3.3E-05	3.3E-05	1.8E-07	4.8E-06	1.0E-05
207-08-9	Benzo(k)fluoranthene	3.9E-05	3.9E-05	2.4E-07	5.9E-06	3.4E-05
3697-24-3	5-Methylchrysene	4.1E-05	4.1E-05	2.2E-07	5.8E-06	6.0E-05
56-55-3	Benzo(a)anthracene	5.9E-06	5.9E-06	3.6E-08	8.8E-07	1.3E-05
72-55-9	4,4'-DDE	7.0E-04	7.0E-04	3.7E-06	1.0E-04	6.3E-03

Table C-79 Terrestrial Receptor Estimated Exposure Levels and Daily Doses for the Baseline WTP Operating Configuration

CASRN	Constituent	Western Meadowlark Dose (mg/kg/d)	Coyote Dose (mg/kg/d)	Burrowing Owl Dose (mg/kg/d)	Red-Tailed Hawk Dose (mg/kg/d)
1336-36-3	PCBs	7.9E-05	6.6E-04	1.5E-03	3.9E-03
205-99-2	Benzo(b)fluoranthene	1.2E-06	7.3E-06	1.8E-05	4.2E-05
207-08-9	Benzo(k)fluoranthene	3.6E-06	2.5E-05	6.1E-05	1.5E-04
3697-24-3	5-Methylchrysene	6.1E-06	4.1E-05	9.7E-05	2.4E-04
56-55-3	Benzo(a)anthracene	1.3E-06	6.6E-06	1.6E-05	3.8E-05
72-55-9	4,4'-DDE	6.2E-04	3.2E-03	7.4E-03	1.8E-02

C.9.2 Aquatic Receptors

The *EEL*s for plants, biota, invertebrates, and fish, and *DD* for aquatic mammals and birds from the baseline WTP operating configuration are presented in Table C-80.

Table C-80 Aquatic Receptor Estimated Exposure Levels and Daily Doses for the Baseline WTP Operating Configuration

Exposure Levels							
CASRN	Constituent	Aquatic Plant (mg/L)	Aquatic Biota (mg/L)	Benthic Invertebrate (mg/L)	Planktivorous Fish (mg/L)	Omnivorous Fish (mg/L)	Chinook Salmon (mg/L)
1336-36-3	PCBs	1.9E-07	6.2E-11	1.9E-07	6.2E-11	6.2E-11	6.2E-11
205-99-2	Benzo(b)fluoranthene	2.0E-06	4.7E-11	2.0E-06	4.7E-11	4.7E-11	4.7E-11
207-08-9	Benzo(k)fluoranthene	7.6E-07	1.9E-11	7.6E-07	1.9E-11	1.9E-11	1.9E-11
3697-24-3	5-Methylchrysene	8.2E-07	5.1E-11	8.2E-07	5.1E-11	5.1E-11	5.1E-11
56-55-3	Benzo(a)anthracene	1.7E-07	1.2E-11	1.7E-07	1.2E-11	1.2E-11	1.2E-11
72-55-9	4,4'-DDE	7.7E-07	2.2E-10	7.7E-07	2.2E-10	2.2E-10	2.2E-10
Daily Dose							
CASRN	Constituent	Canada Goose (mg/kg/d)	Spotted Sandpiper (mg/kg/d)	Great Blue Heron (mg/kg/d)	Bald Eagle (mg/kg/d)	Mink (mg/kg/d)	
1336-36-3	PCBs	9.2E-07	3.1E-07	2.1E-06	1.6E-06	1.9E-06	
205-99-2	Benzo(b)fluoranthene	1.2E-08	2.5E-07	4.8E-08	3.4E-08	3.9E-08	
207-08-9	Benzo(k)fluoranthene	5.0E-09	2.5E-07	2.1E-08	1.4E-08	1.6E-08	
3697-24-3	5-Methylchrysene	1.3E-08	4.4E-07	1.6E-06	1.2E-06	1.4E-06	
56-55-3	Benzo(a)anthracene	2.4E-09	1.3E-07	9.1E-09	5.6E-09	6.5E-09	
72-55-9	4,4'-DDE	7.9E-08	2.3E-06	7.3E-06	5.4E-06	6.3E-06	

C.10 Ecological Screening Quotients for the DFLAW Operating Configuration

Section C.10 presents the *ESQ*s for all ecological receptors for those COPCs identified as risk drivers (e.g., COPCs with an *ESQ* greater than 0.025 for at least one receptor) for the DFLAW operating configuration. The *ESQ* is the ratio of the *EEL* or *DD* to the *TRV*. An *ESQ* value in excess of 1.0 does not necessarily indicate a potential risk issue, but one that merits further evaluation. The *ESQ* for total organics is also shown to put the risk driver *ESQ* values into perspective.

C.10.1 Terrestrial Receptors

The *EEL*s and *DD* in Table C-77 were compared to the *TRV*s in RAWP Supplement 4 to derive the *ESQ* values. Table C-81 presents the results for terrestrial receptors.

Table C-81 Terrestrial Receptor ESQs for the DFLAW Operating Configuration

CASRN	Constituent	Plant	Terrestrial Invertebrate	Mule Deer	Mourning Dove	Great Basin Pocket Mouse
205-99-2	Benzo(b)fluoranthene	4.1E-05	2.7E-06	2.6E-07	5.0E-02*	2.5E-05
207-08-9	Benzo(k)fluoranthene	2.7E-05	1.8E-06	2.2E-07	3.5E-02*	4.6E-06
56-55-3	Benzo(a)anthracene	4.5E-06	3.0E-07	2.0E-07	1.0E-03	1.9E-05
Total Organics		4.5E-04	7.6E-05	3.3E-04	1.1E-01	1.3E-02

CASRN	Constituent	Western Meadowlark	Coyote	Burrowing Owl	Red-Tailed Hawk
205-99-2	Benzo(b)fluoranthene	1.3E-02	1.7E-06	1.9E-01*	4.4E-01*
207-08-9	Benzo(k)fluoranthene	2.1E-02	3.4E-05	3.6E-01*	8.7E-01*
56-55-3	Benzo(a)anthracene	1.5E-03	9.7E-06	1.8E-02	4.4E-02
Total Organics		3.9E-02	1.0E-02	5.8E-01	1.4E+00

"*" indicates risk driver (COPC ESQ ≥ 0.025 or 10 percent of 0.25).

As discussed in Section 4.5 of the main report, benzo(b)fluoranthene, benzo(k)fluoranthene, and benzo(a)anthracene were identified as risk drivers—each in excess of 0.025 (greater than 10% of the threshold value of 0.25)—for the mourning dove, burrowing owl and red-tailed hawk. In the case of the hawk, their impact contributes to a total organic *ESQ* in excess of 1. The sum of their COPC-specific *ESQ*s is 1.36, constituting over 96% of the total organics *ESQ*. Benzo(b)fluoranthene, benzo(k)fluoranthene, and benzo(a)anthracene have not been detected in tank waste samples and were included as COPCs because of their inclusion in EPA's PIC list (EPA530-D-98-001A, *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*; CCN 097844, *Discuss and Resolve the Outstanding Risk Assessment Issues in The Risk Assessment Work Plan (RAWP)*). None were detected in the testing of the pilot-scale prototypical offgas system, and operating conditions at the WTP are unlikely to generate PAHs because there are no PAH precursors in the tank waste. Their presence in the offgas is a presumption based on a presumed upset condition and the limits of analytical detection (refer to Appendix A). They are readily metabolized by vertebrates and the dose used to calculate the bird *ESQ*s do not reflect the actual expected distribution of PAHs in food and forage for the receptors.

The high contribution of these PAHs to the organics *ESQ* of birds in indicative of its low *TRV* (0.14 µg/kg/day for the fluoranthenes, and 0.79 µg/kg/day for benzo(a)anthracene, refer to EPA530-D-99-001A, *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, Table E-8). These values were derived from an acute study performed with chicken embryos and have an uncertainty factor of 0.01 applied. It is important to note that the *ESQ* of these individual compounds do not exceed the threshold value of 1, that individually they are considered below levels indicative of potential ecological impacts.

Evidence indicates the analysis overestimates the real hazard of the compounds, and they are not likely to be emitted or have a detrimental impact to the surrounding ecology. Without the impact of the PAHs, the net organic *ESQ*s for the red-tailed hawk and other receptors are well below levels that would merit further evaluation.

C.10.2 Aquatic Receptors

The *EEL*s and *DD* in Table C-78 were compared to the *TRV*s in Supplement 4 of the RAWP to derive the *ESQ* values. Table C-82 presents the results for aquatic receptors. All COPCs presented *ESQ*s well below the risk driver threshold.

Table C-82 Aquatic Receptor ESQs for the DFLAW Operating Configuration

CASRN	Constituent	Aquatic Plants	Aquatic Biota	Benthic Invertebrate	Planktivorous Fish	Omnivorous Fish	Chinook Salmon
205-99-2	Benzo(b)fluoranthene	2.3E-06	9.8E-08	4.1E-03	9.8E-08	9.8E-08	9.8E-08
207-08-9	Benzo(k)fluoranthene	7.3E-07	3.5E-08	1.4E-03	3.5E-08	3.5E-08	3.5E-08
56-55-3	Benzo(a)anthracene	1.2E-07	4.6E-09	6.5E-05	4.6E-09	4.6E-09	4.6E-09
Total Organics		6.4E-06	8.5E-07	1.2E-02	7.7E-06	7.7E-06	7.7E-06

CASRN	Constituent	Canada Goose	Spotted Sandpiper	Great Blue Heron	Bald Eagle	Mink
205-99-2	Benzo(b)fluoranthene	1.3E-04	2.6E-03	4.8E-04	3.4E-04	5.6E-08
207-08-9	Benzo(k)fluoranthene	4.1E-05	2.0E-03	1.8E-04	1.1E-04	1.9E-08
56-55-3	Benzo(a)anthracene	2.6E-06	1.4E-04	1.0E-05	6.2E-06	3.4E-08
Total Organics		1.9E-04	5.0E-03	8.6E-04	6.0E-04	5.3E-05

The threshold for a risk driver is a COPC-specific ESQ ≥ 0.025 (or 10 percent of 0.25).

C.11 Ecological Screening Quotients for the Baseline WTP Operating Configuration

Section C.11 presents the *ESQ*s for all ecological receptors for those COPCs identified as risk drivers (i.e., have an *ESQ* greater than 0.025 for at least one receptor) for the baseline WTP operating configuration. An *ESQ* value in excess of 1.0 does not necessarily indicate a potential risk issue, but one that merits further evaluation. The *ESQ* for total organics is also shown to put the risk driver ESQ values into perspective.

C.11.1 Terrestrial Receptors

The *EEL*s and *DD* in Table C-79 were compared to the *TRV*s in Supplement 4 of the RAWP to derive the *ESQ* values. Table C-83 presents the results for terrestrial receptors.

Table C-83 Terrestrial Receptor ESQs for the Baseline WTP Operating Configuration

CASRN	Constituent	Plants Exposure	Terrestrial Invertebrate	Mule Deer	Mourning Dove	Great Basin Pocket Mouse
1336-36-3	PCBs	1.8E-05	7.1E-05	1.9E-04	1.3E-05	3.9E+00*
205-99-2	Benzo(b)fluoranthene	2.8E-05	1.9E-06	1.8E-07	3.4E-02*	1.7E-05
207-08-9	Benzo(k)fluoranthene	3.3E-05	2.2E-06	2.4E-07	4.2E-02*	5.6E-06
3697-24-3	5-Methylchrysene	3.4E-05	2.3E-06	2.2E-06	5.8E-03	9.7E-05
56-55-3	Benzo(a)anthracene	4.9E-06	3.3E-07	2.1E-07	1.1E-03	2.1E-05
72-55-9	4,4'-DDE	n/a	1.2E-03	3.7E-06	4.4E-04	4.3E-02*
Total Organics		1.6E-03	1.4E-03	4.6E-04	1.0E-01	4.0E+00

Table C-83 Terrestrial Receptor ESQs for the Baseline WTP Operating Configuration

CASRN	Constituent	Western Meadowlark	Coyote	Burrowing Owl	Red-Tailed Hawk
1336-36-3	PCBs	1.1E-03	3.2E+00*	2.1E-02	5.4E-02*
205-99-2	Benzo(b)fluoranthene	8.7E-03	1.2E-06	1.3E-01*	3.0E-01*
207-08-9	Benzo(k)fluoranthene	2.6E-02*	4.1E-05	4.3E-01*	1.1E+00*
3697-24-3	5-Methylchrysene	6.1E-03	6.7E-05	9.7E-02*	2.4E-01*
56-55-3	Benzo(a)anthracene	1.7E-03	1.1E-05	2.0E-02	4.9E-02*
72-55-9	4,4'-DDE	2.7E-03	2.1E-02	8.7E-03	8.1E-02*
Total Organics		5.0E-02	3.2E+00	7.3E-01	1.8E+00

"n/a" indicates "not available," the value could not be determined because there was no TRV available.
"*" indicates risk driver (COPC ESQ ≥ 0.025 or 10 percent of 0.25).

The values presented above for PCBs represent PCB risks after refinement of the feed PCB concentration as discussed in detail in Appendix A. PCB-specific *ESQ*s of the mouse and coyote slightly exceed the threshold of 1 despite modeling with a more realistic feed stream. Besides the source term, exposure and toxicity parameters can have a major influence on the results presented by specific compounds, and review of the parameters indicated a commonality across toxicity modeling for the coyote and mouse. As explained in Section 4.5.2, the *ESQ*s are based on an EPA530-D-99-001A, *TRV* of 0.206 µg/kg/day for PCBs derived using a safety factor of 100 from a lowest-observed-adverse-effect-level of 20.6 µg/kg-day calculated from a study with the mink exposed to 3,4,5-hexachlorobiphenyl. As discussed in Section 4.5.2, the *ESQ*s reported for the coyote and mouse grossly overrepresent the potential impact by several orders of magnitude. The evaluation of more recent information on the ecological toxicity of PCBs indicates that the emissions from the operation of the WTP will not adversely affect ecological receptors inhabiting the Central Plateau.

As with the DFLAW operating configuration, benzo(b)fluoranthene, benzo(k)fluoranthene, and benzo(a)anthracene were identified as risk drivers. In the baseline WTP operating configuration, their net contribution is 1.4 to the red-tailed hawk's total organic *ESQ* of 1.8. With the single exception of benzo(k)fluoranthene for the hawk, none of these constituents exceed an *ESQ* of 1, indicating that individually they are below levels that would be associated with a potential ecological impact. As previously explained, benzo(b)fluoranthene, benzo(k)fluoranthene, and benzo(a)anthracene are not waste components, and are presumed PICs that have not been detected in related laboratory testing of prototypic WTP offgas controls. Likewise, 5-methylchrysene and 4,4'-DDE are also a presumed PICs (EPA530-D-98-001A; CCN 097844) without having been related to tank waste operations or detected in offgas analysis. In summary, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)anthracene, 5-methylchrysene, and 4,4'-DDE are not anticipated to be emitted at levels indicative of any kind of potential ecological issue. Their net contribution is a product of their assumed emissions and low *TRV*s, and not attributed to any expected presence in the emissions.

C.11.2 Aquatic Receptors

The *EEL*s and daily doses in Table C-80 were compared to the *TRV*s in Supplement 4 of the RAWP to derive the *ESQ* values. Table C-84 presents the results for aquatic receptors. All COPCs presented *ESQ*s well below the risk driver threshold.

