BHI-01592
Rev. 0

Remedial Investigation Data Quality Objectives Summary Report for the 200-MW-1 Operable Unit

Prepared for the U.S. Department of Energy, Richland Operations Office
Office of Environmental Restoration

Submitted by: Bechtel Hanford, Inc.

BHI-01592
Rev. 0
OU: 200-MW-1
TSD: N/A
ERA: N/A

APPROVAL PAGE

Title: Remedial Investigation Data Quality Objectives Summary Report for the 200-MW-1 Operable Unit

Approval: L. R. Curry, Groundwater/Vadose Zone Integration Project Engineer

L. R. Curry 4/30/02

Signature Date

B. H. Ford, Groundwater/Vadose Zone Integration Project, 200 Area Assessment Task Lead

4/30/02

Signature Date

L. M. Dittmer, Groundwater/Vadose Zone Integration Project Environmental Lead

Lorna M Dittmer 4/30/02

Signature Date

BHI-DIS dmc 4/30/2002

The approval signatures on this page indicate that this document has been authorized for information release to the public through appropriate channels. No other forms or signatures are required to document this information release.

BHI-01592
Rev. 0

Remedial Investigation Data Quality Objectives Summary Report for the 200-MW-1 Operable Unit

Author

M. J. Galgoul
CH2MHILL Hanford, Inc.

Date Published

April 2002

EXECUTIVE SUMMARY

This data quality objective (DQO) summary report supports site characterization decisions for remedial investigation (RI) at representative waste sites in the 200-MW-1 Miscellaneous Waste Group Operable Unit (OU). The 200-MW-1 OU consists of *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* past-practice waste sites (consisting mostly of french drains, cribs, and trenches). The OU designation and waste site assignments are defined in the *200 Areas Remedial Investigation/Feasibility Study Implementation Plan – Environmental Restoration Program* (hereinafter referred to as the Implementation Plan [DOE-RL 1999]). The waste streams discharged to sites within 200-MW-1 OU are the most varied in terms of waste stream sources but are generally characterized by low volumes and low levels of contamination. An indicator of the low volume is that many of the waste streams were disposed at french drain sites. Data collected during the RI will be used to determine if the waste sites are contaminated above levels that will require remedial action, to support evaluation of remedial alternatives, and to verify or refine the conceptual contaminant distribution models.

This DQO effort follows the concepts developed in the Implementation Plan (DOE-RL 1999) for using analogous site contaminant data to reduce the amount of characterization required to support RI/feasibility study (FS) decisions. These concepts involve grouping sites with similar process histories, structures, and contaminants and then choosing one or more representative waste site(s) for comprehensive field investigation, including sampling of environmental media during RI activities. Findings from the RI at representative waste sites are then used to make remedial action decisions for all of the waste sites in the OU. Analogous sites for which field data have not been (or will not be) collected are assumed to have soil contamination characteristics similar to the representative waste sites that are characterized. A Record of Decision for the OU will be obtained through the RI/FS process using the data collected during the RI. The analogous sites (i.e., those not sampled during the RI) will be addressed during the confirmatory sampling phase to ensure that the remedial action specified in the Record of Decision is appropriate and to provide design data as needed. Following remedial actions, verification samples will be collected to support site closeout.

For the 200-MW-1 OU, five representative waste sites have been identified. The goals of the RI are to provide the data needed to support remedial decisions and to refine the preliminary conceptual contaminant distribution and exposure models for these OUs. The data will be generated mainly through soil sampling and analysis.

Washington State Department of Ecology Toxics Cleanup Program Guidance on Sampling and Data Analysis Methods (Ecology 1995) was used to develop the sampling design for the RI. Because the data will not be used to demonstrate compliance with a cleanup level, focused (biased) soil sampling of areas selected with the highest contamination potential was selected over an area-wide (unbiased) sample design. The concentrations of all contaminants in each soil sample will be compared directly with the cleanup levels. A statistical analysis of the sampling data is not appropriate for focused sampling schemes and, therefore, is not used in this report. The locations of samples exceeding the cleanup level will be used to delineate the areas of soil contamination requiring a decision regarding the need for remediation.

The proposed sampling strategy was to intersect the areas of highest contamination and determining the vertical extent of contamination. The nature (e.g., contaminant type and concentration) and the vertical extent of the contamination are the major RI data needs. Either boreholes or test pits will be used at each representative site, and soil samples will be collected at discrete intervals, as appropriate. Geophysical logging of planned boreholes will also be performed.

The contaminants of potential concern were identified based upon process history information for the representative waste sites and from review of previous data collection efforts. Analytical performance criteria were based on *Model Toxics Control Act* chemical compliance criteria (*Washington Administrative Code* 173-340) and other applicable or relevant and appropriate requirements. In the absence of applicable or relevant and appropriate requirements, other preliminary action levels were identified to determine analytical performance criteria. These levels provide the basis for identifying the laboratory or field screening detection limits required to support remedial action decisions. A modified version of the U.S. Environmental Protection

Agency's DQO guidance (EPA 1994) was used to identify project data quality needs, evaluate sampling and analysis options, and document project data quality decisions.

TABLE OF CONTENTS

APPENDICES

FIGURES

TABLES

ACRONYMS

AA	alternative action
AEA	alpha energy analysis
ANN	aluminum nitrate nonahydrate
ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
BHI	Bechtel Hanford, Inc.
CAS	Chemical Abstract Services
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	*Code of Federal Regulations*
CHI	CH2M HILL Hanford, Inc.
CMS	corrective measures study
COC	contaminant of concern
COPC	contaminant of potential concern
CVAA	cold vapor atomic absorption
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
DQO	data quality objective
DR	decision rule
DS	decision statement
Ecology	Washington State Department of Ecology
EMI	electromagnetic imaging
EPA	U.S. Environmental Protection Agency
FS	feasibility study
GC	gas chromatograph
GCMS	gas chromatography/mass spectrometry
GEA	gamma energy analysis
GPC	gas proportional counter
GPR	ground-penetrating radar
HEIS	Hanford Environmental Information System
HEPA	high-efficiency particulate air
HPGe	high-purity germanium
HVAC	heating, ventilation, and air conditioning
IC	ion chromatography
ICP	inductively coupled plasma
ICPMS	inductively coupled plasma mass spectrometer
IDW	investigation-derived waste
MCL	maximum contamination level
MTCA	*Model Toxics Control Act*
NaI	sodium iodide
NPL	National Priorities List
O&M	operating and maintenance
OU	operable unit

Acronyms

PCB	polychlorinated biphenyl
PNL	Pacific Northwest Laboratory
PNNL	Pacific Northwest National Laboratory
PQL	practical quantitation limit
PRG	preliminary remediation goal
PSQ	principal study question
PUREX	plutonium-uranium extraction
QC	quality control
RAO	remedial action objective
RDR/RAWP	remedial design report/remedial action work plan
REDOX	reduction-oxidation
RESRAD	RESidual RADioactivity dose model
RFI	*Resource Conservation and Recovery Act of 1976* facility investigation
RI	remedial investigation
RL	U.S. Department of Energy, Richland Operations Office
ROD	Record of Decision
SAP	sampling and analysis plan
SGL	spectral gamma logging
SST	single-shell tank
STOMP	subsurface transport over multiple phases
SVOC	semi-volatile organic compound
TBP	tributyl phosphate
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
TRU (waste)	waste materials contaminated with 100 nCi/g of transuranic materials having half-lives longer than 20 years
UCL	upper confidence limit
UNH	uranyl nitrate hexahydrate
UO_3	uranium trioxide
UPR	unplanned release
URP	uranium recovery process
VOA	volatile organic analysis
WAC	*Washington Administrative Code*
WESF	Waste Encapsulation and Storage Facility
WHC	Westinghouse Hanford Company
WIDS	Waste Information Data System

METRIC CONVERSION CHART

Into Metric Units			Out of Metric Units		
If You Know	*Multiply By*	*To Get*	*If You Know*	*Multiply By*	*To Get*
Length			**Length**		
inches	25.4	millimeters	millimeters	0.039	inches
inches	2.54	centimeters	centimeters	0.394	inches
feet	0.305	meters	meters	3.281	feet
yards	0.914	meters	meters	1.094	yards
miles	1.609	kilometers	kilometers	0.621	miles
Area			**Area**		
sq. inches	6.452	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.093	sq. meters	sq. meters	10.76	sq. feet
sq. yards	0.0836	sq. meters	sq. meters	1.196	sq. yards
sq. miles	2.6	sq. kilometers	sq. kilometers	0.4	sq. miles
acres	0.405	hectares	hectares	2.47	acres
Mass (weight)			**Mass (weight)**		
ounces	28.35	grams	grams	0.035	ounces
pounds	0.454	kilograms	kilograms	2.205	pounds
ton	0.907	metric ton	metric ton	1.102	ton
Volume			**Volume**		
teaspoons	5	milliliters	milliliters	0.033	fluid ounces
tablespoons	15	milliliters	liters	2.1	pints
fluid ounces	30	milliliters	liters	1.057	quarts
cups	0.24	liters	liters	0.264	gallons
pints	0.47	liters	cubic meters	35.315	cubic feet
quarts	0.95	liters	cubic meters	1.308	cubic yards
gallons	3.8	liters			
cubic feet	0.028	cubic meters			
cubic yards	0.765	cubic meters			
Temperature			**Temperature**		
Fahrenheit	subtract 32, then multiply by 5/9	Celsius	Celsius	multiply by 9/5, then add 32	Fahrenheit
Radioactivity			**Radioactivity**		
picocuries	37	millibecquerel	millibecquerel	0.027	picocuries

1.0 STEP 1 – STATE THE PROBLEM

The purpose of data quality objective (DQO) Step 1 is to clearly and concisely state the problem to ensure that the focus of the study will be unambiguous.