Table C-84 Aquatic Receptor ESQ due to the Baseline WTP Operating Configuration

CASRN	Constituent	Aquatic Plant	Aquatic Biota	Benthic Invertebrate	Planktivorous Fish	Omnivorous Fish	Chinook Salmon
1336-36-3	PCBs	1.9E-08	4.4E-07	2.8E-06	4.4E-07	4.4E-07	4.4E-07
205-99-2	Benzo(b)fluoranthene	1.6E-06	6.9E-08	2.9E-03	6.9E-08	6.9E-08	6.9E-08
207-08-9	Benzo(k)fluoranthene	6.3E-07	3.0E-08	1.2E-03	3.0E-08	3.0E-08	3.0E-08
3697-24-3	5-Methylchrysene	6.9E-07	6.0E-08	9.6E-04	6.0E-08	6.0E-08	6.0E-08
56-55-3	Benzo(a)anthracene	1.4E-07	5.2E-09	7.5E-05	5.2E-09	5.2E-09	5.2E-09
72-55-9	4,4'-DDE	n/a	2.1E-08	1.5E-04	2.1E-08	2.1E-08	2.1E-08
Total Organics		7.7E-06	2.2E-06	1.3E-02	2.2E-05	2.2E-05	2.2E-05

CASRN	Constituent	Canada Goose	Spotted Sandpiper	Great Blue Heron	Bald Eagle	Mink
1336-36-3	PCBs	1.3E-05	4.3E-06	3.0E-05	2.2E-05	9.0E-03
205-99-2	Benzo(b)fluoranthene	8.9E-05	1.8E-03	3.4E-04	2.4E-04	3.9E-08
207-08-9	Benzo(k)fluoranthene	3.6E-05	1.8E-03	1.5E-04	9.8E-05	1.6E-08
3697-24-3	5-Methylchrysene	1.3E-05	4.4E-04	1.6E-03	1.2E-03	1.4E-05
56-55-3	Benzo(a)anthracene	3.0E-06	1.7E-04	1.1E-05	7.1E-06	3.9E-08
72-55-9	4,4'-DDE	9.4E-08	2.8E-06	8.7E-06	6.4E-06	6.3E-06
Total Organics		1.7E-04	4.4E-03	2.2E-03	1.6E-03	9.0E-03

"n/a" indicates not available, the value could not be determined because there was no TRV available.

C.12 References

C.12.1 Project Documents

CCN 097844, *Discuss and Resolve the Outstanding Risk Assessment Issues in The Risk Assessment Work Plan (RAWP)*. 12 April 2005.

C.12.2 Codes and Standards

WAC 173-340-900. *Tables*, Washington Administrative Code, effective 12 November 2007.

C.12.3 Other

EPA530-D-98-001A. 1998. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, Peer Review Draft. Office of Solid Waste, US Environmental Protection Agency, Washington, DC.

EPA530-D-99-001A. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, Peer Review Draft. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC.

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Appendix D

Sources of Uncertainty

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Acronyms

ADAF	age-dependent adjustment factors
BBI	Best-Basis Inventory
CASRN	Chemical Abstracts Service registry number
COPC	constituents of potential concern
CSF	cancer slope factor
CTUIR	Confederated Tribes of the Umatilla Indian Reservation
DFLAW	Direct Feed Low-Activity Waste
DOE	US Department of Energy
EPA	US Environmental Protection Agency
HEPA	high-efficiency particulate air
HHRA	human health risk assessment
HHRAP	*Human Health Risk Assessment Protocol*
HLW	High-Level Waste (Facility)
HQ	cancer risk
HTWOS	Hanford Tank Waste Operations Simulator
ILCR	Incremental lifetime cancer risk
LAW	Low-Activity Waste (Facility)
MDL	method detection limit
MM5	Fifth-Generation mesoscale model
MTG	metric tons of glass
NOAEL	no-adverse-effect-level
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyls
PCDD	polychlorinated dibenzo-p-dioxins
PCDF	polychlorinated dibenzofurans
PEM	Process Emissions Model
PIC	products of incomplete combustion
PRA	preliminary risk assessment
PT	Pretreatment (Facility)
RAWP	24590-WTP-RPT-ENV-14-002, *Environmental Risk Assessment Work Plan for the Hanford Tank Waste Treatment and Immobilization Plant*
RfC	reference concentration
RfD	reference dose
SLERA	screening level ecological risk assessment
SLERAP	*Screening Level Ecological Risk Assessment Protocol*
SOCMI	synthetic organic chemical manufacturing industry
TCDD	tetrachlorodibenzo-p-dioxin
TEF	toxicity equivalence factor
TEQ	toxic equivalent
TOC	total organic carbon
TRV	toxicity reference value

TWINS	Tank Waste Information Network System
UF	uncertainty factor
URF	unit risk factor
WTP	Hanford Tank Waste Treatment and Immobilization Plant

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Appendix D
Sources of Uncertainty

Sources of uncertainty in risk assessment arise from the use of assumptions where data may be lacking. The assumptions used in this preliminary risk assessment (PRA) are designed to err on the side of human health and species protection by compounding conservatism to avoid underestimating risk. As noted in EPA530-R-05-006, *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, hereinafter called HHRAP, uncertainty occurs because risk assessment is a complex process, requiring integration of source information, fate and transport in various environments, exposure assessment, and effects assessment. Uncertainty is inherent in the risk assessment process even when the most accurate, up-to-date data and the most sophisticated models are used. The objective of this appendix is to characterize the sources of uncertainty and demonstrate how the analysis took a proactive approach to reduce the likelihood that the risks were underestimated by using conservative (i.e., health- and species-protective) assumptions. The first three sections follow the contents of Sections 2 through 4 in the main report:

- Waste Emissions and Environmental Modeling
- Human Health Risk Assessment (HHRA)
- Screening Level Ecological Risk Assessment (SLERA)

As required by the Risk Assessment Work Plan (RAWP) Section 10.2.3.2, this appendix closes with a discussion of the estimated risks for two American Indian scenarios.

D.1 Waste Emissions and Environmental Modeling

This section discusses the sources of uncertainty for the major components of "Waste Emissions and Environmental Modeling," covered in Section 2 in the main report. The risk assessment approach is based on all feed constituents of potential concern (COPC) being present at assumed concentrations in every batch of waste treated and, by extension, in stack gas emissions all the time.

D.1.1 Waste Characterization

A feed vector for tank waste delivery to the Hanford Tank Waste Treatment and Immobilization Plant (WTP) was developed and documented in report 24590-WTP-RPT-ENV-16-001, *Feed Vector Development in Support of WTP Environmental Risk Assessment Activities* (herein referred to as the feed vector report). This section briefly summarizes some of the primary sources of uncertainty related to the development of the feed vector.

The feed vector was generated using Hanford Tank Waste Operations Simulator (HTWOS), accompanied by supplemental data on inventory estimates for COPCs not tracked by HTWOS. A feed vector contains the quantity (i.e., concentrations) of each COPC. The HTWOS is a dynamic event-simulator, governed by prescribed conditions, constraints, and operating logic used to simulate the movement of waste material through the tank farm system and delivery to the WTP. The Best-Basis Inventory (BBI) serves as the initial inventory for HTWOS operations and as the source of information for supplemental inventory estimates. The BBI is the official database for Hanford Site tank waste inventory estimates and contains data on the current state of constituent inventories as they are determined to currently exist within Tank Farms. The BBI contains standard inventory estimates for 25 chemical and 46 radionuclide tank waste components and supplemental inventory estimates for up to 112 additional analytes. Data are

included in the supplemental inventory only when either[1]: (1) sample data are available for all waste phases in a tank, or (2) process knowledge values can be calculated from combined sample results. With the utilization of relevant available data sources, waste delivery information for 176 of the 225 COPCs initially identified in the feed vector was provided.

The BBI utilizes the data with the highest pedigree available – with sample-based values and direct calculations having the highest level of certainty, engineering-based values utilizing sample information falling next, and model-based templates (estimates) having the lowest level of certainty (i.e., highest uncertainty) (RPP-7625, Rev. 12, *Guidelines for Updating Best-Basis Inventory*). "Sample-based" estimates are grounded directly in laboratory analytical results of waste samples, while "calculated" values are based on correlations with other analytes (for example, yttrium-90 values are derived from strontium-90 estimates). Engineering-based values include estimates derived from pre-1989 analytical results, results for one tank applied to another, and engineered process knowledge calculations.

Even though sample-based inventory estimates are prioritized over other estimation methodologies, uncertainty and bias exist when determining inventory estimates from waste sample data. Limited sampling locations, poor sample recovery, and spatial heterogeneities within the waste all contribute to possible bias in sample-based inventories. Although horizontal homogeneity has been observed in supernatant (13-ECD-0073, *Transmittal of Class 2 Modification to the Hanford Facility Resource Conservation and Recovery Act (RCRA) Permit Operating Unit 4, 242-A Evaporator (Treatment, Storage, and Disposal Unit: T-2-6) and Request for Temporary Authorization*), sludge and solid wastes can be horizontally as well as vertically heterogeneous (RPP-RPT-26878, Rev. 0, *Best-Basis Inventory Templates for Polychlorinated Biphenyls*), limiting the implementation of statistically-developed sampling strategies that could be used to reduce uncertainties associated with estimating tank waste inventories. To address data uncertainty and reduce the likelihood that the PRA underestimated risk, the feed vector modeled for this risk assessment had a multiplier applied to increase constituent concentrations to provide an upper bound to the feed vector (refer to Appendix A, Section A.2.1).

There is also uncertainty associated with the analysis of the tank waste itself. Tank waste samples are often diluted for safe handling, increasing many constituent detection limits. Furthermore, 54 of the organic COPCs (nearly 40%) have only a single concentration value that was measured above the detection limit. The BBI uses the lowest detection limit concentration to represent the respective inventory value, which results in an inventory for the COPC, even though the presence of the COPC is unconfirmed.

In cases where tank-specific sample analyses or process knowledge calculations are not available, process knowledge model estimates (i.e., templates) are used within the BBI. Model-based results are, for example, the only available information for many of the standard radionuclide constituents (RPP-7625). These model estimates are derived using the Hanford Defined Waste Model, which compiles fuel activity records, plant processing records, and waste transfer records to provide waste concentration estimates as of January 1, 2001 (RPP-19822, Rev. 0, *Hanford Defined Waste Model - Revision 5.0*).

HTWOS provides batch delivery data for 112 waste components, including oxalate and total organic carbon (TOC), but does not track any of the individual organic compounds. As explained in Appendix A, Section A.2.2, a ratio for each quantifiable[2] organic was calculated on a per-TOC basis using the current

[1] Two exceptions exist to these rules: (1) total PCB inventories are calculated for all waste phases using default concentrations if sample data are not available, and (2) free $_{OH}$- inventories are calculated for all waste phases using various methods.

[2] Quantifiable organics are those organic compounds identified as having non-zero concentrations based on analytical data (including non-detect) and template estimates.

waste inventory estimates. This approach was based on a general assumption that the TOC mass is a representative scalar for the mass of quantified organics in the waste feed. It was additionally assumed that not only would TOC reported by the BBI generally remain within the same phase it started in (e.g., liquid, sludge or saltcake), but also that the distribution of organic analytes as it currently exists within tank farms is representative of the distribution of organics once waste is retrieved and delivered to WTP. Uncertainty exists in this estimate in that there is no accounting for the impact of historical operations (e.g., the ratio of organic-to-TOC may vary with the type of waste), retrieval operations (e.g., water additions, washing, and blending of tank waste), and tank heterogeneity, although a comparison of the feed vector to historical sample data supports the assertion that the feed vector is bounding.

During development of the feed vector report (24590-WTP-RPT-ENV-16-001), 31 instances were found where the BBI reported non-zero inventory values for individual organic species, while simultaneously reporting a zero value for TOC. Investigation of the characterization reports for tanks impacted by this issue revealed that it primarily occurred when sample and model estimates are applied to the same waste layer. In this instance, the issue seemed to have been caused when a sample value was used for an individual organic species (primarily total polychlorinated biphenyls [PCB]) while a modeled value was applied for the respective TOC value.

An additional source of uncertainty is in the assumption of non-zero quantities for COPCs not quantified in the feed vector report (refer to Appendix A, Section A.2.3). There are 48 organic COPCs for which there is no inventory data.

Table D-1 summarizes the sources of feed vector uncertainty and their potential impact on the risk results.

Table D-1 Sources of Uncertainty in the Feed Vector

Sources of Uncertainty	Model Assumptions and Discussion	Potential Effect on Risk Estimates*		
		Over-estimation	Neutral	Under-estimation
Tank sampling data	Sampling data are subject to limited locations, poor sampling recovery, and spatial heterogeneity. Data were assumed to be representative of tanks. Effect of Uncertainty: Unknown; may lead to an over- or underestimate of risks.		○	
Multiplier applied to feed vector	Multiplier designed to provide upper bound concentrations. Effect of Uncertainty: Upper bound concentrations lead to an overestimate of risks.	+		

Table D-1 Sources of Uncertainty in the Feed Vector

Sources of Uncertainty	Model Assumptions and Discussion	Potential Effect on Risk Estimates*		
		Over-estimation	Neutral	Under-estimation
Detection limits	Tank waste samples are often diluted, increasing the detection limit. Concentration estimates assumed the detection limits even where there is no positive evidence the chemical was present in the sample. Effect of Uncertainty: The increased detection limits lead to an overestimate of concentrations and thus risks.	+		
Tank model process estimates	Process model estimates were assumed when sampling data are not available. Effect of Uncertainty: Unknown; may lead to an over- or underestimate of risks.		○	
Non-zero quantity estimates	Non-zero quantities were assumed for 48 organic COPCs for which there is no evidence of presence in the waste. Effect of Uncertainty: This assumption leads to an overestimate of risks.	+		
PCB inventory	For the HHRA, the PCB inventory was assumed equal to the 97.5% upper confidence limit for the mean PCB concentrations, which has the net effect of assuming PCBs are present in many tanks when they probably are not. Effect of Uncertainty: The artificial increase in PCB waste leads to an overestimate of PCB risks.	+		

* "Neutral" means that the source may lead to over- or under-estimating the risk.

D.1.2 Constituents of Potential Concern

The identification of COPCs discussed in Section 2 is uncertain because these constituents were identified before operation of the WTP; this identification relied on assumptions regarding what may be in the waste feed and what may be produced as products of incomplete combustion (PIC). The WTP vitrification facilities are not hazardous waste combustors. They do not operate under conditions similar to incinerators. Melter plenum temperature is controlled between 400 °C and 600 °C (750 °F to 1100 °F), and residence time in the plenum is dictated by the amount of time it takes a constituent to boil off the cold cap (i.e., solidified waste and glass formers that float on top of the pool of molten glass) or become incorporated into the glass matrix.

The list of feed constituents includes such COPCs as "tentatively identified" in the tank waste (CCN 011395, *Resolution of RAWP Comments from May 7, 1999 Version of the Work Plan*), which means that a standard for the suspect compound had not been analyzed on the same instrument which made the tentative identification. Such identification is not considered "absolute" or "confirmed"

(EPA 2006, *Tentatively Identified Compounds—What are they and why are they important?*). Also included in the list of COPCs are chemicals identified in tank vapors (Section 2.2, Step 4), but not detected in tank waste. It is not known if some of these compounds can exist in the waste itself, or are created by the degradation of heavier organic vapors within tank headspace. There are 48 feed constituents for which no data are available; in the absence of data, their inclusion as COPCs is speculative and based primarily on their toxicity. Fifty-four (nearly 40%) of the organic COPCs with data have only a single concentration value measured above the detection limit (24590-WTP-RPT-ENV-16-001). Assuming all tank waste feed COPCs are present is a conservative approach designed to compensate for uncertainties associated with limited tank characterization data.

Several PICs included as COPCs were included because they were identified as commonly detected incinerator PICs by the US Environmental Protection Agency (EPA), in EPA530-D-98-001A, *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, even though the vitrification process differs greatly from that of incineration. There were 11 PICs on the EPA list for incinerators that were sampled for and not detected in pilot-scale melter testing performed at the Vitreous State Laboratory of The Catholic University of America (24590-101-TSA-W000-0009-166-00001, *Final Report – Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants*) (Table D-2).

Table D-2 List of PICs from EPA Not Detected in Testing

CASRN*	Product of Incomplete Combustion
105-67-9	2,4 Dimethyl-phenol
132-64-9	Dibenzofuran
207-08-9	Benzo(k)fluoranthene
218-01-9	Chrysene
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)
51-28-5	2,4-Dinitrophenol
56-55-3	Benzo(a)anthracene
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)
91-57-6	2-Methylnaphthalene

* CASRN: Chemical Abstracts Service registry number

There are additional uncertainties associated with the risk drivers reported in Sections 3.1.6, 4.3.2, and 4.3.3 In accordance with the RAWP, these risk drivers were further assessed for sources of uncertainty. With modeling techniques (emissions and dispersion) being the same for all COPCs, absent information about the uncertainty of one COPC uptake or exposure parameter versus that of others, the source of the COPC is one of the key assumptions affecting uncertainty specific to a COPC. The feed vector concentrations for dibenz[a,h]anthracene were further assessed.

Dibenz[a,h]anthracene is modeled as a feed COPC and a PIC. It was reported as a feed constituent in the feed vector report, but its concentration was based on two samples with results at the detection limit (i.e., undetected; supernatant reported at 0.038U mg/L, and sludge reported at 0.091U mg/L) (24590-WTP-RPT-MGT-04-001, *Regulatory Data Quality Objective Optimization Report*), with an additional multiplier applied for the development of the bounding feed vector. Tank Waste Information Network System (PNNL 2018) analytical data show analysis of 224 samples for dibenz[a,h]anthracene with nothing ever detected. No records were found indicating the disposal of this compound to the tank system or its likelihood of being a degradation product of heavier organics. In all likelihood, the

dibenz[a,h]anthracene analytical detection limit (the basis for its feed concentration) is a conservative and bounding value, overestimating its actual concentration in the waste.

Four other polycyclic aromatic hydrocarbons (PAH) were identified as risk drivers for ecological receptors: 5-methylchrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, and benzo(a)anthracene. Similarly, these compounds are not known to have been in use during Hanford operations. They were included in the PRA because EPA identified them as PICs in other combustion units (EPA530-D-98-001A; CCN 097844, *Discuss and Resolve the Outstanding Risk Assessment Issues in The Risk Assessment Work Plan (RAWP)*). None of these compounds were detected in the testing of the pilot-scale prototypical offgas system. Since there are no PAH precursors in the tank waste, there is a low likelihood that PAHs will be emitted from the WTP.

Furthermore, PAHs are readily metabolized by vertebrates, another line of evidence indicating the analysis overestimates the hazards of the compounds.

4,4'-DDE, or p,p'-dichlorodiphenyldichloroethylene, is shown as a risk contributor for three terrestrial receptors. 4,4'-DDE is an organochlorine pesticide. It is retained as a COPC because of its listing as an underlying hazardous constituent in 40 CFR 268, *Land Disposal Restrictions*, and its inclusion in EPA's PIC list (EPA530-D-98-001A; CCN 097844). The compound is also identified as a probable COPC in RPP-22491, Rev. 0, *Industrial Hygiene Chemical Vapor Technical Basis*, although the same report acknowledges that the compound has not been detected in the tank vapor space. 4,4'-DDE is a byproduct of DDT, use of which discontinued in 1972. There are no tank waste characterization or vapor data for 4,4'-DDE.

Table D-3 summarizes the uncertainty sources for COPC identification and their potential impacts on the risk estimates.

Table D-3 Sources of Uncertainty in the Identification of COPCs

Sources of Uncertainty	Model Assumptions and Discussion	Potential Effect on Risk Estimates*		
		Over-estimation	Neutral	Under-estimation
Tank characterization data	Constituents identified in tank waste were assumed as COPCs. Some, however, have only a single detection. Effect of Uncertainty: This assumption suggests that all detected constituents are widespread, which is likely to be an overestimate of the conditions, leading to an overestimate of the risk.	+		
Nondetected constituents	Constituents not detected in tank waste but which may have been used at Hanford, were assumed as COPCs. Effect of Uncertainty: It is unlikely that all nondetected constituents are actually present in the waste, so this assumption leads to an overestimate of the risk.	+		

Table D-3 Sources of Uncertainty in the Identification of COPCs

Sources of Uncertainty	Model Assumptions and Discussion	Potential Effect on Risk Estimates*		
		Over-estimation	Neutral	Under-estimation
PICs identified in bench scale testing	Constituents identified in bench-scale testing were assumed as COPCs. The scale up of these PICs to commercial scale is unknown. Effect of Uncertainty: Bench scale results may over- or underestimate risks at commercial scale.		○	
PICs identified at hazardous waste combustion facilities	Constituents identified in emissions from hazardous waste combustion facilities were assumed as COPCs even though the vitrification facilities operate at lower temperatures than the combustion facilities. Effect of Uncertainty: It is unlikely that all these PICs results from vitrification, so this leads to an overestimate of the risk.	+		
Tank vapors	Constituents measured in tank vapors but not in the tank liquids or solids were assumed to be present in the tanks. It is not known whether these exist in the tanks or are degradation products of tank waste. Effect of Uncertainty: It is unlikely that all constituents in the tank vapors are found in the waste, so this assumption leads to an overestimate of risk	+		
Toxic constituents	Some constituents that have not been measured above detection limits in the tanks were assumed to be present because of their toxicities. Effect of Uncertainty: It is unlikely that all these constituents are in the tanks, and thus this assumption leads to an overestimate of risk.	+		

* "Neutral" means that the source may lead to over- or under-estimating the risk.

D.1.3 Emissions Estimates

There are uncertainties with regard to the design of the Pretreatment (PT) and High-Level Waste (HLW) Facilities. The design for these facilities is not 100% complete, and their design is evolving to incorporate recommendations from the resolution and closure of technical issues previously identified by the external flowsheet review team (CCN 132846, *Report of External Flowsheet Review Team for the Hanford Tank Waste Treatment and Immobilization Plant - Final Report Titled: "Comprehensive Review of The Hanford Waste Treatment Plant Flowsheet and Throughput"*). The net impact of final design of these facilities on unit processes in the flowsheet model is not yet known, but the performance specifications for emissions control remain unchanged. Therefore, it is anticipated that, given the degree of conservatism within this PRA, it bounds the potential impact of any future design evolution.

Emission were estimated using a Process Emissions Model (PEM) developed from Aspen Process Performance Simulation© version 3.0, a steady-state mass and energy balance incorporating sequential WTP unit operations. The impact of unit operations such as entrainment, release, volatilization, condensation, oxidation, glass fabrication, and abatement by offgas equipment was accounted for in the PEM. The PEM estimated the mass and phase (vapor, liquid, or solid) of each modeled constituent based on inputs for each unit operation. Unit operation inputs included design data (e.g., capacity, operating temperature, throughput), as well as information regarding unit process efficiency. These, in turn, were often based on bench- or pilot-scale units and experimentation. Generally, if unit operation efficiency was not available for a constituent and (or) phase, data from like constituents for which data were available were used as surrogate data. In cases where no data were available, assumptions were made regarding unit operation efficiency with supporting bases; otherwise, there was no assumed impact of the unit operation (e.g., no abatement was credited to an offgas control). Such assumptions, as well as an assumption of continuous steady-state operation, introduce uncertainty into the emissions estimate along with the uncertainties that accompany any modeling effort.

Modeling was performed assuming that the facility operates at maximum capacity for its entire design life (100% capacity). This is a very conservative assumption, as there are maintenance-related outages. The design capacity of the Low-Activity Waste (LAW) and HLW Facilities (30 metric tons of glass [MTG]/day and 7.5 MTG/day, respectively) were modeled. Treatment capacity is rated at 70% of the design capacity.

The HHRAP (EPA530-R-05-006) default upset factors are 2.8 for organic chemicals and 1.45 for metals (RAWP Section 5.3). These upset factors are applied to emissions to account for events such as periods of startup, shutdown, process malfunction, equipment failure, and maintenance. They are based on data from operating hazardous waste combustion facilities. The WTP vitrification facilities are not hazardous waste combustors. They do not operate under conditions similar to incinerators. Melter plenum temperature is controlled between 400 °C and 600 °C (750 °F to 1100 °F), and residence time in the plenum is dictated by the amount of time it takes a constituent to boil off the cold cap. Hazardous waste incinerators typically run at 980 °C to 1370 °C (1800 °F to 2500 °F) to ensure that virtually all organic compounds in the wastes are destroyed (EPA/530/SW-88/018, *Hazardous Waste Incineration: Questions and Answers*). Although WTP waste feed may have batch-to-batch variability, melters do not periodically receive a slug of highly flammable material, as may be the case with a hazardous waste incinerator. Therefore, the uncertainty factors applied are considered conservative.

There are additional uncertainties associated with the substitution of method detection limits (MDL) for COPCs with predicted emissions rates below detection (refer to Appendix A, Section A.6). The MDLs vary between analytical laboratories, and are subject to change when new MDL studies are completed. It is not known at this time which laboratory will be performing the analysis of emissions samples for the LAW or HLW Facilities. The EPA revised the MDL procedure in 40 CFR 136, *Guidelines Establishing Test Procedures for the Analysis of Pollutants*, Appendix B in August 2017. What impact, if any, these changes may have on future MDL determinations is not known.

There are uncertainties associated with the cell emissions estimate. The estimated release of organic material from ancillary equipment is calculated using EPA-453/R-95/017, *Protocol for Equipment Leak Emission Estimates*. This guidance provides several different methods to determine releases. The guidance recommends using the method that best matches the type of process being evaluated and the data available on the process. Since the WTP is not in operation, actual release measurements are not available; thus, average release factors given in the guidance are used to estimate cell emissions. This

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PRA used average release factors developed for the synthetic organic chemical manufacturing industry (SOCMI) for heavy liquids. While there are similarities in the processes used in SOCMI and some WTP processes, WTP treats a highly alkaline waste, high in sodium hydroxide; therefore, SOCMI release rates may not be representative of release rates at WTP. There is also uncertainty regarding the equipment that may be incorporated into the final design of a facility; a factor of 1.18 was applied to the equipment count to compensate for potential design changes in the PT or HLW Facilities.

Table D-4 summarizes the emissions estimate uncertainty sources and their potential impact on the risk results.

Table D-4 Sources of Uncertainty in the Emissions Estimate

Sources of Uncertainty	Model Assumptions and Discussion	Potential Effect on Risk Estimates*		
		Over-estimation	Neutral	Under-estimation
PT and HLW Facility design	PT and HLW Facility designs are incomplete. Effect of Uncertainty: Not known until design is complete, but the off-gas treatment system is based on best available control technologies.		○	
Throughput of treatment system	The facilities were assumed to run at full capacity for their lifetimes: 10 years for Direct Feed Low-Activity Waste (DFLAW) and 40 years baseline WTP. However, large-scale facilities historically do not run at design capacities for a lifetime. Effect of Uncertainty: Assuming higher than actual capacity leads to overestimates of emissions and risks.	+		
Facility availability	Facilities were assumed to run at 100% availability for their lifetimes. However, they do not operate at 100% availability because of events such as planned maintenance and unplanned events. Effect of Uncertainty: Assuming higher than actual availability leads to overestimates of emissions and risks.	+		
Efficacy of pollution control equipment	Removal is based on engineering design, bench- or pilot-scale derived values, and assumptions. Lowest value was chosen when a range was available. Value of “0” was used if no data were available. Effect of Uncertainty: Assuming lower than actual removal efficiencies leads to overestimates of emissions and risks.	+		

Table D-4 Sources of Uncertainty in the Emissions Estimate

Sources of Uncertainty	Model Assumptions and Discussion	Potential Effect on Risk Estimates*		
		Over-estimation	Neutral	Under-estimation
Default upset factors for vapor-phase emissions	The upset factors are based on data from operating hazardous waste combustion facilities and are believed to represent worst-case conditions for the two operating configurations. The technology and waste feed of the WTP melters are different (e.g., glass production not incineration) and less subject to upset than these facilities. WTP processes are contained within buildings designed such that the only exits for air and emissions are through one or more high-efficiency particulate air (HEPA) filters. Effect of Uncertainty. Using higher than actual upset factors leads to overestimates of emissions and risks.	+		
Products of incomplete combustion conversion factors	In lieu of having actual full-scale prototypic test data, PIC conversion factors (i.e., ratio of PIC generation to total organic carbon in the melter feed) are used to approximate PIC generation rates and are based on average analytical results as determined from offgas samples from pilot-scale testing with offgas controls representing the WTP design. Their scale-up to the WTP facilities is not known. Effect of Uncertainty: Not known, so may lead to an over- or underestimate or emissions and risks.		○	
Conversion factors for dioxins, furans, and coplanar PCBs	Generation of dioxins, furans, and co-planar PCBs assumed even if never detected. Effect of Uncertainty: Assuming chemicals are present when they are not believed to be present leads to an overestimate of emissions and risks.	+		

* "Neutral" means that the source may lead to over- or under-estimating the risk.

D.1.4 Air Dispersion Modeling

There are three basic sources of uncertainty in air quality modeling: (1) uncertainty in the representativeness of the model input data, (2) model formulation uncertainty (i.e., how accurately the model equations simulate atmospheric physics), and (3) uncertainty caused by the limitation that models can only characterize a portion of the naturally occurring variations in the atmosphere. Specific sources of uncertainty exist in the air dispersion modeling, such as:

- Input values (i.e., stack emission characteristics, deposition rates)
- Meteorological data
- Accurate simulation of the atmospheric dispersion of the emissions plume from each stack

Some of these uncertainties are based on the limited data available, such as estimated emission rates (Appendix A). Other uncertainties become larger when the model is used at the limits of its normal application (for instance, in very complex terrain as distances from the source increase). Uncertainty in deposition rates influence the water, soil, and plant concentration estimates.

Stack emission uncertainties exist in that stack parameters (i.e., flowrate, temperature, humidity) are estimates. The actual parameters are a function of operations. Fluctuations in these parameters occur as a result of such phenomena as exhauster and offgas control system performance, waste feed composition, ambient pressure fluctuations, and the like. It is expected that upset factors account for such fluctuations, and their application bounds emissions.

Another major source of uncertainty lies in the assumptions regarding particle size distribution. There are two particle sizes assumed: 1 micron for pure particles, and 2.5 microns for particle-bound constituents (CCN 194345, *Modeling Particle-bound Constituents in CalPuff*). The HEPA filters are rated for 99.97% removal of 0.3 micron particles (DOE-STD-3020-2005, *Specification for HEPA Filters Used by DOE Contractors*), resulting in a decontamination factor of 1.1E+07 for dual-stage HEPAs. In the emissions estimate, the removal efficiency for dual-stage HEPA filters has been set at 99.95% for the first HEPA bank, and 99% for the second HEPA bank, with a combined decontamination factor of 200,000. The performance specification for the HEPAs (24590-WTP-3PS-MKH0-T0002, *Nuclear Grade High Efficiency Particulate Air (HEPA) Filters (ASME AG-1 Section FK Filters)*) is based on DOE-STD-3020-2005 and represents a 56-fold increase in particle removal efficiency over the assumed efficiency in the emission estimate modeling. In all likelihood, a substantial percentage of the actual particle size distribution expected from the facility flues (after HEPA filtration) includes particles under the 1-micron size range, with very few particles above 1 micron, and with the overall mass of particles emitted being far less than what has been modeled. Such small particles easily disperse and are unlikely to yield air concentration and depositions higher than those modeled in this PRA.