1.1 INTRODUCTION

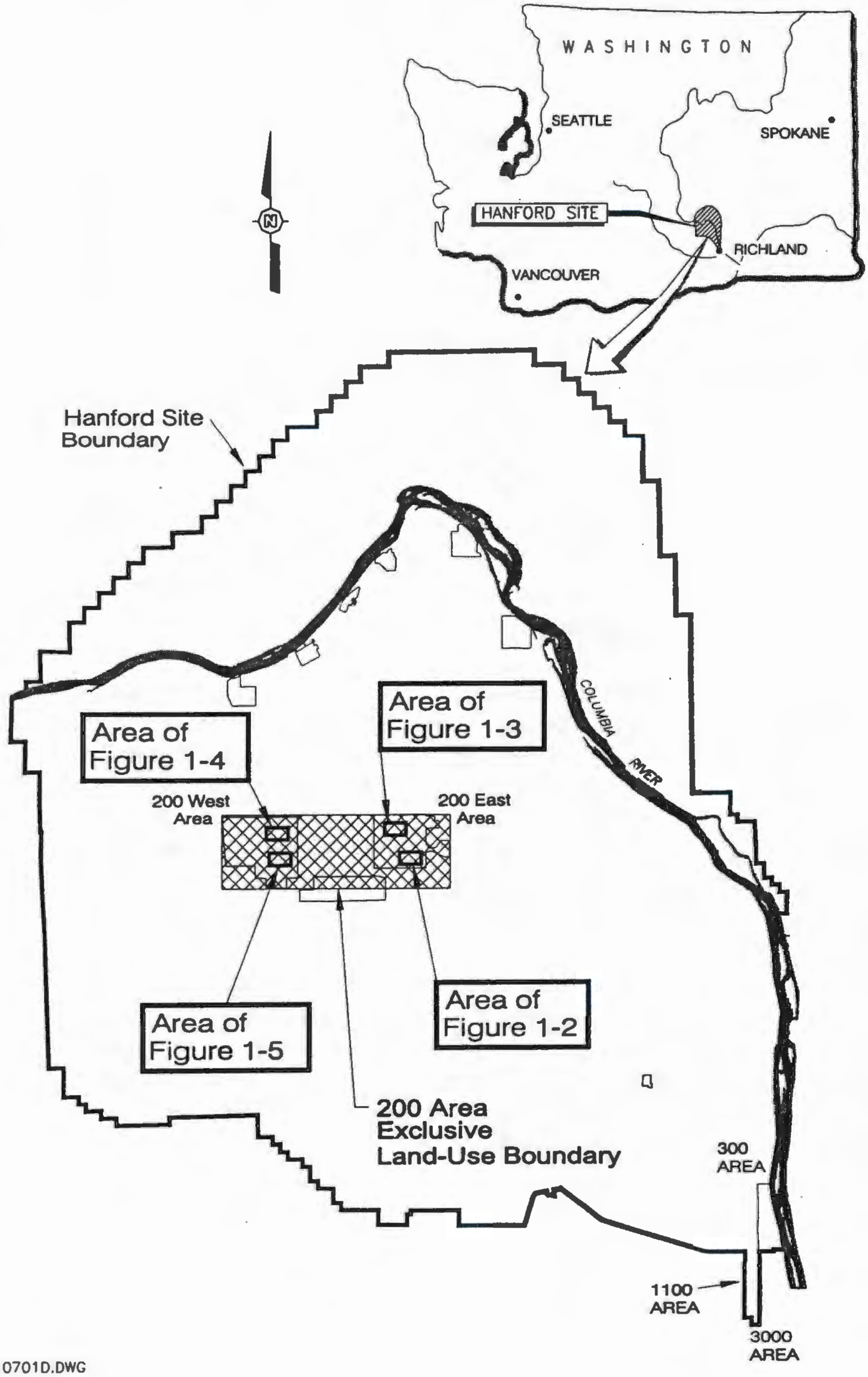
This summary report has been developed to support the remedial investigation/feasibility study (RI/FS) and remedial action decision-making processes for the 200-MW-1 Operable Unit (OU). The 200-MW-1 OU is being addressed under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA). Most of the 200-MW-1 OU waste sites consist of french drains, cribs and trenches, which generally received relatively low volumes of liquid waste. The waste disposed at the 200-MW-1 waste sites contained low concentrations of radionuclides and nonradiological constituents relative to process condensate and process waste sites. Three representative waste sites were originally identified for the 200-MW-1 OU in the *Waste Site Grouping for 200 Area Soil Investigations* report (DOE-RL 1997) and in the *200 Areas Remedial Investigation/Feasibility Study Implementation Plan – Environmental Restoration Program* (hereinafter referred to as the Implementation Plan [DOE-RL 1999]). Two additional representative waste sites have been added based upon the results of this DQO process. As defined in the waste site grouping report (DOE-RL 1997), the 200-MW-1 OU is the only OU in the miscellaneous waste category.

This DQO summary report focuses on the development of sampling designs for the representative (typical and worst-case) sites identified in the waste site grouping report (DOE-RL 1997), in the Implementation Plan (DOE-RL 1999), and as part of this DQO effort. The five representative waste sites chosen for the 200-MW-1 OU are discussed in Section 1.4.

A map of the Hanford Site is provided in Figure 1-1 and depicts the 200 Areas and the location of the 200-MW-1 OU. Figures 1-2 through 1-5 identify the locations of the 200-MW-1 OU waste sites addressed by this DQO effort, as well as associated source facilities in the vicinity.

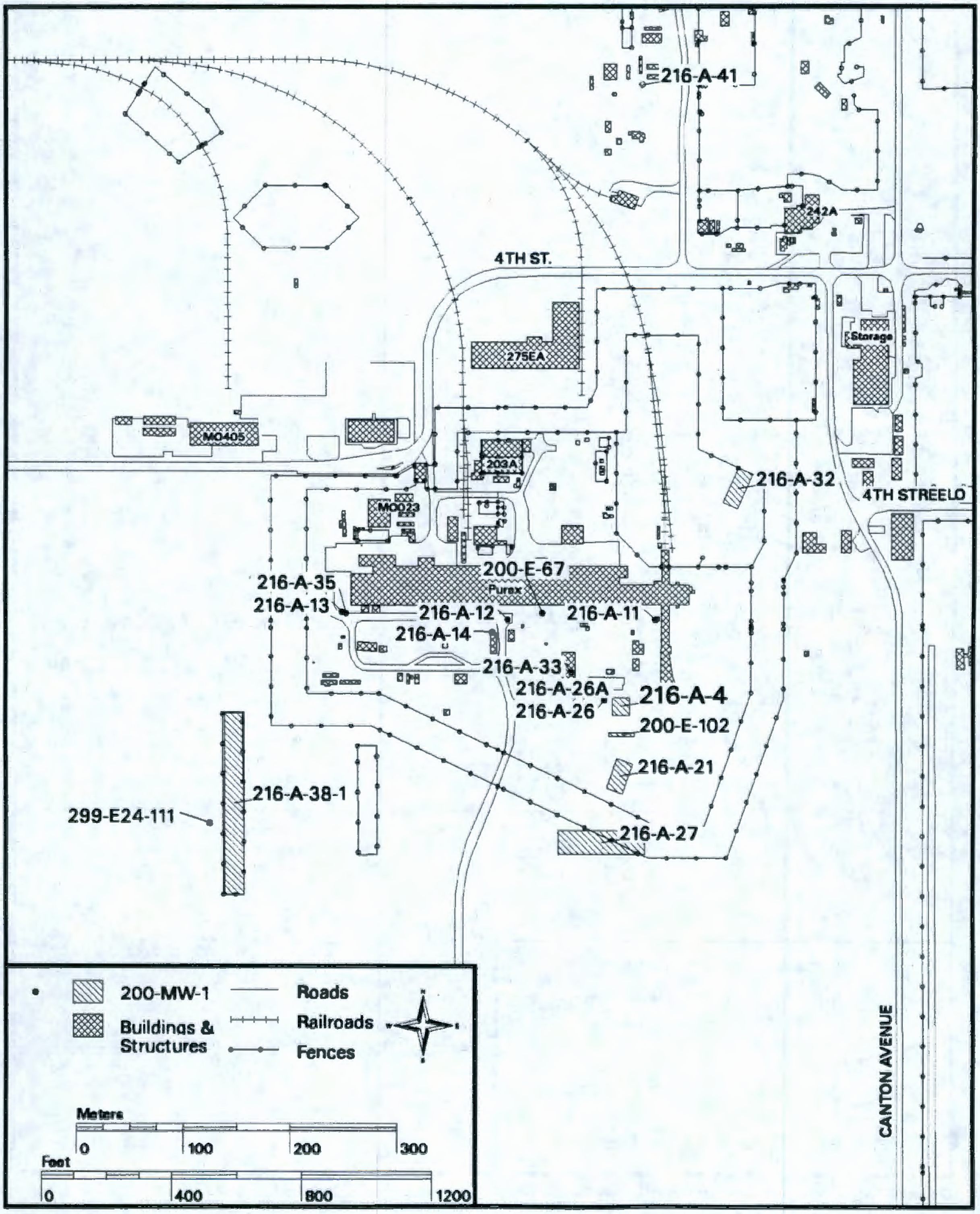
The Washington State Department of Ecology's (Ecology's) guidance document on sampling and data analysis methods (Ecology 1995) was used during this DQO process to support selection of an appropriate sampling approach. Table 1 of the Ecology guidance summarizes approaches for sampling and data analysis that are considered acceptable to Ecology. This guidance shows that a focused sampling approach may be used to investigate a known contamination site and that contaminated regions may be identified for sampling and analysis.