Meteorological data used for the air dispersion modeling included surface and precipitation data from the Hanford site, coupled with data from the Fifth-Generation mesoscale model (MM5)[3], using data from 2002 through 2006. The assumption is that the data for this time period are a sufficient representation of the time period over which the WTP operates. While the assumption is reasonable, it does introduce a small degree of uncertainty that cannot be assessed until weather data for the period of operation and actual monitoring data are available.

The uncertainties in transport and dispersion model formulation and parameters (model simulation accuracy) are difficult to estimate, because there are not actual site data for comparison to the predicted values. As with any model, CALPUFF is a simplification of real-life physics. CALPUFF was chosen for its ability to make use of Hanford site meteorological data and produce gridded upper air wind field data (RAWP Supplement 5) and was deemed more appropriate than simpler, Gaussian dispersion models.

Table D-5 summarizes the sources of uncertainty in the air dispersion modeling and their potential impacts on the risk results.

[3] The Fifth-Generation mesoscale model (MM5) was developed by Pennsylvania State University and the National Center for Atmospheric Research.

Table D-5 Sources of Uncertainty in the Air Dispersion Modeling

Sources of Uncertainty	Model Assumptions and Discussion	Potential Effect on Risk Estimates*		
		Over-estimation	Neutral	Under-estimation
Stack parameters	Stack parameters such flowrate, temperature, and humidity are estimated. Effect of Uncertainty: These conditions will be assumed until actual measurements become available. Effect on uncertainty is not known.		○	
Flue aggregation	All flues were assumed to be bundled for a single stack emission for each facility for model simplicity Effect of Uncertainty: This assumption is believed to not to have a significant effect on risks.		○	
Particle size	Particle size influences deposition. Particle sizes of 1 µm and 2.5 µm were assumed. Effect of Uncertainty: Actual particle size is probably less than assumed, resulting in smaller air concentrations and deposition than modeled.	+		
Meteorological data	Meteorological data (2002-2006) from the Hanford meteorological stations were assumed to be representative of the operations period. Effect of Uncertainty: The degree of representativeness can only be assessed following the operations period. Thus, it is not known whether this assumption results in an over- or underestimate of conditions.		○	
CALPUFF model	Simulation of the atmospheric dispersion of emissions is limited by data limitations and simplifications inherent in the model. Model is a simplification of reality. Effect of Uncertainty: The effect is unknown.		○	
Terrain data	Data represents land uses at a point in time, with terrain resolution that varies from 70 m to 90 m, with an absolute accuracy of 130 m in the horizontal and 30 m in the vertical. This resolution was assumed to be sufficient so that results are not underestimated. Effect of Uncertainty: The effect is unknown.		○	

Table D-5 Sources of Uncertainty in the Air Dispersion Modeling

Sources of Uncertainty	Model Assumptions and Discussion	Potential Effect on Risk Estimates*		
		Over-estimation	Neutral	Under-estimation
Constituent deposition rates	Deposition is the first step in soil, plant, and water accumulation. These media concentrations are influenced by the deposition rates. Rates were assumed because actual measurements have not been made for these conditions. Effect of Uncertainty: Rates are assumed to be continuous throughout the exposure periods assessed, and are believed to overestimate the actual conditions.	+		

* "Neutral" means that the source may lead to over- or under-estimating the risk.

D.1.5 Soil, Water, and Plant Modeling

The uncertainty associated with estimating fate and transport is described in RAWP Section 6.8. The discussion below summarizes the RAWP and provides some additional detail.

Uncertainties are associated with the models used because models are simplifications of reality. Additionally, uncertainties and assumptions associated with the parameters and data used in the models propagate the uncertainty in the model results. A variety of conservative assumptions are used throughout the modeling process to compensate for unknown or unavailable data, resulting in conservative model results.

Estimating soil concentrations incorporates numerous uncertainties, which are inherent in the assumptions that are the basis for the calculations. Examples of uncertainty in the parameters would be soil mixing depth, soil bulk density, and volumetric water content, which are assigned a single value but may vary widely over a relatively small area. The concentration of COPCs in soil is subject to loss due to biotic and abiotic degradation; however, transformation and subsequent increase of secondary COPCs (that is, degradation products) was not considered in the assessment. Transformation of radionuclides and formation of daughter products was included in this assessment through the use of toxicity values (slope factors) that include daughter products.

Uncertainty in the estimation of surface water and fish concentrations of COPCs results from the assumptions used in the calculations. The equations assume that the water body reaches a steady-state condition; however, for application to the Columbia River and any other flowing surface water, this assumption is extremely conservative. Additionally, many of the equations used to model the fate of COPCs deposited into the water body greatly simplify the mechanisms occurring within such a dynamic system and may overestimate or underestimate the concentration of given COPCs in the surface water. It is also assumed that the maximum deposition of COPCs occurs over the entire depositional area of the water body, which is a source of additional uncertainty and conservatism.

There is uncertainty in assigning COPCs exclusively to either water column or bed sediment for purposes of estimating fish-tissue concentrations as described in HHRAP (EPA530-D-98-001A), and concentrations of other organisms as described in EPA530-D-99-001A, *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, hereinafter called SLERAP.

The problem is that this approach to partitioning COPCs in the aquatic environment may not reflect the multiple pathways by which different kinds of organisms are potentially exposed to any given constituent.

The EPA approach estimates concentrations of organisms using bioconcentration factors (*BCF*) and dissolved water concentrations for COPCs with low values for K_{ow} (octanol/water partitioning coefficient), bioaccumulation factors (*BAF*) and whole-water concentrations for COPCs with moderate values for K_{ow}, and *BAF*s and sediment concentrations for COPCs with high values for K_{ow}. The uncertainty lies in the source and meaning of the different biotransfer factors used for the different media. If the HHRAP (EPA530-R-05-006) biotransfer factors do not incorporate all pathways to all organisms from the single medium where each COPC was assumed to predominate, then the exposure is underestimated. It is unlikely that the EPA transfer factors account for all pathways relevant to all fish.

Fish take up constituents into their tissue via the water in contact with their gills and via the ingestion of water, abiotic particulates, and biota. Some organisms are exposed primarily by one pathway, while others are exposed over multiple pathways:

- Dissolved constituents are primarily taken up across the gill membrane; thus, all organisms living in the water column are exposed to dissolved constituents.
- Filter-feeding organisms, which usually live in the water column, are also exposed to constituents bound to suspended particulates that they filter out of the water and ingest.
- Sediment-ingesting organisms that live in the water column are also exposed to sediment constituents by direct ingestion.
- Carnivorous fish that live in the water column are also exposed indirectly to dissolved, particulate-bound, and sediment constituents by ingesting prey that were so exposed, as well as by direct uptake from the water column and ingestion of suspended particulates.

In fact, there are probably few organisms that are exposed to only dissolved constituents – perhaps only those that live in the water column and selectively feed on planktonic animals to the exclusion of abiotic particulates. Therefore, assigning each constituent to a particular class of media (dissolved water, whole water, and bed sediment) based on its tendency to adsorb to particles or organic carbon potentially neglects pathways from other media.

Calculation of COPC concentrations in biota incorporates the uncertainties inherent in calculation of air and soil concentrations, because the air and soil are the sources of COPCs to plants. Uncertainties also arise from the assumption that the location of maximum soil concentration is the location of exposure to biota over a multiple-year period. Additionally, although COPCs are incorporated into plants and animal tissue, it was assumed that the COPC concentration in soil does not decrease from these processes. Assumptions of the animal feed ingestion rates introduce additional uncertainty, because they are based on average rates.

Additional pathways, such as fugitive dust emissions or entrainment of soil in rainwater splash, may contribute to COPC concentrations in biota. However, no equations are available to quantify these pathways. In addition, the chemical transport through inedible portions of plants (such as corn husks) may contribute to COPC concentrations in edible portions of plants (such as corn kernel). Transfer factors for this type of chemical transport are not available.

Table D-6 summarizes the sources of uncertainty and the potential consequences for the environmental modeling.

Table D-6 Sources of Uncertainty in Environmental Modeling

Source of Uncertainty	Model Assumptions and Discussion	Potential Effect on Risk Estimates		
		Over-Estimation	Neutral	Under-Estimation
Soil Accumulation Modeling				
Descriptive soil parameters	Parameters such as mixing depth, bulk density, and volumetric water content, which are assigned a single value, may vary widely over a relatively small area, but single values for each were chosen for the model Effect of Uncertainty: The effect of soil heterogeneity may over- or underestimate the concentrations and resulting risks.		○	
Soil loss mechanisms – degradation	COPCs in soil are subject to loss due to biotic and abiotic degradation; however, transformation or degradation products are not evaluated in the assessment. Effect of Uncertainty: The assumption of transformation or degradation products results may over- or underestimate concentrations and resulting risks.		○	
	Degradation rates, which are assigned a single value, generally from laboratory testing, may vary widely under environmental conditions. Effect of Uncertainty: The assumption of laboratory testing results may over- or underestimate concentrations and resulting risks.		○	
Surface Water and Sediment Accumulation Modeling				
Surface water and sediment model	Equations used to model the fate of COPCs deposited into the water body greatly simplify the mechanisms occurring within such a dynamic system. Effect of Uncertainty: The simplifying assumptions may over- or underestimate concentrations and resulting risks.		○	
Deposition area	The maximum deposition of COPCs was assumed over the entire depositional area of the water body. Effect of Uncertainty: The assumption leads to increased concentrations and resulting risks.	+		
Descriptive surface water and sediment parameters	Parameters such as depth of water column and depth of upper benthic sediment layer, which were assigned a single value, may vary widely. Effect of Uncertainty: The assumption of single values for heterogeneous conditions may lead to an over- or underestimate of concentrations and resulting risks.		○	

Table D-6 Sources of Uncertainty in Environmental Modeling

Source of Uncertainty	Model Assumptions and Discussion	Potential Effect on Risk Estimates		
		Over-Estimation	Neutral	Under-Estimation
Plant Accumulation Modeling				
Plant uptake factors	Air-to-plant and soil-to-plant uptake factors, which were assigned a single value, generally from laboratory testing of a limited number of chemicals, may vary widely depending on constituent, plant species, and environmental conditions. Effect of Uncertainty: The assumption of single values instead of the actual heterogeneous conditions may result in an over- or underestimate of plant concentrations and resulting risks.		○	
Pathways not included	Additional pathways not included in the assessment may contribute to biota concentrations. Effect of Uncertainty: The assumption of limited pathways may result in underestimated concentrations and resulting risks.			-
Descriptive plant parameters	Parameters such as length of growing season and yield, which were assigned a single value, may vary widely among plant species and agricultural practices. Effect of Uncertainty: The assumption of single values instead of the actual heterogeneous conditions may result in an over- or underestimate of plant concentrations and resulting risks.		○	

* "Neutral" means that the source may lead to over- or under-estimating the risk.

D.2 Human Health Risk Assessment

The sources of uncertainties and their effects are discussed in subsections that cover the major components of the HHRA, which was presented in Section 3 of the main report:

- Exposure assessment
- Toxicity assessment
- Risk characterization

D.2.1 Exposure Assessment

Human exposures to COPCs in the environment are quantified by determining the concentration of COPC in environmental media (air, water, soil, and foods), which humans may then ingest or otherwise contact resulting in COPC uptake. The exposure assessment process involves determining the concentration of COPC in the environmental media of concern and combining this information with estimates of human exposure to the environmental media. The variability of environmental concentrations, the likelihood of exposure occurring via particular pathways, and the frequency and duration of human exposure are all components of the exposure assessment. Sources of uncertainty in the exposure assessment include:

- Land-use assumptions
- Selection of representative human receptor populations and exposure parameter values

Each of these sources of uncertainty in the exposure assessment is described below.

D.2.1.1 Land-Use Assumptions

Land-use assumptions are consistent information presented in the *Final Tank Closure and Waste Management Environmental Impact Statement Hanford Site, Richland, Washington* (DOE/EIS-0391). DOE anticipates multiple uses of Hanford, including consolidation of waste management activities in the Central Plateau; industrial development in the eastern and southern portions, including the 400 Area; increased recreational access to the Columbia River; expansion of the Saddle Mountain National Wildlife Refuge to include all of the Wahluke Slope; and management of the Fitzner-Eberhardt Arid Lands Ecology Reserve by the U.S. Fish and Wildlife Service. Therefore, even defining current land use (i.e., during WTP operations) has some uncertainty associated with it, and defining future land use (i.e., after WTP shutdown and beyond US Department of Energy [DOE] control) has even greater uncertainty. To compensate for this uncertainty, receptors were assumed to be present at the locations of maximum or bounding concentration regardless of actual land use at those locations and as determined by combining air model concentration and deposition rates according to Appendix B. For example, the current residential scenario was evaluated at the Hanford offsite location regardless of whether this location is presently in residential use.

D.2.1.2 Selection of Representative Receptor Populations and Exposure Parameter Values

The term “receptor” is used to describe subgroups of the exposed population. This definition of several receptor population groups does not suggest that these represent distinct individuals or even separate populations. Distinguishing separate receptors does not imply these populations are mutually exclusive; rather, the receptors are defined for convenience of distinguishing different exposure possibilities. Every individual is unique, with different activity patterns (e.g., amount of time spent at home or work) and different physiologic characteristics (e.g., body weight). Modeling broad categories of receptors (e.g., resident) therefore introduces uncertainties, because (1) a limited number of general receptor categories are evaluated and (2) exposure parameters are assigned within each receptor category to represent the activity patterns and physiological characteristics of that receptor type. To compensate for these uncertainties, receptor types representing the highest potential for exposure were evaluated in the risk assessment, and these receptors were modeled using upper-bound assumptions to describe their activity patterns. For example, evaluation of a resident who was assumed to be at home 24 hours per day, 350 days per year at the point of maximum constituent concentration overestimates the risk to many other receptor types not included in the quantitative risk assessment, such as a school child at the same location who may be at school 8 hours per day, 180 days per year.

Potential human receptors (infants, children, and adults) were addressed with a range of plausible and worst-case exposure scenarios that included conservative exposure parameter values. The scenarios included: site worker, resident, subsistence farmer, and subsistence fisher. Conservative assumptions were made in each exposure scenario, such as assuming 100% of inhaled, ingested, and adsorbed media was contaminated. Another conservative assumption was that, with the exception of vacation, residential

exposure time was 24 hours per day (e.g., the resident did not leave home for work, errands, etc.). Bioavailability, metabolism factors[4], and the fraction of produce grown in contaminated soil were set to 1.

Receptors may be exposed through more than one pathway. To maintain the conservative nature of the risk assessment, it was assumed that each receptor is exposed to all COPCs by all reasonable pathways. This is a conservative approach, because it is unlikely all individuals represented by a specific receptor would be exposed through all the modelled pathways (e.g., a farmer may consume homegrown dairy products but purchase produce and meats from the local supermarket), or with the assumed exposure parameter values.

While exposure assumptions used in the HHRA were designed to overestimate risk, some assumptions may underestimate the risk due to an individual having higher exposure than accounted for in the exposure assessment or due to exposures via pathways (such as dermal) that have been identified by EPA/540/R/99/005, *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment)* as providing only small proportions of the aggregate exposure.

Potential infant exposures to polychlorinated dibenzo-p-dioxins (PCDD)/polychlorinated dibenzofurans (PCDF) and coplanar PCBs in human breast milk were evaluated by comparing a site-specific calculated average daily dose to the infant (ADD_{inf}) to a background dose of 60 pg/kg·day of PCDD/PCDF and 33 pg/kg·day of coplanar, dioxin-like PCBs (RAWP Section 7.2.1.3). These background values were obtained from an allocation of an average background infant intake of 93 pg/kg·day (EPA530-R-05-006). This is close to the time-weighted value of 87 pg/kg·day, which was calculated from a Centers for Disease Control and Prevention database that contained 316 individuals from six sites in the period of 1995-1997, and was based on an average blood concentration, adjusted for dioxin-like PCBs, of 25.4 ppt toxic equivalent (TEQ). The 95th percentile blood concentration was 38.8 ppt TEQ (EPA/600/P-00/001Cb, *Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds*), which would lead to a higher background level estimate. A lower percentile leads to a lower background level estimate.

Table D-7 summarizes the potential impacts of these sources of uncertainty.

Table D-7 Sources of Uncertainty in the Exposure Estimate

Sources of Uncertainty	Model Assumptions and Discussion	Potential Effect on Risk Estimates*		
		Over-estimation	Neutral	Under-estimation
Land use assumptions	Land use may change over time, particularly with the postcleanup condition for Hanford. Thus, receptors were assumed to be located at points of maximum concentrations regardless of actual land use. Effect of Uncertainty: It is unlikely that receptors remain at points of maximum concentrations over their lifetimes. Thus, this assumption leads to an overestimate of exposures and thus risks.	+		

[4] The exception is the metabolism factor for bis(2-ethylhexyl)phthalate, which EPA530-R-05-006 recommends a value of 0.01.

Table D-7 Sources of Uncertainty in the Exposure Estimate

Sources of Uncertainty	Model Assumptions and Discussion	Potential Effect on Risk Estimates*		
		Over-estimation	Neutral	Under-estimation
Receptors	Receptors were defined to distinguish different exposure possibilities and were assumed to represent the range of potential receptors. Effect of Uncertainty: The range of receptors was believed to represent a reasonable set, and thus was not anticipated to over- or underestimate risks.		○	
Receptor activities	Receptors were assumed to perform a variety of activities over their lifetimes, consistent with the definitions of the receptors. Effect of Uncertainty: The range of activities was believed to represent a reasonable set, and thus was not anticipated to over- or underestimate risks.		○	
Activity exposure parameters	Exposure parameters are a combination of average (e.g., body weight) and upper bound (e.g., soil ingestion) point estimates of parameters that vary widely among individuals. Exposure parameters assume, for example, that all produce is home grown, whereas some may be purchased. Effect of Uncertainty: The use of upper bound parameter estimates leads to an overestimate of risks.	+		
Dermal pathway	Dermal pathway was not included. The dermal pathway is usually only a small contributor to the risk for receptors. Effect of Uncertainty: Not including this pathway for the other receptors likely leads to a small underestimate of risks.			-
PCDD/PCDF/ coplanar dioxin-like PCBs background	Limited studies are available to estimate current background concentrations. Background values were assumed for this assessment exposure scenarios based on available studies. Effect of Uncertainty: The effect on this assessment was unknown because no site-specific studies are available.		○	

* "Neutral" means that the source may lead to over- or under-estimating the risk.

D.2.2 Toxicity Assessment

Sources of uncertainty in the toxicity assessment include uncertainties surrounding the following:

- Toxicity values (reference doses [*RfD*], reference concentrations [*RfC*], cancer slope factors [*CSF*], and unit risk factors [*URF*])
- Cancer weight-of-evidence classifications

- Toxicity value data gaps
- Route-to-route extrapolations

Each of these sources of uncertainty in the toxicity assessment is described briefly below.

Toxicity Values

Because most of the toxicity values (*RfD*s and *RfC*s, *CSF*s and *URF*s) are based on laboratory exposures of animals, the actual effects of environmental exposures to humans is unknown. The EPA derives *RfD*s and *RfC*s by applying uncertainty factors to the no-adverse-effect-level (NOAEL) or lowest observed adverse effect level to provide a margin of safety. Uncertainty factors can range from 1 to 10,000. For chemicals, the *CSF* is defined as a plausible upper-bound estimate of the probability of a response. Therefore, EPA-derived toxicity values are designed to provide an upper-bound estimate of risk (e.g., by incorporating numerous uncertainty factors). However, previous or concurrent exposures from sources other than the WTP are not considered in the EPA toxicity values for most chemicals. For example, all humans have been exposed to dioxins and PCBs and have some body burden associated with them. The additional exposures and their potential to increase body burdens of these chemicals from the WTP emissions were evaluated independent of existing risks or as an incremental increase. It was not known how much such incremental exposures actually affect an individual's potential to suffer adverse effects from these exposures. This was regarded as a nonconservative uncertainty in the overall risk assessment.

Toxicity equivalence factors (TEF) have been utilized by EPA to evaluate mixtures of structurally similar constituents (e.g., dioxins). TEFs are estimates of compound-specific toxicity relative to the toxicity of an index chemical (typically, 2,3,7,8-tetrachlorodibenzo-p-dioxin [TCDD]). TEFs are the result of expert scientific judgment using all of the available data and considering uncertainties in the available data.

Cancer Weight-Of-Evidence Classification

Uncertainty in the cancer weight-of-evidence classification was considered in the HHRA by evaluating all Class A (human carcinogen), Class B (probable human carcinogen), and Class C (possible human carcinogen) chemicals as carcinogens.

Toxicity Value Data Gaps

The lack of toxicity data for some COPCs contributes to an underestimation of risk if these chemicals are present in the emissions and are toxic to humans at the concentration emitted.

Route-To-Route Extrapolations

Uncertainties are associated with the estimation of dermal toxicity values from oral values. If no *URF* or *RfC* were available, they can be derived from the CSF_{inh} or RfD_{inh} (respectively) using the conversion in WAC 173-340-708(7)b, *Model Toxics Control Act—Cleanup, Human Health Risk Assessment Procedures*, which directs the risk assessor to consider, where available, the respiratory deposition and absorption characteristics of the gases and inhaled particles.

Table D-8 summarizes the potential effects of these sources of uncertainty.

Table D-8 Sources of Uncertainty in the Toxicity Assessment

Sources of Uncertainty	Model Assumptions and Discussion	Potential Effect on Risk Estimates*		
		Over-estimation	Neutral	Under-estimation
COPC cancer slope values	Values were designed to be upper-bound estimates of risk. Estimates are usually based on extrapolations from animal studies. Effect of Uncertainty: The use of upper-bound estimates leads to an over-estimate of the risks.	+		
Radionuclide cancer slope values	Values are central estimates of the age-averaged, lifetime radiation cancer incidence risk and are based on human data. Effect of Uncertainty: The use of average cancer slope values based on human data is neutral in producing over- or underestimates of risks.		○	
Cancer weight of evidence	All EPA Class A, B, and C chemicals were assumed to be carcinogens in this assessment. The weight-of-evidence supporting the carcinogen status actually varies with the classes. Effect of Uncertainty: The assumption that even lower likelihood chemicals are carcinogens leads to an overestimate of the cancer risks.	+		
Reference doses	Values are designed to be upper-bound estimates, without deleterious effects during a lifetime, even for sensitive receptor subpopulations. Effect of Uncertainty: The use of upper-bound estimates even applicable to sensitive subpopulations leads to overestimates of the risks.	+		
Toxicity value gaps	Toxicity values are not available for all COPCs. Effect of Uncertainty: The absence of toxicity values leads to an underestimate of risks.			-
Toxicity equivalence factors	Values provide expert judgements for estimates of relative toxicity for constituents within the same chemical family (e.g., dioxins). Effect of Uncertainty: The effects of these factors are not well characterized. Thus, it is unknown whether they lead to an over- or underestimate of risks.		○	
Background exposure	Background exposures may increase the probability of adverse noncancer effects. Background values were not assumed in the assessment. Effect of Uncertainty: The risks of some noncancer effects may be underestimated.			-

Table D-8 Sources of Uncertainty in the Toxicity Assessment

Sources of Uncertainty	Model Assumptions and Discussion	Potential Effect on Risk Estimates*		
		Over-estimation	Neutral	Under-estimation
Dermal toxicity values	Dermal toxicity values were estimated from the oral values using accepted conversion equations. Effect of Uncertainty: The effects of this application for a large number of chemicals are not well characterized. Thus, the methodology may over- or underestimate risks in specific circumstances.		○	

* "Neutral" means that the source may lead to over- or under-estimating the risk.

D.2.3 Risk Characterization

The risk characterization combines the results of the exposure assessment and toxicity assessment; therefore, all the uncertainty in these two steps, as well as the steps prior to the exposure assessment (e.g., air dispersion modeling), contributes to the uncertainty in the risk characterization. Additional uncertainty in the risk characterization step surrounds the practice of summing cancer risks and noncancer hazard results across all chemicals and exposure pathways, regardless of the mode of action, as described below.

The emissions estimate included 409 constituents, which includes 187 feed constituents, 183 PICs, and 39 constituents that are both a feed constituent and a PIC. In addition to the 409 COPCs in the emissions estimate, the risk modeling also included mercuric chloride and methyl mercury, which are required to assess the impacts of mercury in accordance with HHRAP (EPA530-R-05-006) and SLERAP (EPA530-D-99-001A) guidance. In addition, Cr(VI) is modeled for risk based on emissions for total chromium (RAWP Section 7.2.2.1). This brings the total COPCs assessed in the risk model to 412.

Of the 183 PICs, 63 are PICs for which there are not estimated emissions due to a lack of data. These are PICs for which there is no sampling, preparation, and analytical method for stack gas, so there is no basis for their generation from pilot-scale melter testing and no detection limit to assign as a default emissions value. In addition, particulate and ozone, which have no toxicity data, were excluded from quantitative analysis. Of the 187 feed COPCs, there is no quantification of risk for bromide, which is not in the emissions model. Bromide was initially identified as a COPC because of its classification as a toxic air pollutant, but was removed from the toxic air pollutant list in 2009. Additionally, barium-137m and yttrium-90 are not assessed as distinct COPCs, because they are the daughter products of cesium-137 and strontium-90, respectively. Slope factors for the parent isotopes (which are assessed) include the contribution of the daughter products.

In all, 341 COPCs were modeled for risk. Of those, 229 COPCs had available inhalation toxicity data, 290 had ingestion toxicity data, and 247 had toxicity data to assess the impact of dermal adsorption. Supplement 4 of the RAWP provides the available toxicity values.

Multiple chemical carcinogen exposures result in synergisms, antagonisms, or additivity of biological responses on the target organ. The assumption of strict additivity of chemical carcinogens that were used assumes that (1) intakes of individual chemicals are small, and (2) there is no interaction among chemicals (i.e., no synergism or antagonism). The assumption of strict additivity of cancer risk

from radionuclides is much less uncertain than for chemicals, because the carcinogenic mode of action (i.e., irreparable cell DNA damage by ionization and the formation of highly reactive compounds) is the same for all radionuclides.

Multiple chemical exposures to constituents with noncarcinogenic effects can result in synergism, antagonism, and/or additivity of biological responses when the chemicals act on similar target organs or when the chemicals are metabolized by the same enzymatic pathways. The assumption of additivity was used and is likely to overestimate the true human health hazards associated with exposure to the COPCs, since many chemicals may act on different target organs.

Table D-9 summarizes the potential effects of these sources of uncertainty.

Table D-9 Sources of Uncertainty in the Risk Characterization

Sources of Uncertainty	Model Assumptions and Discussion	Potential Effect on Risk Estimates*		
		Over-estimation	Neutral	Under-estimation
Assessed COPCs	Not all COPCs were modeled and included in the risk characterization. The absence of exposure and/or toxicity parameters limited the number of COPCs assessed. Effect of Uncertainty: The inability to complete the COPC assessment leads to an underestimate of risk. This is complicated, however, by the methods that created a rather and perhaps not representative list of COPCs.			-
Dose summation for noncancer effects	Exposures for a chemical are summed across pathways, assuming the same mechanism of action. Effect of Uncertainty: This likely overestimate risks because chemicals act on different target organs.	+		
Risk summation for cancer effects	The assumption of additivity of cancer risk assumes intakes of individual chemicals are small, and there is no interaction among chemicals. Chemical interactions are generally unknown. Effect of Uncertainty: The potential interactions among such a large number of chemicals are unknown.		○	
Risk summation for radionuclide cancer effects	The assumption of additivity of radionuclide cancer risk is much less uncertain than for organic and inorganic COPCs, because the mode of action is the same for all radionuclides. Effect of Uncertainty: The summation may lead to an over- or –under estimate of risks.		○	

Table D-9 Sources of Uncertainty in the Risk Characterization

Sources of Uncertainty	Model Assumptions and Discussion	Potential Effect on Risk Estimates*		
		Over-estimation	Neutral	Under-estimation
Summation of upper bound cancer risk estimates	Cancer toxicity values are designed to be upper-bound estimates and thus result in upper bound risk estimates for each COPC. The assumed summation of upper-bound risk estimates across COPCs and exposure routes results in additional health protectiveness. Effect of Uncertainty: The summation of upper bound estimates leads to an overestimate of risks.	+		

* "Neutral" means that the source may lead to over- or under-estimating the risk.

D.3 Screening Level Ecological Risk Assessment

The uncertainties regarding the modeling of media exposure point concentrations are compounded by additional uncertainties in the ecological risk assessment methodology. These uncertainties are discussed below for the three major components of the SLERA, which were presented in Section 4 of the main report:

- Exposure assessment
- Toxicity assessment
- Risk characterization

D.3.1 Exposure Assessment

The SLERA evaluated nine terrestrial receptors and nine aquatic receptors representing soil, aquatic, and sediment communities and wildlife populations inhabiting the Central Plateau and Columbia River, respectively. Receptor exposures to COPCs were quantified by determining the concentrations of COPCs in environmental media (i.e., soil, air, water, and sediment) contacted and ingested, as well as the concentrations of plant and animal matter ingested. The variability of environmental concentrations, the likelihood of exposure occurring via particular pathways, and food chain modeling are all components of the exposure assessment. Sources of uncertainty in the exposure assessment include:

- Conceptual exposure model
- Selection of representative ecological receptors and exposure parameters
- Food chain modeling variables

These sources of uncertainty in the exposure assessment are described below.

D.3.1.1 Conceptual Exposure Model

The conceptual exposure model identifies the ecological exposure scenarios used to define exposure pathways and potentially exposed populations. The model was developed from SLERAP (EPA530-D-99-001A), and DOE/RL-96-16, *Screening Assessment and Requirements for a Comprehensive Assessment: Columbia River Comprehensive Impact Assessment*. Current habitats and receptors are reasonably

certain, and the specific receptors used to evaluate risk are known to inhabit the site. While future land use is not expected to change significantly, some uncertainty remains, particularly after WTP shutdown. To compensate for this uncertainty, receptors were assumed to be present at the locations of maximum or bounding concentration regardless of actual community and population dynamics, home range, and temporal use of the site. This approach assumed that receptors, as well as their food (i.e., forage and prey), lived only at these locations of maximum and bounding concentrations. The analysis concludes that the methodology most likely overcompensated for uncertainty associated with land use and habitat character.

D.3.1.2 Selection of Representative Receptor Populations and Exposure Parameter Values

Ecological receptors evaluated included communities and populations. The terrestrial plant community is a broad mosaic of numerous subcommunities composed of many different plant populations. Similarly, the terrestrial invertebrate community is composed of countless and invariably unknown populations of animals that live in the soil and inhabit the soil litter. There is considerable uncertainty about specific terrestrial plant and invertebrate populations most exposed because there is insufficient information to model these communities at the population level. However, the use of upper bounding soil concentrations in the exposure assessment reasonably compensates for uncertainty at the population level. For the aquatic ecosystem, there is considerable information about the likely make-up of the fish, aquatic invertebrate, and aquatic plant communities, and while uncertainty about the most vulnerable populations is characteristic of this SLERA, the use of federal and state ambient water quality criteria to assess the risk to these communities is highly compensatory, as the criteria protect 95% of the aquatic life 95% of the time.