Figure 1-1. Location of the Hanford Site and 200-MW-1 Operable Unit Waste Sites.



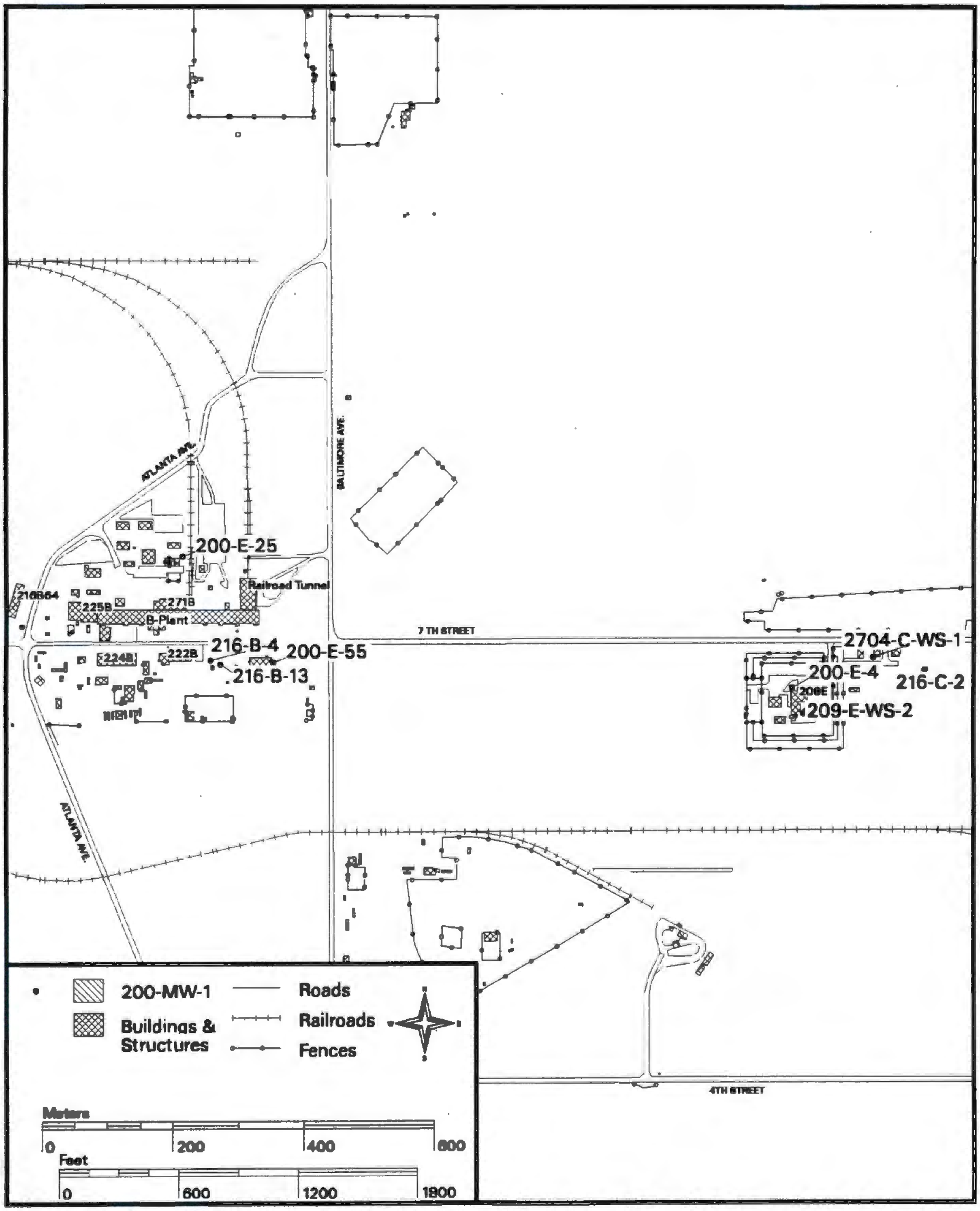
G:\Maps\110701D.DWG

Figure 1-2. Location of the 200-MW-1 Operable Unit Waste Sites in the 200 East Area.



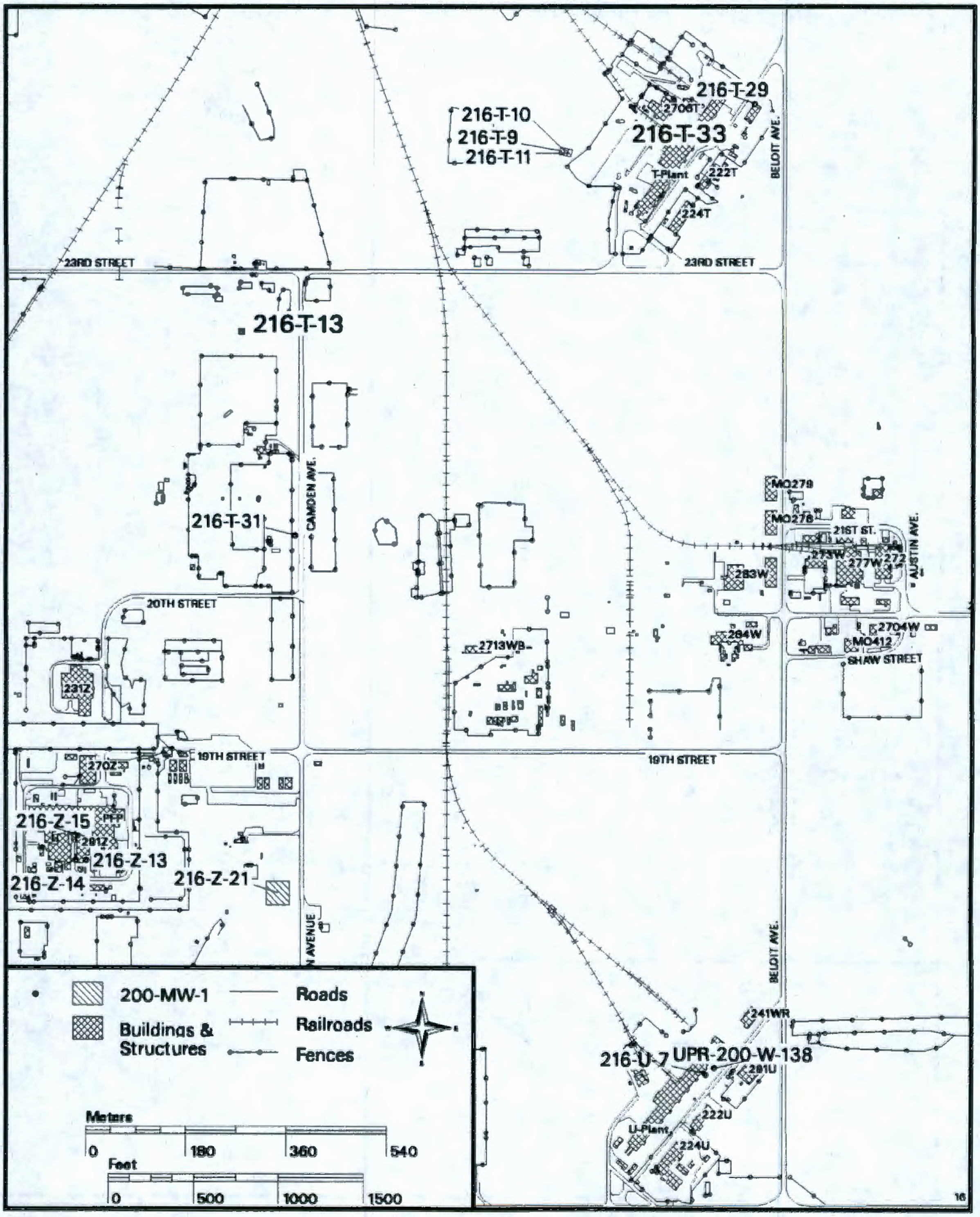
BHI:maa 10/29/01 /home/maa/amls/mw_easts1.aml Database: 05-DEC-2001

Figure 1-3. Location of the 200-MW-1 Operable Unit Waste Sites in the 200 East Area.