Mammals and birds used to characterize risk are known to inhabit the Central Plateau and Columbia River habitats, so the wildlife are highly representative of populations at the site. The natural history or exposure parameter values, such as body weights and food ingestion rates, are based on site-specific information and sound data in EPA/600/R-93/187, *Wildlife Factors Exposure Handbook*. The SLERA assumed the wildlife are exposed year-round to the maximum and upper bounding COPC concentrations. Conservative assumptions were made in each exposure scenario, such as assuming 100% of ingested food and media (e.g., soil) was contaminated. Bioavailability was assumed to be 100%, and no metabolism factors were used to calculate total exposure. To address any uncertainty about dietary pathways, the wildlife receptors were assumed to ingest equal proportions of each food item. The latter assumption was made to somewhat simplify a particularly complicated exposure assessment, and it is a reasonable approximation of dietary exposures across a population. While the assumption might underestimate exposure from a particularly predominant pathway for a proportion of individuals in a population, potential underestimation of exposure by a population is unlikely. This is compensated for by the use of numerous other conservative assumptions for the exposure assessment.

While the inhalation and dermal pathways were not evaluated in the SLERAP (EPA530-D-99-001A), which indicates that these pathways are not significant for ecological receptors, they do represent sources of uncertainty that may have underestimated risk.

Table D-10 summarizes the potential impacts of these sources of uncertainty.

Table D-10 Sources of Uncertainty in the Ecological Exposure Estimate

Sources of Uncertainty	Model Assumptions and Discussion	Potential Effect on Risk Estimates*		
		Over-estimation	Neutral	Under-estimation
Land use and habitat assumptions	Land use and habitat may change over time, particularly with the post-cleanup condition for Hanford. Thus, receptors were assumed to be located at points of maximum concentrations regardless of actual land use. Effect of Uncertainty: It is unlikely that receptors remain at points of maximum concentrations over their lifetimes. Thus, this assumption leads to an overestimate of exposures and thus risks.	+		
Media/community receptors	Soil, water, and sediment receptors evaluated at a broad community scale. Effect of Uncertainty: The effect of the uncertainty about exposures by specific populations in the communities is unknown.		○	
Wildlife receptors	Receptors were defined to distinguish different exposure possibilities and were assumed to represent the range of potential receptors. Effect of Uncertainty: The range of receptors is believed to represent a reasonable set, and thus is not anticipated to over- or underestimate risks		○	
Activity exposure parameters	Exposure parameters are reasonable representative measurements or estimates of body weights and ingestion rates. Exposure parameters assume all food and media ingested correspond to locations of maximum and upper bounding COPC concentrations. Effect of Uncertainty: The use of representative natural history parameter estimates coupled with maximum and upper-bounding exposure concentrations leads to an overestimate of risks.	+		
Dermal and inhalation pathways	Dermal and inhalation pathways were not evaluated because there is virtually no scientific information on these pathways for wildlife. EPA530-D-99-001A indicates these pathways do not need to be evaluated. Effect of Uncertainty: Not including these pathways may lead to a small underestimate of risks.			-

* "Neutral" means that the source may lead to over- or under-estimating the risk.

D.3.2 Toxicity Assessment

Sources of uncertainty in the toxicity assessment for the SLERA include uncertainties surrounding the basis for the toxicity reference values (*TRV*) for media communities and wildlife populations and the absence of *TRV*s for many receptors.

Each of these sources of uncertainty in the toxicity assessment is described briefly below.

D.3.2.1 Toxicity Reference Values

The *TRV*s are based on laboratory exposures of plants and animals. The actual effects of environmental exposures are unknown because of differences between (1) the laboratory and environmental exposure regimes, (2) the form and bioavailability of the COPC, and (3) susceptibility of the laboratory organisms versus receptor populations. Laboratory exposure regimes are a mixture of short, moderate, and long timeframes under highly controlled conditions, while actual exposure regimes are highly variable due to dietary variations and the size of a receptor's home range. Laboratory studies typically focus on toxic and highly bioavailable forms of COPCs, while the form and bioavailability of a COPC in the environment are unknown. Lastly, laboratory organisms, by definition, are in excellent health. Conversely, the health of receptor populations can be quite variable due to differences in food availability, disease, predation, and other natural factors. The effect of superimposition of chemical stressors on the natural variability in the health of populations is unknown.

Due to the uncertainties associated with laboratory toxicity studies used to develop *TRV*s, the SLERAP (EPA530-D-99-001A) used the lowest available toxicity values, regardless of test organism, to develop *TRV*s by applying uncertainty factors to extrapolate to "chronic" NOAELs. For example, if the lowest toxicity value was an acute (short duration) study that measured an LC_{50} [(5)], then uncertainty factors (UF) were applied to convert the duration from acute to chronic (UF=0.1 [*TRV* is one tenth of the toxicity value]) or convert the LC_{50} to an NOAEL (UF=0.01 [*TRV* is one one-hundredth of the toxicity value]). Overall, EPA's approach resulted in toxicity values that are upper bounding by any measure. They are doubly conservative because the lowest toxicity values were used to derive the *TRV*s and very low (and technically unsubstantiated) UFs were used to make the conversions. Using these *TRV*s often results in the identification of false-positive risks. In this case, the SLERA did identify false-positive risks associated with PCBs for mammals and birds, and NO_2 for plants.

The *TRV*s for aquatic receptors are based on a mixture of federal and state ambient water quality criteria and toxicity values from the scientific literature. The ambient water quality criteria have been technically scrutinized and are well vetted conservative values that are highly protective of aquatic life.

D.3.2.2 Toxicity Reference Value Data Gaps

The lack of *TRV*s for some COPCs may underestimate overall risk if these COPCs are present in the emissions and are toxic at the concentrations emitted (based on the resulting concentrations in media and food).

Table D-11 summarizes the potential effects of these sources of uncertainty.

[5] Lethal concentration$_{50}$ (LC_{50}) is a calculated concentration of a chemical to which exposure for a specific length of time is expected to cause death in 50% of a defined experimental animal population.

Table D-11 Sources of Uncertainty in the Ecological Toxicity Assessment

Sources of Uncertainty	Model Assumptions and Discussion	Potential Effect on Risk Estimates*		
		Over-estimation	Neutral	Under-estimation
COPC TRVs for media communities	Values are designed to be upper-bound estimates of risk. Estimates are based on highly conservative extrapolations from laboratory studies. Ambient water quality criteria are well vetted and protective of aquatic life. Effect of Uncertainty: The use of upper-bound estimates leads to an overestimate of the risks.	+		
COPC TRVs for wildlife	EPA NOAELs based on the lowest toxicity value and application of uncertainty factors. Effect of Uncertainty: The use of the lowest values and uncertainty factors leads to an overestimate of risks.	+		
Toxicity value gaps	Toxicity values are not available for all COPCs. Effect of Uncertainty: The absence of toxicity values leads to an underestimate of risks.			-

* "Neutral" means that the source may lead to over- or under-estimating the risk.

D.3.3 Risk Characterization

The risk characterization integrates the exposure assessment and toxicity assessment and reflects the uncertainties and conservative assumptions used to compensate for them. Therefore, all the uncertainty in these two steps and inputs to the exposure assessment (including emissions characterization and environmental modeling) contributes to the uncertainty in the risk characterization. Additional uncertainty in the risk characterization step surrounds the practice of summing ecological screening quotients across COPCs and exposure pathways, regardless of the mechanism action, as described below.

Section D.2.3 discussed the nature of the constituents evaluated in the PRA and the reduction in the number of substances evaluated throughout the steps in the PRA analysis due to lack of data, lack of analytical methods, and other aspects not unexpected for such a wide-ranging initiative.

In all, 341 COPCs were modeled for risk. *TRV*s were available for 109 to 232 COPCs, depending on the receptor (27-56% of the substances). Supplement 4 of the RAWP provides the available toxicity values.

The SLERA evaluated total risk across COPCs for each receptor. Multiple chemical exposures to constituents can result in synergism, antagonism, and/or additivity of biological responses when the chemicals act on similar target organs or when the chemicals are metabolized by the same enzymatic pathways. Additivity was assumed, and is likely to overestimate the true ecological risks associated with exposure to the COPCs, since many chemicals may act on different organs and systems, as well as multiple organs and systems.

Table D-12 summarizes the potential effects of these sources of uncertainty.

Table D-12 Sources of Uncertainty in the Ecological Risk Characterization

Sources of Uncertainty	Model Assumptions and Discussion	Potential Effect on Risk Estimates*		
		Over-estimation	Neutral	Under-estimation
Assessed COPCs	Not all COPCs were modeled and included in the risk characterization. The absence of projected emissions, exposure and/or toxicity parameters limited the number of COPCs assessed. Effect of Uncertainty: The inability to fully evaluate all COPCs leads to an underestimate of risk. This is complicated, however, by the methods that created a rather and perhaps not representative list of COPCs. The significance of the uncertainty will be determined depending on the results of the demonstration performance test.			-
ESQ summation	Risks across COPCs are summed. Effect of Uncertainty: This overestimate risks because chemicals act on different target organs and systems.	+		

* "Neutral" means that the source may lead to over- or under-estimating the risk.

D.4 American Indian Exposure Scenario Assessment

Two American Indian resident subsistence scenarios (American Indian #1 and American Indian #2) were assessed to represent more closely the lifestyle described by guidance documents issued by local tribes. More detail on the exposure uptakes for the exposures can be found in RAWP Section 7.1.5.

DOE requested and invited the American Indian perspectives to ensure fair consideration of differing views and to inform the agency's decision-making process. DOE respects those views and considered them for the purposes of preparing this PRA. However, inclusion of these perspectives does not mean or imply that DOE is in agreement with them.

The lifestyle and exposure parameters of the American Indian #1 are primarily based on data from *Exposure Scenario for CTUIR Traditional Subsistence Lifeways* (Harris and Harper 2004) and *Application of the CTUIR Traditional Lifeways Exposure Scenario in Hanford Risk Assessments* (Harris 2008). Other parameters were taken from the "A Native American Exposure Scenario" (Harris and Harper 1997), or from EPA/600/P-95/002F, *Exposure Factors Handbook*. Children's exposure parameters were developed by proportioning the child caloric intake reported in EPA/600/R-06/096F, *Child-Specific Exposure Factors Handbook*, according to the various proportions of meat, vegetable, roots, etc. in the diet of the adult tribal member as reported in the guidance documents provided by the Confederated Tribes of the Umatilla Indian Reservation (CTUIR).

The lifestyle and exposure parameters of the American Indian #2 are primarily based on data from *Yakama Nation Exposure Scenario for Hanford Site Risk Assessment* (RIDOLFI Inc. 2007). Other parameters were taken from EPA/600/R-06/096F. Children's exposure parameters were developed by proportioning the child caloric intake reported in EPA/600/R-06/096F according to the various proportions of meat, vegetable, roots, and so forth in the diet of the adult tribal member, as reported in the guidance documents provided by the Yakama Nation.

Table D-13 summarizes the receptors, locations, exposure scenarios, and exposure pathways and Figure D-1 shows the conceptual exposure model that was used for the two American Indian scenarios.

Table D-13 Resident Subsistence American Indian Exposure Pathways

		Exposure Pathways															
		Inhalation Routes			External radiation		Ingestion									Absorp-tion	
Receptor	**Location**	Emissions [a]	Resuspended Soil	Sweat Lodge Vapors [b]	Radionuclides in air	Radionuclides in soil	Soil	Produce	Beef [c]	Domestic Chicken & Eggs	Wild Produce	Wild Game	Wildfowl & Eggs	Fish [b]	Drinking Water [b]	Sweat Lodge Vapors [b]	Breast milk [d]
Resident Subsistence American Indian #1 (adult and child)	Resides at Hanford offsite location	X	X		X	X	X										X
	Consumes wild produce/game (hunter/gatherer area)										X	X	X	X			
	Consumes water (Columbia River max)			X											X	X	
Resident Subsistence American Indian #2 (adult and child)	Resides at Hanford offsite location	X	X		X	X	X										X
	Consumes homegrown produce/livestock (offsite)							X	X	X							
	Consumes wild produce/game (hunter/gatherer area)										X	X	X	X			
	Consumes water (Columbia River max)			X											X	X	

X = complete exposure pathway for receptor.

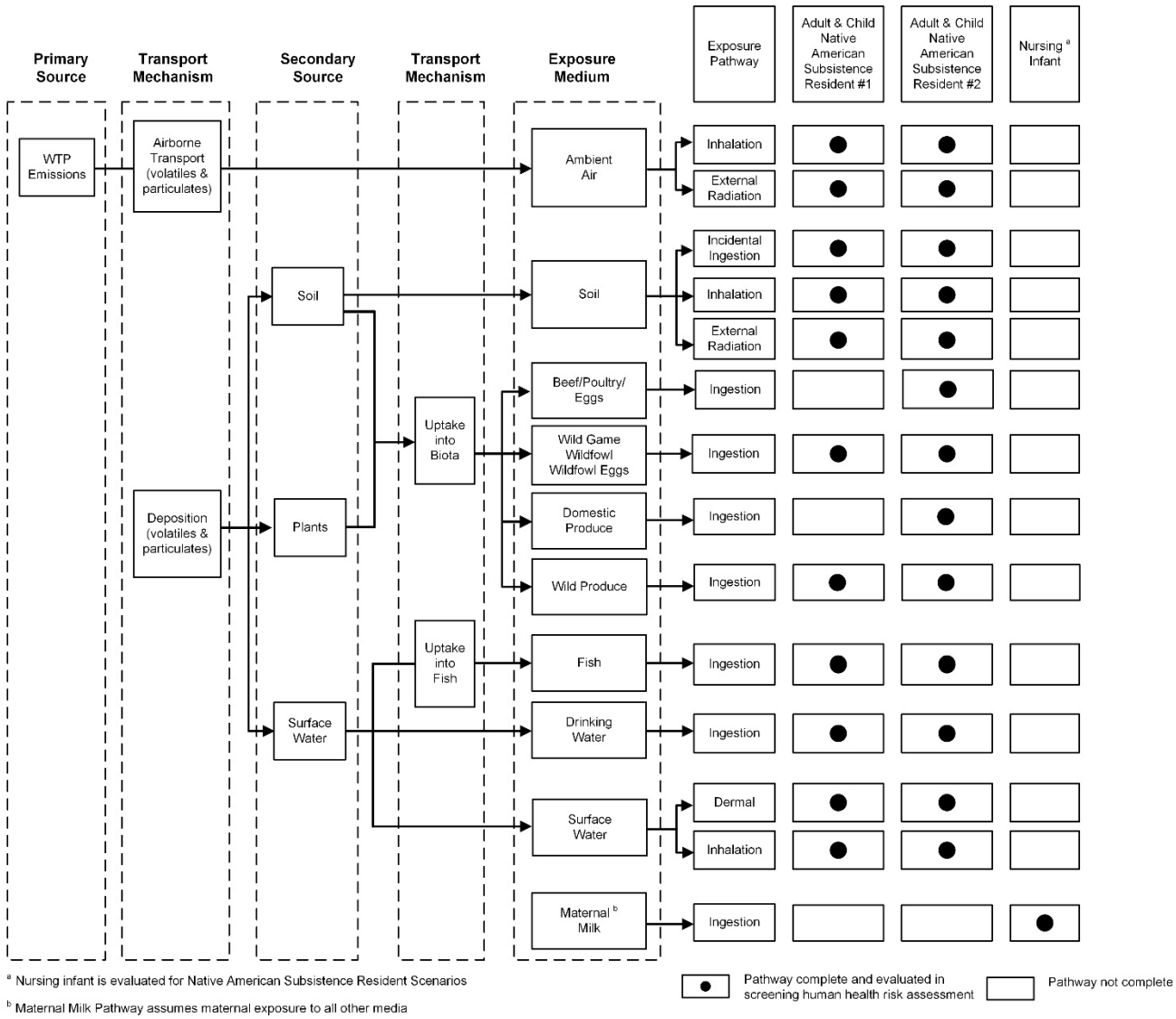
[a] Includes direct inhalation of vapor phase and particulate emissions. Applicable to current timeframe only (during WTP emissions).

[b] Pathway attributable to exposure to water/fish from the Columbia River maximum.

[c] Guidance used to develop the American Indian exposure scenario #2 made no distinction made for type of livestock so beef consumption is assumed (no pork consumption assumed).

[d] Includes nursing infant assessment - maternal exposures indicated.

Figure D-1 Human Health Conceptual Exposure Model for American Indian Scenarios



The American Indian #1 was assumed to live a traditional subsistence lifestyle, based on seasonal hunting, plant gathering, and fishing. This receptor was assumed to live, work, and play at a single location (i.e., assumed to be at home 24 hours per day, 353 days per year), but spends one day a month away from home participating in ceremonial activities (assumed to occur at Gable Mountain[6]). It was assumed that the resident's home is located within the offsite grid. The American Indian #1 (adult and child) was assumed to be exposed through inhalation of emissions, ingestion of soil, inhalation of resuspended soil, ingestion of drinking water, and ingestion of wild plants, game (including game organs), wild fowl and fish (including fish organs), and inhalation and dermal adsorption during sweat lodge activities. It is assumed that all wild produce and game is taken from the hunter/gatherer area. The consumption of livestock, dairy products, and domestic produce does not occur in this scenario. The

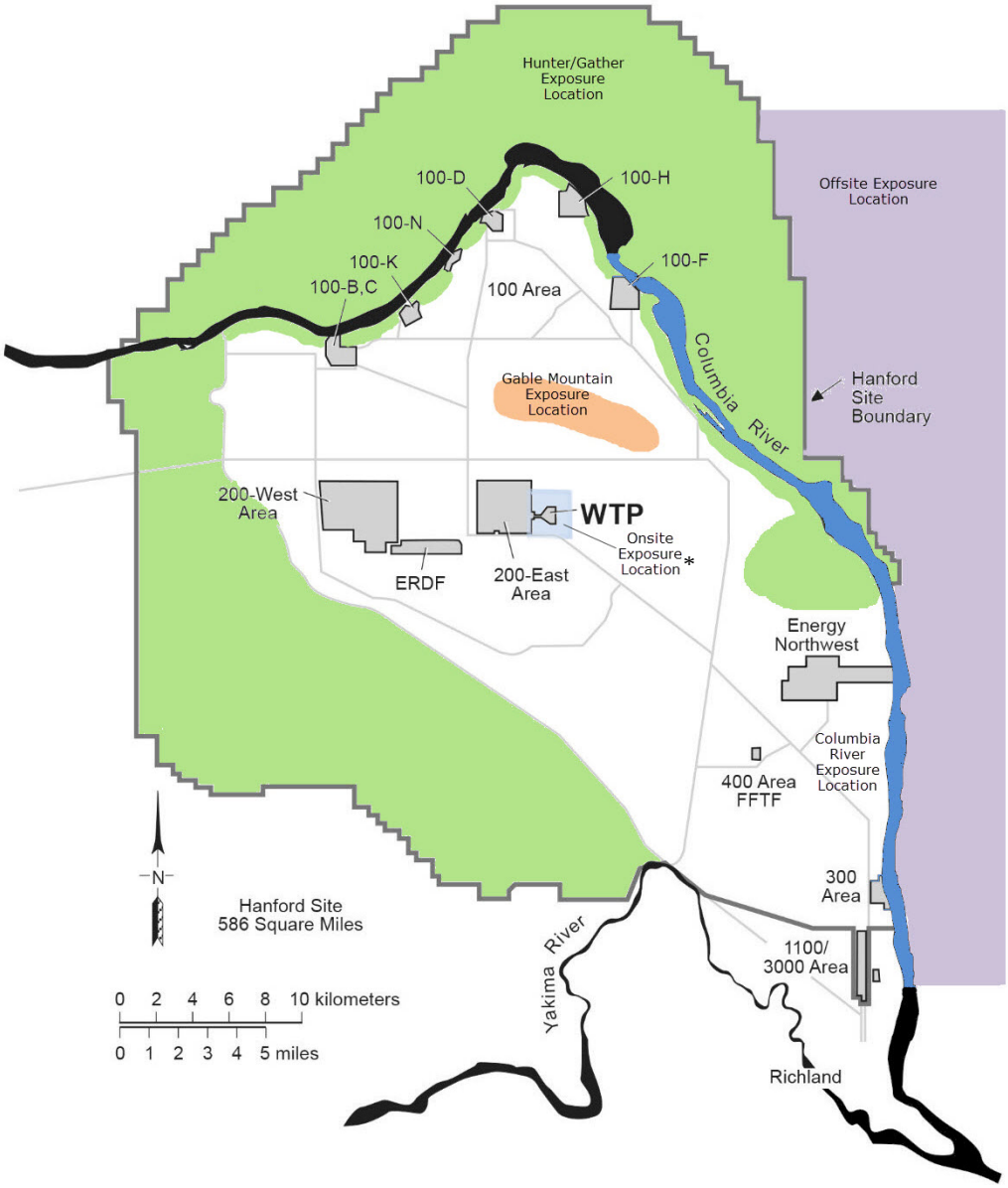
[6] The actual location of tribal ceremonial activities varies with the nature of the activity and is considered confidential. Gable Mountain is chosen as the location for ceremonial activities in the WTP risk assessment because it is a place of significance and is near WTP, making related exposures at this location conservative and bounding.

American Indian #1 was assumed to obtain fish, drinking water, and water for sweat lodge activities from the point of maximum concentration in the Columbia River. No credit is given for soil and air exposures away from home (e.g., while hunting, gathering, fishing, or for ceremonial and cultural activities outside of the assessment area), except for the time spent at ceremonial activities at Gable Mountain. The adult exposures in the current timeframe are assessed over a 70-year duration that spans the operational period of WTP (i.e., 10 years for the DFLAW configuration, 40 years for the baseline WTP configuration) and years following its shutdown. Child exposures are assessed through age 6. Future timeframe exposures were assumed to occur immediately after plant shutdown.

The American Indian #2 was assumed to live a traditional subsistence lifestyle, based on consumption of homegrown produce and livestock, in addition to seasonal hunting, plant gathering, and fishing. This receptor was assumed to live, work, and play at a single location continuously (i.e., was assumed to be at home 24 hours per day, 365 days per year). It was assumed that the resident's home is located within the offsite grid. The American Indian #2 (adult and child) was assumed to be exposed through inhalation of emissions, ingestion of soil, inhalation of resuspended soil, and ingestion of drinking water. This receptor's diet includes domestic produce and livestock, supplemented with wild produce, game, and fish, and inhalation and dermal adsorption during sweat lodge activities. To fully bound the estimated risk, it was assumed that all domestic produce and livestock is homegrown, and that all wild produce and game is taken from the hunter/gatherer area. The American Indian #2 was assumed to obtain fish, drinking water, and water for sweat lodge activities from the point of maximum concentration in the Columbia River. No credit is given for soil and air exposures away from home (e.g., while hunting, gathering, fishing, or for ceremonial and cultural activities away from home). The exposure timing of this scenario is the same as the American Indian #1.

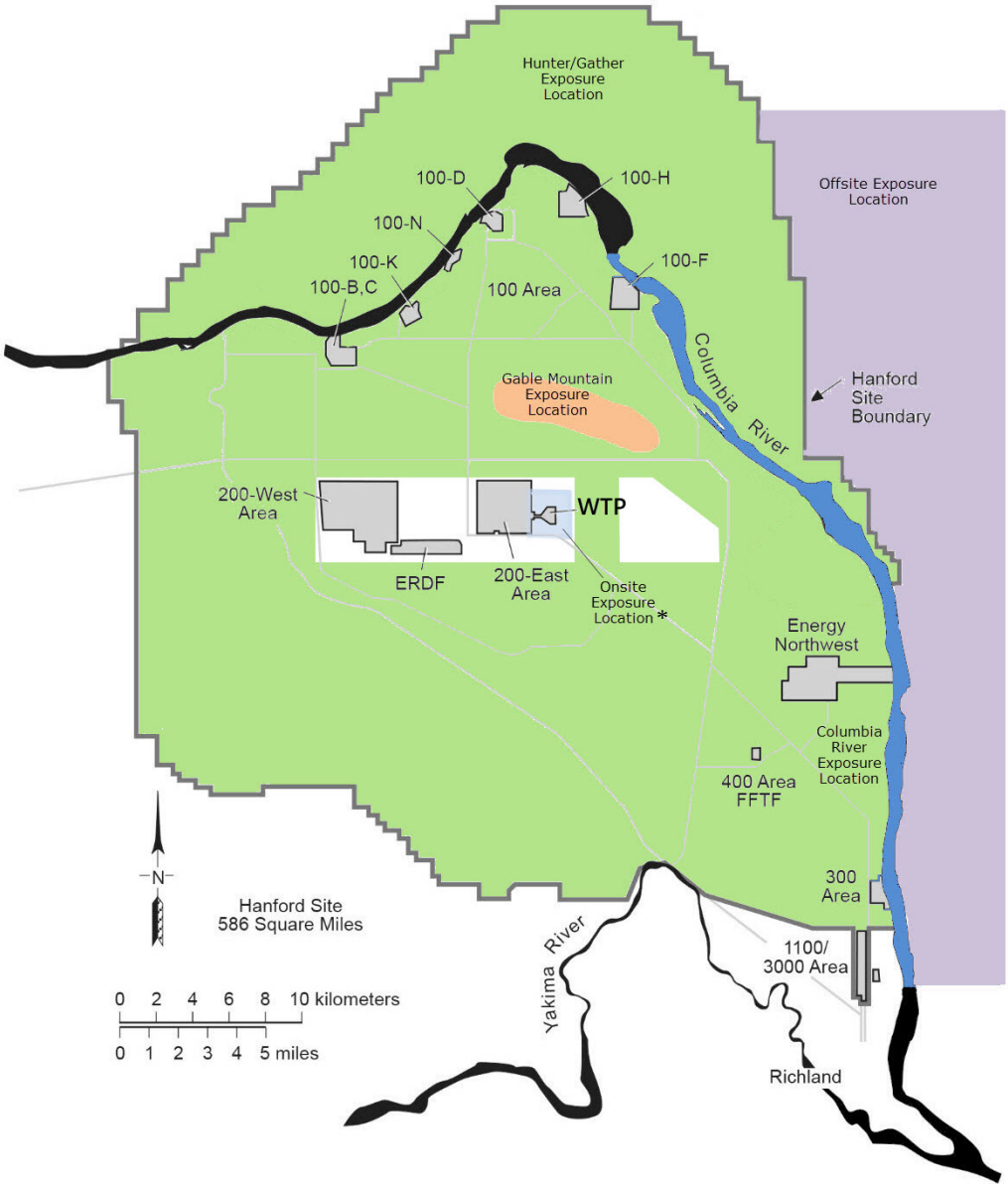
Figure D-2 shows the offsite, Gable Mountain, Columbia River, and hunter/gatherer area. Figure D-3 depicts these same locations in the future timeframe, when the hunting/gathering area is expanded to include portions of the Hanford site interior.

Figure D-2 Offsite, Gable Mountain, Columbia River, and Hunter/Gatherer Area (current timeframe)



* Onsite exposure location does not apply to American Indian exposure scenarios and is shown for information only.

Figure D-3 Offsite, Gable Mountain, Columbia River, and Hunter/Gatherer Area (future timeframe)



* Onsite exposure location does not apply to American Indian exposure scenarios and is shown for information only.

Table D-14 summarizes the parameters for the two American Indian scenarios. Differences can be noted in several parameters.

Table D-14 American Indian Scenario Exposure Parameter Differences

Description	Units	Adult Scenario		Child Scenario	
		#1	#2	#1	#2
Exposure frequency during tribal ceremonies	days/yr	12	-	12	-
Exposure time for sweat lodge	hr/day	1	7	1	0.71
Body weight	kg	70	70	15	16
Inhalation rate	m^3/hr	1.04	1.08	0.625	0.67
Ingestion rate for soil	kg/day	0.0004	0.0002	0.0004	0.0004
Ingestion rate for drinking water	L/day	4	4	2	2
Consumption rate: aboveground wild produce	kg/(kg·day FW)	0.0048	0.0069	0.016	0.0067
Consumption rate: aboveground domestic produce	kg/(kg·day FW)	-	0.0072	-	0.0070
Consumption rate: belowground produce	kg/(kg·day FW)	0.0063	0.0062	0.021	0.0060
Consumption rate: protected produce	kg/(kg·day FW)	-	-	-	-
Consumption rate: wild fowl	kg/(kg·day FW)	0.00089	0.0013	0.0029	0.0017
Consumption rate: domestic chicken	kg/(kg·day FW)	-	0.0020	-	0.0026
Consumption rate: wild game	kg/(kg·day FW)	0.0016	0.0027	0.0050	0.0036
Consumption rate: game organs	kg/(kg·day FW)	0.00018	-	0.00056	-
Consumption rate: beef	kg/(kg·day FW)	-	0.0040	-	0.0053
Consumption rate: eggs	kg/(kg·day FW)	-	-	-	-
Consumption rate: fish	kg/(kg·day FW)	0.0080	0.0074	0.025	0.023
Consumption rate: fish organs	kg/(kg·day FW)	0.00089	-	0.0027	-
Consumption rate: milk	kg/(kg·day FW)	-	0.017	-	0.031
Outdoor exposure time factor for radionuclides in soil	unitless	0.5	0.29	0.5	0.29
Indoor exposure time factor for radionuclides in soil	unitless	0.5	0.71	0.5	0.71
Dermal surface area	m^2	1.8	1.8	0.76	0.76
Volume of water used in sweat lodge	L	4	4	4	4
Diameter of sweat lodge	m	2	2	2	2
Temperature of sweat lodge	deg., F	150	150	150	150

Scenario parameters are from RAWP Tables 7-7 and 7-8.
"-" indicates the related exposure pathway is not applicable for the receptor shown.

The nursing infant of the subsistence tribal resident is the infant of the adult American Indians described above. The nursing infant was assumed to be exposed to PCDDs/PCDFs, coplanar PCBs, and four radionuclides through ingestion of breast milk from the adult American Indian exposed through inhalation of emissions, ingestion of soil, inhalation of resuspended soil, ingestion of drinking water, and ingestion of traditional foods. It was assumed that the mother does not participate in sweat lodge activities during the lactation period and was therefore not exposed to pathways associated with the sweat lodge. The nursing infant was assumed to reside with the parent described above within the Hanford offsite location. Table D-15 shows the exposure parameters for the two scenarios.

Table D-15 American Indian Nursing Infant Exposure Parameters

Description	Units	Value
Infant exposure duration	yrs	2
Maternal exposure duration	yrs	25
Ingestion rate: breast milk	L/day	0.742
Infant body weight	kg	9.2
Averaging time for carcinogens	yrs	2

Scenario parameters are from RAWP Tables 7-7 and 7-8.

In addition to a comparison to background exposures, the TCDD TEQs were computed for the PCDD/PCDF and coplanar PCBs. The TEQs were assessed for cancer effects multiplying the TEQ by the slope factor of TCDD. Radionuclides (strontium-90, iodine-129, cesium-134, and cesium-137) are also included in the cancer assessment for breast milk consumption.