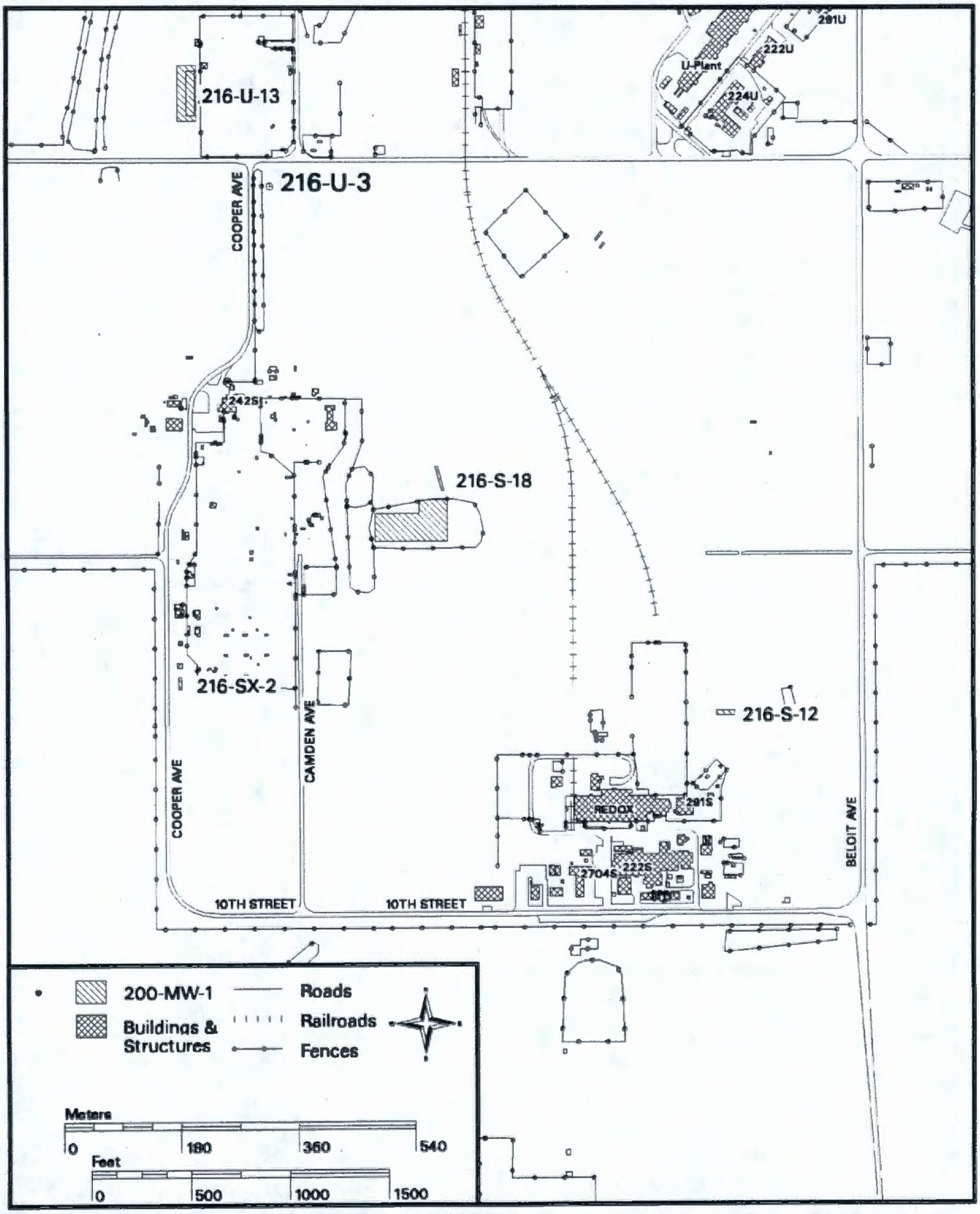
BHI:maa 10/29/01 /home/maa/amls/mw_easts2.aml Database: 26-NOV-2001

Figure 1-4. Location of the 200-MW-1 Operable Unit Waste Sites in the 200 West Area.



BHI:maa 10/29/01 /home/maa/amls/mw_wests1.aml Database: 05-DEC-2001

Figure 1-5. Location of the 200-MW-1 Operable Unit Waste Sites in the 200 West Area.



BHI:maa 10/29/01 /home/maa/amls/mw_wests2.aml Database: 05-DEC-2001

1.2 PROJECT SCOPE

This DQO summary report focuses on the representative waste sites associated with the 200-MW-1 Miscellaneous Waste Group OU. The scope of this project includes the DQO process and development of a sampling and analysis plan (SAP) for the representative waste sites. The DQO summary report and SAP will provide the basis for the RI/FS work plan, as well as the basis for RI of the 200-MW-1 OU waste sites (using the analogous site concept).

The Implementation Plan (DOE-RL 1999) presents a consistent approach to data collection activities associated with 200 Area assessment and remediation activities. The activities include all phases of sampling required to support completion of the CERCLA process, which is outlined in Section 2.3 and depicted in Figure 2-2 of the Implementation Plan. Specific activities include the following:

- Data collection at representative waste sites defined for the waste group-specific OU work plan emphasizing verification of the conceptual contaminant distribution model(s). This will support preparation of a risk evaluation, focused FS, and remedial action decision making.

- Data collection after issuance of the Record of Decision (ROD) to confirm that the analogous sites in the specific waste group OU are represented by the conceptual contaminant distribution model(s). In addition, data collection activities will be included as part of the remedy selected for the waste group. The site-specific information obtained from the data collection will be used to prepare the remedial design report/remedial action work plan (RDR/RAWP).

- Verification sampling will be performed to determine that remedial objectives have been met. For the Remove, Treat, and Dispose alternative, the RDR/RAWP will identify data collection requirements to verify that remedial action objectives (RAOs) have been met. For sites where wastes have been contained in place, an operating and maintenance (O&M) plan will be prepared to demonstrate adequacy of the remedial action. For example, an O&M plan would specify barrier performance monitoring activities.

This DQO process supports the collection of data that will be used to evaluate remedial alternatives and select a preferred alternative through the RI/FS process. Additional DQO processes will be conducted to define the sampling requirements for additional phases of data collection.

1.3 PROJECT OBJECTIVES

The objective of the DQO process for the 200-MW-1 Miscellaneous Waste Group OU is to determine the environmental measurements necessary to support the RI/FS process and remedial decision making, including refinement of the preliminary conceptual contaminant distribution model. Additionally, the DQO process supports development of a SAP for the RI, which will be included as an appendix to the RI/FS work plan for the OU.

Possible alternatives identified in the Implementation Plan (DOE-RL 1999) for the OUs in the miscellaneous waste category include the following:

- No-Action alternative (no institutional controls)
- Engineered multimedia barrier
- Excavation and disposal of waste
- In situ vitrification of soil
- In situ grouting or stabilization
- Monitored natural attenuation (with institutional controls).

1.4 PROJECT ASSUMPTIONS

Project assumptions for the RI include the following:

- The DQO process will be conducted in accordance with BHI-EE-01, *Environmental Investigations Procedures*, Procedure 1.2, "Data Quality Objectives," and Section 6.1 of the Implementation Plan (DOE-RL 1999).

- The 200-MW-1 OU waste group is a source waste group, and the investigations will focus on vadose zone soil contamination.

- The Implementation Plan (DOE-RL 1999) outlines the assessment and remediation approach to be followed for the OU:

  - Defines the regulatory framework

  - Generally identifies the characterization approach

  - Provides background information on 200 Area site conditions, operational history, and secondary plans (e.g., quality assurance, health and safety, information management, and waste management)

  - Provides governing assumptions, including preliminary applicable or relevant and appropriate requirements (ARARs), land-use considerations, RAOs, and remedial action alternatives.

- The analogous site approach will be used. Characterization will be limited to representative waste sites and the characterization data will be used to reach remedial decisions for all of the waste sites within the OU. The DQO effort will focus on representative waste sites within the OU. Preliminary representative waste sites were selected in the waste site grouping report (DOE-RL 1997), the Implementation Plan (DOE-RL 1999), and this DQO effort that were considered to be representative of typical and worst-case conditions for the OU. The rationale for review and selection of the representative waste sites is presented in Appendix A. The representative waste sites for the 200-MW-1 OU are as follows:

- 200-E-4 french drain
- 216-A-4 Crib
- 216-T-13 Crib
- 216-T-33 Trench
- 216-U-3 french drain.

Specific waste sites within the OU are listed in Appendix A of this summary report.

- Sampling to characterize the analogous waste sites is not included in the 200-MW-1 work plan scope.

- A review of the representative waste sites is a key component of the DQO process. The representative waste sites identified in the waste site grouping report (DOE-RL 1997) and the Implementation Plan (DOE-RL 1999) are revisited with the DQO scoping team members and key decision makers to ensure that appropriate sites are selected. The final selection of representative waste sites is considered flexible (i.e., different waste sites may be selected as representative waste sites, or additional representative waste sites may be added) and will consider critical data needs of other Groundwater/Vadose Zone core projects (e.g., the River Protection Project or the Science and Technology Project). Integration of characterization efforts will promote more efficient and cost-effective use of resources while still obtaining the necessary data to support the objectives for the 200-MW-1 OU as a whole. Active participation by other Groundwater/Vadose Zone core projects will be solicited to provide input to the DQO process.

- The potential for transuranic radionuclides at waste definition concentrations greater than 100 nCi/g may exist for sites in this OU.

- Existing characterization data from waste sites within the OU and analogous data (i.e., borehole logging results from boreholes near the waste sites) will be used to support the DQO process and to prepare the work plan. Based on historical uses of the waste sites and current contaminant of potential concern (COPC) information, it is expected that waste site contaminants of concern (COCs) will exceed action levels and that remediation will be required at most sites. However, it is possible that COC action levels will not be exceeded. In this instance, follow-up verification sampling during the confirmatory, design, and verification phases would be conducted to ensure that site closeouts without remediation are adequately supported. These activities would be conducted under separate DQO processes.

- The DQOs will be used to prepare a SAP to be included in the 200-MW-1 RI/FS work plan. The *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1998) Milestone M-13-00L requires the submittal of three National Priorities List (NPL) RI/FS *Resource Conservation and Recovery Act of 1976* facility investigation (RFI)/corrective measures study (CMS) work plans (Draft A versions) by December 31, 2001. The 200-MW-1 work plan will satisfy the requirement for one of these work plans, and the 200-LW-1 and 200-PW-1 OU work plans are assumed to satisfy the requirement for the two additional work plans.

- A preliminary conceptual contaminant distribution model for the 200-MW-1 waste group has been developed in waste site grouping report (DOE-RL 1997). This preliminary conceptual contaminant distribution model provides an initial prediction of the nature and extent of the primary COCs. Models for individual representative waste sites will be developed during preparation of the DQO summary report and the work plan.

- Remedial actions will likely be required at 200-MW-1 waste sites to achieve ARARs, *Model Toxics Control Act* (MTCA) (*Washington Administrative Code* [WAC] 173-340), including soil cleanup standards for nonradiological contaminants. The radiological dose limits will be determined in the future. For purposes of this DQO process, a dose limit range of 15 to 500 mrem/yr above natural background for radionuclides in soil under an industrial exposure scenario is assumed as a reasonable representation of an acceptable range of dose limits. In accordance with 10 *Code of Federal Regulations* (CFR) 20 and 10 CFR 835, the total effective dose equivalent for members of the public entering a controlled area is 100 mrem/yr. Because the waste sites in this OU are contained within the exclusive land-use boundary for the 200 Areas, an industrial land-use scenario is assumed.

- Potential data uses that need to be considered when developing DQOs include refining the preliminary conceptual contaminant distribution model; evaluating remedial action alternatives, remedial action decisions, and risk assessment; and maintaining worker health and safety.

- The collected data will be used to support the disposal of investigation-derived waste (IDW). The data collected to solve the problem statement will support the designation of the IDW. However, prior to the RI, a DQO effort will be conducted to support waste designation. Any additional sampling requirements needed for waste designation will be identified at that time and included in an approved waste control plan.

- Characteristic wastes will be evaluated based on total analytical results. Toxicity characteristic leaching procedures may be conducted if total results exceed the regulatory standards identified in WAC 173-303-090.

- Following a review of the process history associated with the 200-LW-1 (200-MW-1) waste sites and *Listed Waste History at Hanford Facility TSD Units* (Miskho 1996), listed waste contaminants associated with the process that discharged to these waste sites will be identified. An assessment of these contaminants as COPCs will then be made. If listed waste contaminants are determined to potentially be present in waste sites in quantities that may require an assessment of human health or ecological risk, then these contaminants will be added as COPCs; if, however, the listed waste contaminants are not considered to be of concern (e.g., volatile or disposed in small quantities), then the contaminants will not be identified as such. Listed waste contaminants will be retained as analytes of interest because of issues associated with waste designation and compliance with land disposal restrictions.

- Groundwater may have been impacted in the past by some waste sites in this OU, and mobile contaminants were disposed at the sites within these waste groups. However, evaluations of groundwater contamination and remediation are not included in the scope of the work plan.

- The RI (i.e., initial OU characterization) will validate, or will provide the basis to refine, the preliminary conceptual contaminant distribution models for the waste sites in the OU from the characterization of representative waste sites. The preliminary conceptual contaminant distribution models and the preliminary exposure model will be used to develop and evaluate remedial action alternatives applicable to the OU in a FS. The RI/FS will form the basis for selecting a preferred remedial action in a proposed plan for the CERCLA past-practice sites.

- Ecological DQOs (if established/needed) will be addressed under a 200 Area-wide strategy. The strategy is phased and supports both 200 Area-wide and OU-specific evaluations. Phase I of the strategy consists of compiling existing 200 Area ecological data into an ecological summary report, which is scheduled to be completed in fiscal year 2002. Specific requirements for Phase II will be developed based on the results of the Phase I evaluation. For the 200-MW-1 OU, an ecological SAP will be prepared if waste site-specific soil samples are required to support an OU-specific ecological evaluation. The Phase II DQO is planned to be completed in fiscal year 2003, at which time the 200-MW-1 ecological SAP will be prepared and implemented, if necessary.

1.5 PROJECT ISSUES

Project issues include both the global issues that transcend the specific DQO project and the technical issues that are unique to the project. Both global and project technical issues have the potential to impact the sampling design or the DQOs for the project.

1.5.1 Global Issues

The global issues that were identified include the following:

1. The preliminary action level for exposure to radionuclides was identified as a global issue. Current activities to evaluate cleanup levels are underway for the 100 and 300 Areas, and similar activities will also be conducted for the 200 Areas. For the purpose of this DQO summary report, a preliminary action level of 500 mrem for annual dose exposure to radionuclides under an industrial exposure scenario will be used to evaluate appropriate analytical requirements. This level is within the representative range of potential cleanup

standards based on current land-use assumptions, regulatory requirements, and other requirements. The actual cleanup standards will be proposed in the FS and proposed plan and will be approved in the ROD for the OU.

2. The miscellaneous nature of waste sites within this OU and the appropriateness of the representative waste sites to reflect this was identified as a global issue. The detailed rationale for selection of the representative waste sites is presented in Appendix A. As a result of the regulator interview, an additional representative site was included in the scope of this DQO effort.

No other global issues were identified at the regulator interview meeting held on October 29, 2001.

1.5.2 Project Technical Issues

The project technical issues include the following:

- Characterization of the 216-A-4 Crib should consider radiological control requirements for possible transuranic-contaminated soils at levels above the U.S. Department of Energy (DOE) definition for TRU waste of 100 nCi/g.

- If contaminated soils are present above the TRU waste definition level in the representative waste sites, stringent health and safety restrictions will be imposed on workers and work practices. The presence of transuranic-contaminated soils may unfavorably impact analytical costs, detection limits, analyte lists, and sample media disposal.

1.6 WASTE SITES AND OPERATING HISTORY

The 200-MW-1 Miscellaneous Waste Group OU consists of waste sites located in the Hanford Site's 200 East and 200 West Areas. Figures 1-1 through 1-5 depict the locations of the waste sites addressed by this DQO effort. Waste streams from the following sources were received at 200-MW-1 waste sites:

- U and Uranium-Trioxide (UO_3) Plants

- Reduction-Oxidation (REDOX) Plant (also known as S Plant)

- Plutonium-Uranium Extraction (PUREX) Plant (also known as A Plant)

- 221-B/bismuth-phosphate process operations, or the Waste Encapsulation and Storage Facility (WESF) (also known as B Plant)

- Semi-Works Plant (also known as C Plant)

- 209-E Critical Mass Laboratory
- Vehicle and heavy equipment decontamination efforts in the 200 West Area and at T Plant
- Z Plant complex
- SX and U tank farms.