D.4.1 DFLAW Operating Configuration

The DFLAW configuration includes characterization of chronic total risk, and the characterization of risk due to risk drivers and mutagens, and characterization of risk to the nursing infant.

D.4.1.1 Chronic Total Risk

Table D-16 summarizes the incremental lifetime cancer risk for adult and child exposures for the two American Indian scenarios. The results for the two scenarios are within about a factor of seven of each other and are all below the cancer risk health threshold of 1.0E-05. Table D-17 shows the noncancer risk results for the adult and child scenarios. They are within about a factor of three of each other and are all below the hazard index health threshold of 0.25.

Additional results for chronic total risk, by exposure pathway, are presented in Appendix C.

Table D-16 American Indian Total Incremental Lifetime Cancer Risk for the Exposure Scenarios for the DFLAW Operating Configuration

Timeframe	COPC Type	American Indian #1		American Indian #2	
		Adult	Child	Adult	Child
Current	Chemicals	3.6E-07	2.7E-07	2.7E-06	3.8E-07
Current	Radionuclides	2.6E-07	1.0E-07	3.1E-07	5.3E-08
Future	Chemicals	7.6E-09	3.6E-09	2.4E-08	3.5E-09
Future	Radionuclides	1.6E-08	1.3E-09	9.8E-08	3.3E-09

Incremental lifetime cancer risk health threshold value is 1.0E-5.

Table D-17 American Indian Total Hazard Index for the Exposure Scenarios for the DFLAW Operating Configuration

Timeframe	COPC Type	American Indian #1		American Indian #2	
		Adult	Child	Adult	Child
Current	Chemicals	3.6E-03	1.0E-02	3.3E-03	5.9E-03
Future	Chemicals	4.9E-04	1.6E-03	1.4E-03	1.4E-03

Hazard index health threshold is 2.5E-01.

D.4.1.2 Summary of Risk Driver

As with the other receptors, no inorganics presented a cancer risk or *HQ* (or *HI*) that would cause them to be considered risk drivers for human receptors. Likewise, no radionuclides presented a corresponding cancer risk that would cause them to be considered risk drivers for human receptors. No risk drivers were identified for exposures in the future timeframe. However, dibenz[a,h]anthracene was determined to be a risk driver for the American Indian #2 adult. The cancer risks for dibenz[a,h]anthracene for the American Indian #1 adult and child and the resident subsistence American Indian #2 child were not sufficiently close to the threshold to qualify as a risk driver. The COPC-specific cancer risk for dibenz[a,h]anthracene, the only human health risk driver identified for current resident subsistence American Indian #2 adult, is 1.6E-06. This is below the cancer risk health threshold of 1.0E-05.

The cancer risk of dibenz[a,h]anthracene for all receptors is presented in Appendix C, along with its proportion of the cancer risks for total organics.

D.4.1.3 Mutagens

The COPCs benzo(a)pyrene, dibenz[a,h]anthracene, and carbon-14 had cancer risk values in excess of 1.0E-07. The dibenz[a,h]anthracene cancer risk was only in excess of 1.0E-07 for the resident subsistence American Indian adult, scenario #2. After applying and re-computing their cancer risk values with age-dependent adjustment factors (*ADAF*), all COPCs still had cancer risk values well below (i.e., two orders of magnitude) the threshold of 1.0E-05. Table D-18 shows the cancer risk value and associated exposure pathway of greatest risk contribution for the COPC indicated using an *ADAF*. The total cancer risk for all exposure pathways is also shown for the COPC with the *ADAF* applied. In no cases was the overall cancer risk threshold of 1.0E-05 exceeded.

Table D-18 American Indian Mutagenic COPCs with Incremental Lifetime Cancer Risk in Excess of 1-in-10,000,000 for the DFLAW Operating Configuration

Receptor	Time-frame	CASRN	COPC	Dominant Exposure Pathway	ILCR for Dominant Pathway with ADAF	ILCR All Pathways with ADAF
American Indian #1 Adult	Current	50-32-8	Benzo(a)pyrene	Fish Ingestion	3.5E-07	4.4E-07
		14762-75-5	Carbon-14	Fish Ingestion	1.7E-07	2.3E-07

Table D-18 American Indian Mutagenic COPCs with Incremental Lifetime Cancer Risk in Excess of 1-in-10,000,000 for the DFLAW Operating Configuration

Receptor	Time-frame	CASRN	COPC	Dominant Exposure Pathway	ILCR for Dominant Pathway with ADAF	ILCR All Pathways with ADAF
American Indian #2 Adult	Current	50-32-8	Benzo(a)pyrene	Beef Ingestion	6.1E-07	8.6E-07
		53-70-3	Dibenz[a,h]-anthracene	Beef Ingestion	2.5E-07	2.9E-07
		14762-75-5	Carbon-14	Beef Ingestion	1.2E-07	2.9E-07

Incremental lifetime cancer risk (ILCR) health threshold value is 1.0E-5.

D.4.1.4 Nursing Infant

Table D-19 shows that the two Indian nursing infant scenarios have average daily doses (ADD_{inf}) less than the background dose of 60 pg/kg·day of PCDD/PCDF and 33 pg/kg·day of coplanar, dioxin-like PCBs. The sums are less than the background dose of 93 pg/kg·day. The cancer risks were also below the health threshold of 1.0E-05. Table D-20 shows the radionuclide cancer risks are also below 1.0E-05.

Table D-19 American Indian Dioxins/Furans and Coplanar PCB Incremental Lifetime Cancer Risks for the Nursing Infant for the DFLAW Operating Configuration

Total Dioxins/Furans (TCDD TEQ)				
	American Indian #1		American Indian #2	
Timeframe	Average Daily Dose (pg/kg·day)	Incremental Lifetime Cancer Risk	Average Daily Dose (pg/kg·day)	Incremental Lifetime Cancer Risk
Current	4.5E-05	5.9E-09	2.7E-04	3.5E-08
Future	2.5E-06	3.3E-10	3.9E-06	5.0E-10
Total Coplanar PCBs (as TCDD TEQ)				
	American Indian #1		American Indian #2	
Timeframe	Average Daily Dose (pg/kg·day)	Incremental Lifetime Cancer Risk	Average Daily Dose (pg/kg·day)	Incremental Lifetime Cancer Risk
Current	1.4E-02	1.8E-06	5.0E-02	6.5E-06
Future	4.3E-06	5.6E-10	4.3E-05	5.6E-09

Table D-19 American Indian Dioxins/Furans and Coplanar PCB Incremental Lifetime Cancer Risks for the Nursing Infant for the DFLAW Operating Configuration

Sum of Total Dioxins/Furans and Coplanar PCBs (as TCDD TEQ)				
	American Indian#1		American Indian #2	
Timeframe	Average Daily Dose (pg/kg·day)	Incremental Lifetime Cancer Risk	Average Daily Dose (pg/kg·day)	Incremental Lifetime Cancer Risk
Current	1.4E-02	1.8E-06	5.0E-02	6.5E-06
Future	6.9E-06	8.9E-10	4.7E-05	6.1E-09

Incremental lifetime cancer risk health threshold value is 1.0E-5.

Table D-20 American Nursing Infant Total Incremental Lifetime Cancer Risks for Radionuclides for the DFLAW Operating Configuration

	American Indian #1		American Indian #2	
Timeframe	Average Daily Dose (pCi/kg·day)	Incremental Lifetime Cancer Risk	Average Daily Dose (pCi/kg·day)	Incremental Lifetime Cancer Risk
Current	8.1E+02	2.6E-07	2.1E+03	6.8E-07
Future	1.2E+03	3.8E-07	2.9E+03	9.3E-07

Incremental lifetime cancer risk health threshold value is 1.0E-5.

D.4.2 Baseline WTP Operating Configuration

The baseline WTP configuration includes characterization of chronic total risk, and the characterization of risk due to risk drivers and mutagens, and characterization of risk to the nursing infant.

D.4.2.1 Chronic Total Risk

Table D-21 summarizes the cancer risks for adult and child exposures for the two American Indian scenarios. The results for the scenarios are within an order of magnitude of each other and are all below 1.0E-05. Table D-22 shows the noncancer risk results for the adult and child scenarios. They are within an order of magnitude of each other and are all below the health threshold of 0.25.

Table D-21 Total Incremental Lifetime Cancer Risk for the American Indian Exposure Scenarios for the Baseline WTP Operating Configuration

		American Indian #1		American Indian #2	
Timeframe	COPC Type	Adult	Child	Adult	Child
Current	Chemicals	2.1E-06	9.2E-07	5.1E-06	8.3E-07
Current	Radionuclides	6.2E-07	6.2E-08	6.3E-07	3.8E-08
Future	Chemicals	4.2E-08	2.5E-08	2.9E-07	4.1E-08
Future	Radionuclides	5.5E-08	4.2E-09	2.7E-07	8.9E-09

Incremental lifetime cancer risk health threshold value is 1.0E-5.

Table D-22 Total Hazard Index for the American Indian Exposure Scenarios for the Baseline WTP Operating Configuration

Timeframe	COPC Type	American Indian #1		American Indian #2	
		Adult	Child	Adult	Child
Current	Chemicals	5.0E-02	1.5E-01	3.6E-02	8.0E-02
Future	Chemicals	2.6E-03	8.6E-03	7.8E-03	7.7E-03

Hazard index health threshold is 2.5E-01.

D.4.2.2 Summary of Risk Driver

As with the other receptors, no inorganics presented a cancer risk or *HQ* (or *HI*) that would cause them to be considered risk drivers for human receptors. Likewise, no radionuclides presented a corresponding cancer risk that would cause them to be considered risk drivers for human receptors. No risk drivers were identified for exposures in the future timeframe. Only total PCBs were identified as a noncancer risk driver, associated with chronic exposure in the current timeframe for both resident subsistence American Indian scenarios, adults and children (Table D-23). However, total PCBs were identified as a cancer risk driver for the adult resident subsistence American Indian, scenario #1 with a corresponding cancer risk of 1.1E-06. Dibenz[a,h]anthracene was a cancer risk driver for the adult resident subsistence American Indian, scenario #2 with a corresponding cancer risk of 1.2E-06. For the resident subsistence American Indian, scenario #2, PCBs were not sufficiently close to the threshold to qualify as a risk driver, while for the resident subsistence American Indian, scenario #1, dibenz[a,h]anthracene was not sufficiently close to the threshold to qualify as a risk driver.

Table D-23 HHRA HQ for Total PCBs for the Baseline WTP Operating Configuration

Receptor	COPC-specific HQ
Resident Subsistence American Indian Adult (scenario #1)	4.8E-02
Resident Subsistence American Indian Child (scenario #1)	1.5E-01
Resident Subsistence American Indian Adult (scenario #2)	2.9E-02
Resident Subsistence American Indian Child (scenario #2)	7.4E-02

HI value shown is summed across all applicable exposure pathways.

The *HI* and *ILCR* of the COPCs above are presented for all receptors in Appendix C, along with its proportion of the risk due to total organics.

D.4.2.3 Mutagens

The COPCs benzo(a)pyrene, dibenz[a,h]anthracene, 3-methylcholanthrene, and carbon-14 had cancer risk values in excess of 1.0E-07. After applying and re-computing their cancer risk values with *ADAF*s, all COPCs still had cancer risk values well below (i.e., two orders of magnitude) the no-impact threshold of 1.0E-05. Table D-24 shows the cancer risk values and associated exposure pathway of greatest risk contribution for the COPC indicated using an *ADAF*. The total cancer risks for all exposure pathways are also shown for the COPC with the *ADAF* applied. In no cases was the overall cancer threshold of 1E-05 exceeded.

Table D-24 American Mutagenic COPCs with Incremental Lifetime Cancer Risk in Excess of 1-in-10,000,000 for the Baseline WTP Operating Configuration

Receptor	Time-frame	CASRN	COPC	Dominant Exposure Pathway	ILCR for Dominant Pathway with ADAF	ILCR All Pathways with ADAF
American Indian #1 Adult	Current	50-32-8	Benzo(a)pyrene	Fish Ingestion	4.6E-07	5.5E-07
		56-49-5	3-Methyl-cholanthrene	Game Ingestion	1.5E-07	2.6E-07
		14762-75-5	Carbon-14	Fish Ingestion	4.8E-07	5.8E-07
American Indian #2 Adult	Current	53-70-3	Dibenz[a,h]-anthracene	Beef Ingestion	1.9E-07	2.2E-07
		50-32-8	Benzo(a)pyrene	Beef Ingestion	5.8E-07	8.7E-07
		56-49-5	3-Methyl-cholanthrene	Game Ingestion	7.9E-08	1.8E-07
		14762-75-5	Carbon-14	Fish Ingestion	2.1E-07	5.6E-07
	Future	14762-75-5	Carbon-14	Beef Ingestion	1.9E-07	2.0E-07

Incremental lifetime cancer risk (ILCR) health threshold value is 1.0E-5.

D.4.2.4 Nursing Infant

Table D-23 shows that the two American Indian nursing infant scenarios have average daily doses that are less than the background dose of 60 pg/kg·day of PCDD/PCDF and 33 pg/kg·day of coplanar PCBs. The sums are less than the background dose of 93 pg/ kg·day. The cancer risks were also below the health threshold of 1.0E-05. Table D-24 shows that the radionuclide cancer risks are also below 1.0E-05.

Table D-25 American Indian Dioxin/Furans and Coplanar PCB Incremental Lifetime Cancer Risks for the Nursing Infant for the Baseline WTP Operating Configuration

Total Dioxins/Furans (TCDD TEQ)				
	American Indian #1		American Indian #2	
Timeframe	Average Daily Dose (pg/kg·day)	Incremental Lifetime Cancer Risk	Average Daily Dose (pg/kg·day)	Incremental Lifetime Cancer Risk
Current	6.5E-05	8.4E-09	3.6E-04	4.7E-08
Future	6.0E-06	7.8E-10	9.2E-06	1.2E-09
Total Coplanar PCBs (as TCDD TEQ)				
	American Indian #1		American Indian #2	
Timeframe	Average Daily Dose (pg/kg·day)	Incremental Lifetime Cancer Risk	Average Daily Dose (pg/kg·day)	Incremental Lifetime Cancer Risk
Current	1.3E-02	1.7E-06	4.6E-02	5.9E-06
Future	5.6E-06	7.3E-10	5.0E-05	6.5E-09

Table D-25 American Indian Dioxin/Furans and Coplanar PCB Incremental Lifetime Cancer Risks for the Nursing Infant for the Baseline WTP Operating Configuration

Sum of Total Dioxins/Furans and Coplanar PCBs (as TCDD TEQ)				
	American Indian#1		American Indian #2	
Timeframe	Average Daily Dose (pg/kg·day)	Incremental Lifetime Cancer Risk	Average Daily Dose (pg/kg·day)	Incremental Lifetime Cancer Risk
Current	1.3E-02	1.7E-06	4.6E-02	6.0E-06
Future	1.2E-05	1.5E-09	5.9E-05	7.7E-09

Incremental lifetime cancer risk health threshold value is 1.0E-5.

Table D-26 American Indian Nursing Infant Total Incremental Lifetime Cancer Risks for Radionuclides for the Baseline WTP Operating Configuration

	American Indian #1		American Indian #2	
Timeframe	Average Daily Dose (pCi/kg·day)	Incremental Lifetime Cancer Risk	Average Daily Dose (pCi/kg·day)	Incremental Lifetime Cancer Risk
Current	5.6E+03	1.7E-06	1.5E+04	4.5E-06
Future	9.5E+03	2.9E-06	2.3E+04	7.2E-06

Incremental lifetime cancer risk health threshold value is 1.0E-5.

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