1.6.1 Plant History

The U Plant was constructed in 1944 and included the 221-U Canyon Building and 224-U Building. U Plant was based on the design of T and B Plants and was initially used to train personnel for the bismuth-phosphate plutonium separation and purification operations conducted in T and B Plants. During the training phase, only water was used in the plant's systems and no waste streams were generated. U Plant was modified in 1951 for the uranium for use in the uranium recovery process (URP). From 1952 to 1958, U Plant was used to recover uranium from bismuth-phosphate wastes stored in the single-shell tanks (SSTs) for reuse in the reactor plants and for waste volume reduction at T and B Plants. A later operation conducted at U Plant involved the "scavenging" or precipitation of long-lived fission products from the settling process before residual wastes were discharged to the soil column. The 221-U Building was used for equipment decontamination and refurbishment work from 1958 to 1961. In 1961, these activities were relocated to T Plant, and 221-U was used for the storage of miscellaneous equipment (clean and contaminated) on the canyon deck and unprocessed irradiated uranium in cells 5 and 6.

The final operation of U Plant was the conversion of uranyl nitrate hexahydrate (UNH) to uranium trioxide, which was accomplished by calcining the UNH in a batch process within the 224-U Building. In 1957, the batch conversion of UNH to uranium trioxide was renovated. The two calcinators previously used were removed and replaced with six newer calcinators. The operation was updated to a continuous flow, and the 224-U Building became known as the UO_3 Plant (DOE-RL 1992b).

The UO_3 Plant operated from 1958 until 1972 when PUREX was placed in standby mode. During that time, the UO_3 Plant converted UNH received from PUREX and REDOX into UO_3 powder. It was packaged at the UO_3 Plant, stored, and sent offsite to Oak Ridge National Laboratory in Tennessee, and later to Fernald, Ohio. There the uranium trioxide powder was converted to uranium metal and then returned to the Hanford Site's 300 Area for fuel extrusion rework. The UO_3 Plant resumed operations in 1984 to process UNH from PUREX. Because the feed lines from REDOX and 221-U were no longer in use, they were disconnected and capped in the UO_3 Plant. Operations of the UO_3 Plant ceased in 1988 (DOE-RL 1992b).

The REDOX Plant (also known as S Plant) was the first continuous plutonium separation operation at the Hanford Site. Not only did REDOX separate weapons-grade plutonium from the irradiated fuel rods, but it was also used to recover uranium. REDOX involved a solvent extraction process that used hexone (methyl isobutyl ketone, or MIBK) and aluminum nitrate nonahydrate (ANN) in nitric acid to complete these separations within anionic resin columns. Plant operations began in 1952 and continued until 1967 (DOE-RL 1992b).

The plutonium-uranium extraction process at PUREX (also known as A Plant) replaced the REDOX separation process. The PUREX process used a recoverable salting agent (nitric acid) that proved to be more economically feasible, generated less waste, and operated more safely than the REDOX process. The PUREX Plant was constructed in late 1955, and the plant operated continuously from November 1955 until 1972, separating weapons-grade plutonium and depleted uranium products from irradiated fuel. The PUREX Plant was placed in standby mode from 1972 until 1983. PUREX operations were restarted in 1983, continuing until deactivation in 1990. Since initial operation of the PUREX Plant, it was modified to reprocess several types of fuel. These fuels included a zirconium alloy (zircaloy) clad fuel with various enrichments ranging from 0.72% to 2.1% of uranium-235 exposed at various durations (300 to approximately 3,000 megawatt-days per ton of uranium). The different types of fuels yielded various types of products, including fuel-grade plutonium, slightly enriched uranium and neptunium, uranium metals, uranium and plutonium oxides, and several thoria targets (DOE-RL 1993c).

B Plant was constructed in 1944. From 1945 to 1952, B Plant operations consisted of a batch-wise, inorganic chemical separation of weapons-grade plutonium from irradiated uranium. This was known as the bismuth-phosphate/lanthanum-fluoride process. From 1952 to 1965, B Plant was used for various waste treatment operations. In 1963, the 221-B Building began recovering strontium, cerium, and rare earths using an acid-side, oxalate-precipitation process as part of the first phase of processing for the 221-B Building Waste Fractionalization Project. This processing at the 221-B Building ended in June 1966 to accommodate additional construction. Waste fractionalization processing began again at the 221-B Building in 1968. This process separated the long-lived radionuclides strontium-90, and cesium-137 from high-level PUREX and REDOX wastes, and stored a concentrated solution of strontium-90 and cesium-137 at the 221-B Building. In 1968, B Plant underwent renovations and WESF was added. Waste fractionalization and encapsulation efforts continued until 1986 (DOE-RL 1993a).

The Semi-Works aggregate area was composed of two primary facilities: the 201-C Process Building and the Critical Mass Laboratory (209-E Building). The 201-C Process Building was the main processing facility for the Semi-Works aggregate area. During its history, the 201-C Process Building went through three distinct operational modes. The 201-C Process Building was constructed in 1949 as a pilot plant for reprocessing reactor fuel using the REDOX (S Plant) chemical process and later the PUREX chemical process in 1954. In 1961, it was again converted to recover strontium from fission product waste. Cerium, technetium, and promethium, as well as minor amounts of americium and curium in the final production run, were also extracted. This facility operated until 1967 and then remained in safe-storage mode until decommissioning began in 1983. The Critical Mass Laboratory was operated from 1960 to 1987 by Pacific Northwest Laboratory (PNL). Criticality experiments and research were conducted at this location. The laboratory is now closed, and the facility was transferred to Westinghouse Hanford Company (WHC) for use by Waste Tank Management. Currently only the CX-70, CX-71, and CX-72 tanks remain. Each of these tanks is inactive but may contain miscellaneous process equipment (DOE-RL 1993d).

T Plant was constructed in 1944. From 1945 to 1956, T Plant operations consisted of a batch-wise, inorganic chemical separation of weapons-grade plutonium from irradiated uranium, known as the bismuth-phosphate/lanthanum-fluoride process. In 1957, the 221-T Building was converted to a decontamination and equipment refurbishment facility. The facility provided services in radioactive decontamination, reclamation, and decommissioning of process equipment and currently still serves the Hanford Site in this capacity. A series of testing programs by PNL and WHC also occurred intermittently from 1964 to 1990 (DOE-RL 1993b, 1993e).

From 1945 until 1990, the Z Plant complex was used to isolate and purify plutonium solutions, produce metallic plutonium and plutonium oxides, and recover plutonium and americium from plutonium scrap materials. Throughout its operation, the Z Plant complex (Plutonium Finishing Plant) received various types of processed (i.e., uranium and fission products removed) plutonium solutions from each of the 200 Area separations facilities.

The 241-U tank farm consists of 16 SSTs and was constructed from 1943 to 1944 using two different designs. For both designs, the tanks are vertical cylinders with a domed top and are constructed of reinforced concrete, with a carbon-steel liner on the base and sides of the vessel. The tanks are all located underground, with at least 1.8 m (6 ft) of earth cover above the dome. Twelve tanks, each with the same design (numbered 241-U-101 through 241-U-112), have diameters of 23 m (75 ft) and a capacities of 2,017,000 L (533,000 gal). Four smaller tanks, each with the same design (numbered 241-U-201 through 241-U-204) have diameters of 6.1 m (20 ft) and capacities of 208,000 L (55,000 gal). The tanks have been removed from liquid processing services, have been pumped so minimum supernatant heel remains, and are awaiting stabilization. The tanks contain high-level wastes from U Plant operations.

While all SSTs have been inactive (i.e., have not received waste) since at least 1980, several activities continue to be conducted on, in, and/or around the SSTs on a case-by-case basis; therefore, the status of any individual SST may change. These continuing activities include pumping liquid waste (stabilization); sealing tank pits; blanking penetrations and piping (isolation); monitoring surface levels, liquid levels, and temperatures; sampling of waste; sampling of cores; obtaining photographs of the interiors of the tanks; changing of filters; surveying; and conducting day-to-day operations activities.

The SX tank farm contains 15 SSTs that were constructed from 1953 to 1954 to contain hot, self-boiling waste in support of the REDOX process. The base of each tank was placed 17 to 18 m (56 to 59 ft) below ground surface (bgs) and consists of vertical cylinders constructed with carbon-steel liners, surrounded by reinforced concrete. The tank top is an ellipsoidal, concrete dome, covered with 1.8 to 2.7 m (6 to 9 ft) of soil/gravel fill. The tanks have been removed from liquid processing services, pumped so minimum supernatant heel remains, and are awaiting stabilization. Each tank is 22.9 m (75 ft) in diameter and has a 3.8-million-L (1-million-gal) capacity. The tanks contain high level wastes from the REDOX Plant. Standard operations at the SX tank farm include cooling operations and also core and air sampling activities.

Miscellaneous liquid effluent waste streams received water drainage from various support facilities that conducted smaller operations and activities (as compared to the processing facilities). Some of these facilities included laboratories, laundries, lunchrooms, and offices.

Liquid waste generated at U Plant, S Plant (REDOX), A Plant (PUREX), WESF (221-B), C Plant (Semi-Works), and T Plant; the Z Plant complex; and SX and U tank farms, as well as miscellaneous liquid streams were often routed to underground collection sumps/pits through an underground transfer system. The liquid waste was may have been sampled, evaporated (concentrated), and neutralized before routing to the facilities. Heavier constituents/particulates settled out of the liquid effluents, forming sludge that clogged the sumps/pits and transfer lines, resulting in unplanned releases (UPRs). The liquid supernatants were ultimately discharged to the soil column through cribs, trenches, french drains, and injection/reverse wells. Process distillate and drainage were also sent to cribs and trenches through this underground network.

Cribs and drains were designed to inject or percolate wastewater into the soil column. Cribs are shallow excavations that are either backfilled with permeable material or are voids created by wooden or concrete structures. Drains are small- to large-diameter metal or concrete pipes that are inserted at shallow depths into the ground. The drains may have been filled with gravel. Cribs and drains typically received low-level radioactive waste for disposal, and most were designed to receive liquid until a specific retention volume or radionuclide capacity was met.

Trenches are shallow, long, narrow, unlined excavations and were often located adjacent to other trenches. Some of the trenches have been backfilled and marked as a single group of trenches.

1.6.2 Process Information

The operations at the U, REDOX, PUREX, WESF, Semi-Works, and T Plants; the Z Plant complex; and miscellaneous liquid effluents that generated the primary waste streams into the 200-MW-1 OU waste sites included the following:

- URP at U Plant and/or waste generated in the 291-U or additional U Plant ancillary buildings/facilities: Waste streams included process drainage condensate, process distillate drainage condensate, and miscellaneous off-gas condensate. The condensate originated from the 291-U-1 stack, waste treatment condensers, equipment condensers, and building heating, ventilation, and air conditioning (HVAC) systems. Contact with radionuclides and nonradiological constituents may have resulted from process upsets and equipment malfunctions, stress fractures, etc., that occurred during the aqueous and organic solvent extraction activities of uranium recovery/uranium trioxide production operations.

- REDOX or waste generated in the 291-S and/or additional S Plant ancillary buildings/ facilities: Waste streams included process drainage condensate, process distillate drainage condensate, and miscellaneous off-gas condensate. The condensate originated from the

291-S-1 stack, waste treatment condensers, equipment condensers, and building HVAC systems. Contact with radionuclides and nonradiological constituents may have resulted from process upsets and equipment malfunctions, stress fractures, etc., that occurred during the aqueous and organic solvent extraction activities of REDOX production operations (DOE-RL 1992b).

- PUREX or waste generated in the 291-A and/or additional A Plant ancillary buildings/facilities: Waste streams included process drainage condensate, process distillate drainage condensate, dissolver scrubber off-gas condensate, 241-A-151 catch sump drainage, laboratory waste drainage from the U-3 and U-4 tanks, and miscellaneous off-gas condensate. The condensate originated from the 291-A-1 stack, waste treatment condensers, equipment condensers, and building HVAC systems. Contact with radionuclides and nonradiological constituents may have resulted from process upsets and equipment malfunctions, stress fractures, etc., that occurred during the aqueous and organic solvent extraction activities of PUREX production operations (DOE-RL 1993c).

- Bismuth-phosphate, lanthanum-fluoride and strontium/cesium separation, recovery, and storage efforts at WESF, and/or waste generated in the 291-B or additional B Plant ancillary buildings/facilities: Waste streams included process drainage condensate, process distillate drainage condensate, and miscellaneous off-gas condensate. The condensate originated from the 291-B-1 stack and sand filter, 272-B insulation shop sink and drain, equipment condensers, and building HVAC systems. Contact with radionuclides and nonradiological constituents may have resulted from process upsets and equipment malfunctions, stress fractures, etc., that occurred during the aqueous chemical operations of the bismuth-phosphate and lanthanum-fluoride processes and/or inorganic and organic solvent extraction activities of the strontium/cesium separation, recovery, and storage efforts at WESF (DOE-RL 1993a).

- Critical Mass Laboratory (209-E Building): Waste streams included condensate and drainage from the 209-E equipment room steam traps, heat exchangers, high-efficiency particulate air (HEPA) filters were sent to the 200-E-4 and 209-E-WS-2 french drains. Contact with radionuclides and nonradiological constituents may have resulted from process upsets and equipment malfunctions, stress fractures, etc., that occurred during experimental process operations (DOE-RL 1993d).

- Bismuth-phosphate, lanthanum-fluoride process operations and equipment/vehicle decontamination and refurbishment waste generated in the 221-T, 2706-T, 291-T or additional T Plant ancillary buildings/facilities: Waste streams included process drainage condensate, process distillate drainage condensate, and miscellaneous off-gas condensate. The condensate originated from the 291-T-1 stack and sand filter, steam condensate "blowouts" of piping, equipment condensers, building HVAC systems, and various equipment/vehicle decontamination and refurbishment activities. Contact with radionuclides and nonradiological constituents may have resulted from process upsets and equipment malfunctions, stress fractures, etc., that occurred during the aqueous chemical operations of the bismuth-phosphate and lanthanum-fluoride processes and/or inorganic and drainage produced by the decontamination of equipment/vehicles.

- Isolation and purification of plutonium solutions, production of metallic plutonium and plutonium oxides (RB, RMA, and RMC lines), and recovery plutonium (RECUPLEX and Plutonium Reclamation Facility), and americium from plutonium scrap materials: Waste streams included condensate that originated from the 291-Z Building, which contains the ventilation exhaust fans, instrument air compressors, and vacuum pumps for all ventilation exhaust from the 234-5Z, 236-Z, 242-Z, and formerly the 232-Z Building. Routine effluents from the 291-Z Building include noncontact cooling and condensate wastewater from HVAC equipment, cooling water for the compressors, and vacuum-pump seal water. However, contact with radionuclides and nonradiological constituents may have resulted from process upsets and equipment malfunctions, stress fractures, etc., that occurred during the aqueous chemical operations. These wastes were discharged to the 216-Z-13, 216-Z-14, and 216-Z-15 french drains, and the 216-Z-1(D) Ditch.

- SX tank farm and ancillary facilities: Waste streams included equipment compressor condensate originated from the 241-SX-701 compressor house building, which contains instrument air compressors to cool and dry all ventilation exhaust equipment associated with the self-boiling REDOX waste tanks in the SX tank farm. Contaminated soil from the S, SX, and SY tank farms from windblown particles or dust particulates that were radioactively contaminated is also present (RHO 1985, DOE-RL 2000).

- Miscellaneous liquid effluents: Drainage was received from various support facilities that conducted smaller operations and activities, various smaller operations, and activities such as tracer studies, logging calibration, laboratory and laundry effluents, lunchroom ice machines, building ventilation heating condensate, and experiments.

- PUREX laboratory wastes: Wastes were generated by experimental operations, including quality assurance/quality control (QC) sampling of process products in various operational stages, and waste sampling to ensure proper routing to cribs or trenches.

The 200 Area decontamination wastes included wastes from the decontamination of vehicles and heavy equipment. Because of the wide separation of processing and reactor operation areas, the extensive use of automotive, railroad, and heavy construction equipment was required. The equipment occasionally became contaminated if it contacted exposure areas. Contamination usually consisted of particles of fission products (e.g., cesium and strontium). The particles were drawn into the radiator and other engine components and became attached to the oily surfaces of the engine compartment. In order to continue using this equipment, a decontamination facility was established at the 269-W garage. The contamination was removed using commercial cleaners (e.g., Actresol, Kerful Cleaner, and AesoWash) and a steam-jet spray on the radiators, engines, and undercarriages. Painted automobile surfaces and all interior surfaces and materials were hand-cleaned using mild detergents. Sometimes external surfaces required more stringent methods (e.g., aggressive chemicals) and occasional sandblasting (GE 1960).

These decontamination operations initially were performed outdoors in open pit areas such as the 216-U-13 Trench (from 1952 to 1956) and the 216-T-13 Trench (from 1956 to 1962). These sites had limited facilities for handling steam and water. Provisions for waste collection, drainage, and disposal were considered unsatisfactory, and cold and inclement weather further complicated the work. In 1964, a new decontamination facility, the 2706-T Building (originally known as 2706-W), was completed. This facility provided improved steam, high-pressure water, and chemical cleaning capabilities for all of the Hanford Site's railroad equipment and heavy- and light-duty automotive equipment. Various chemicals could be added to the steam spray or high-pressure water, and adequate waste collection, drainage, and disposal facilities were provided. Various commercial chemicals were tested for their application to decontamination work. Among the waste sites used for disposal of decontamination wastes from the 2706-T Building were the 216-T-33 Crib in the 200-MW-1 OU and the 216-T-27 and 216-T-28 Cribs in the 200-LW-1 OU. After the line to the 216-T-33 Crib became plugged in February 1963, waste was routed to the 216-T-28 Crib. The 216-T-27 and 216-T-28 Cribs were active from February 1960 through December 1966.

Techniques other than water and chemical flushes were also used. Sandblasting and ultrasonic cleaning were used when considered suitable. Stainless-steel components were treated with a water flush, 5% versene, 1% sodium nitrate, and 5% sodium hydroxide. This cycle was repeated at least four times (GE 1960).

1.6.3 Representative Waste Sites

The following subsections describe the representative waste sites in detail. Information was obtained from the Waste Information Data System (WIDS) database and WIDS historical files, unless otherwise noted.

200-E-4 French Drain. The 200-E-4 french drain is a 1.2-m (4-ft)-diameter dry well, covered with a yellow metal cover. The site is located approximately 7.6 m (25 ft) north of the northeast corner of the 209-E Critical Mass Laboratory Service Building and is connected to 209-E Critical Mass Laboratory via underground piping. The waste was steam condensate from the steam trap in the valve pit, as well as steam condensate from the equipment room.

The Critical Mass Laboratory, located west of the 201-C Process Building, is an L-shaped concrete block structure. One wing houses offices, control room shops, and common facilities. The other wing houses an equipment room, change room, mixing laboratory, and a two-story, heavily shielded reactor hall (DeFord 1992).

Criticality experiments were conducted in the critical mass room from 1960 to 1983, using plutonium nitrate and enriched uranium solutions. Criticality research was also conducted with solid special nuclear materials and fuels (DeFord 1992) such as plutonium blocks, uranium blocks and slabs, and fuel assemblies from the Fast Flux Test Facility and other reactors.

The Critical Mass Laboratory is currently closed (no research has been conducted at the laboratory since 1983), but it has not been decommissioned. The administrative offices were transferred to WHC in January 1992 and were occupied in April 1992 by WHC tank farm waste management personnel.

The 2718 Storage Building is located adjacent to the southwest corner of the Critical Mass Laboratory. It is a small building that was previously used to store uranyl nitrate containers. This location was the site of a UPR in 1984 (UN-200-E-141). This facility is posted as a radiologically controlled area.

The Critical Mass Laboratory valve pit is a concrete structure located near the south wall of the 209-E Building. It is approximately 1.8 m (6 ft) by 2.4 m (8 ft) and stands about 1 m (3 ft) above grade. The pit has a steel lid and is posted with radioactive contamination warning signs. DeFord (1992) suggests that the line running to the 216-C-7 Crib originates in this pit. The ventilation stack and fan assembly for the Critical Mass Laboratory are also located at this point. Radioactive contamination is reportedly associated with the valve pit sump, although no specific waste inventories for this unit were found in the documents that were reviewed. The valve pit and ventilation hardware were integral to the Critical Mass Laboratory and were considered to be active until recently.

1.6.3.1 216-A-4 Crib. The 216-A-4 Crib is an inactive liquid waste disposal site located 79 m (260 ft) south of the 202-A Building and east of the 216-A-2 Crib, and is inside the PUREX exclusion fence (see Figure 1-8). The crib consists of two 6.1-m (20-ft) lengths of 15-cm (6-in) perforated vitrified clay pipe, forming a cross-pattern horizontally, 5.5 m (18 ft) below grade. The excavation has 2.4 m (8 ft) of coarse rock fill with a volume of 280 m^3 (10,000 ft^3), and it has been backfilled.

From 1955 to 1958, the crib received approximately 6,210,000 L (1,640,000 gal) of liquid waste (Stenner et al. 1988). The waste originated from the ventilation fans (i.e., fan bearing, fan turbine condensate, and control house drain), PUREX laboratory low-activity waste tanks U-3 and U-4, the 241-A-151 diversion box drain, and several sources associated with the 291-A stack. The 291-A stack sources included the stack drain, stack liner drain (after neutralization in tank 216A-TK1), sampler house sink and floor drain, stack gas filter drain, stack gutter drains, and the stack pit plenum (GE 1955a).

In December 1958, the crib became plugged and flooded an area between the crib and the 291-A-1 stack, causing an area of surface contamination. The contaminated soils were removed to the 200-E-102 Trench (along the southern boundary of the crib) and were covered with 0.3 m (1 ft) of soil (Baldridge 1959). The crib was deactivated in 1958 by blanking off the effluent piping after the crib had reached its retention capacity. The site is now located within a large gravel area known as the PUREX stabilized area (200-E-103). Only a large green vent riser is visible above the surface.

The volume of waste received (6,210,000 L [1,639,440 gal]) was low in salt and from neutral to basic in chemistry. The radioisotopes believed to be present are cesium-137, strontium-90, and ruthenium-106 (Brown et al. 1990). According to *Waste Site Grouping for 200 Area Soil Investigations* (DOE-RL 1997), the radionuclide inventory included 395 kg (880 lb) of uranium, 140 g (0.4 lb) of plutonium, and minor amounts of cesium-137 (6.93 Ci) and strontium-90 (4.39 Ci). The nonradionuclides included nitrate (300 kg [661.5 lb]) and sodium dichromate (110 kg [242.55 lb]).

1.6.3.2 216-T-13 Trench. The 216-T-13 Trench is an inactive liquid waste disposal site located in the 200 West Area, approximately 853 m (2,800 ft) southwest of the 221-T Canyon Building and 69.5 m (228 ft) south of 23rd Street (Figure 1-9). The trench was located near the 269-W regulated garage (which no longer exists). The trench is no longer marked or posted. The single trench is estimated to have dimensions either 6.1 m by 6.1 m by 3 m (20 ft by 20 ft by 10 ft) (Carpenter and DeFord 1995a), or 7.6 m by 3 m by 2.4 m (25 ft by 10 ft by 8 ft) (Clukey 1954), depending on the reference source used.

The site operated from June 1954 to June 1964 and was used to decontaminate vehicles prior to being worked on at the 269-W regulated garage. Based on the descriptions given for other waste sites (e.g., 216-U-13) that served a similar function, it is assumed that the trench sides were sloped so vehicles could be driven down to the decontamination area at the bottom. The site would have received wastes from vehicle decontamination activities or equipment steam cleaning.

According to ARH (1970), the site received approximately 98,400 L (26,000 gal) of vehicle decontamination liquid waste. The waste included <0.05 kg (<0.1 lb) of uranium, <0.1 g of plutonium, 1 Ci each of strontium-90 and cesium-137, 40 Ci of ruthenium-106, and <0.1 Ci of cobalt-60. ARH (1973) indicates that the concentration of strontium-90 and cesium-137 were only 0.1 Ci each.

When the site was deactivated in 1964, and all vehicle decontamination operations were transferred to the 2706-T Building (also known as 2706-W), and the pit was backfilled with soil later in 1964. In April 1972, the site was excavated and approximately 3.06 m^3 (4 yd^3) of contaminated soil were removed and taken to the 200 West Area dry waste burial ground. The maximum contamination level found was 1,500 counts per minute, and the site was removed from radiological controls.

1.6.3.3 216-T-33 Crib. The 216-T-33 Crib is an inactive liquid waste disposal site located in the 200 West Area, approximately 76.2 m (250 ft) west of the 2706-T Building and 274 m (900 ft) north of 23rd Street (Figure 1-10). The site is currently surrounded with light metal posts and chained and is posted as an underground radioactive material area. The site consists of a rectangular crib with a perforated vitreous clay inlet pipe set into a gravel layer. A layer of plastic sheeting, clean sand, and backfill were placed above the pipe. The bottom dimensions are 9.1 m (30 ft) by 1.5 m (5 ft), with a total height of 3.3 m (10.8 ft), inclusive of an estimated overburden of 2 m (6.8 ft). Surface dimensions are approximately 12.2 m (40 ft) by 6.1 m (20 ft).

The site was only active from January through February 1963 as a subsurface liquid disposal site for the 2706-T Building (also known as 2706-W). After the perforations in the tile line became plugged, the waste was routed to the 216-T-28 Crib via the 241-T-112 tank (Lundgren 1970).

The amount of liquid that actually reached the crib has been questioned by plant management, who believed that the line to the crib retained all of the waste. Sections of the tile line were removed in 1963 after the line was rerouted to the 216-T-28 Crib. No surface contamination has been found at this site (Maxfield 1979). The site was stabilized in July 1991.

The crib received 1,900,000 L (500,000 gal) of low-salt decontamination waste from the 2706-T Building. The waste is mainly sodium hydroxide and is thought to be neutral/basic. According to the waste site grouping report (DOE-RL 1997), the radionuclide inventory included 5.94 kg (10 lb) of uranium, 5 g (0.01 lb) of plutonium, and minor amounts of cesium-137 (0.3 Ci) and strontium-90 (0.3 Ci).

1.6.3.4 216-U-3 French Drain. The 216-U-3 french drain is an inactive liquid waste disposal site located in the 200 West Area, south of the 241-U tank farm on the south side of 16th Street (Figure 1-11). The site is surrounded by light steel posts and chains and is marked as an underground radioactive material area. The drain is a 3.6-m (12-ft)-deep, rock-filled excavation with sloping sides, covering an area approximately 1.8 m (6 ft) in diameter, and contains a 10-cm (4-in.)-diameter vent riser. A 5-cm (2-in.) steel line enters the drain from the northeast at a depth of 2 m (7 ft).

The drain operated from May 1954 to August 1955 and received condensate from the 241-U steam condenser on the 241-U-104 and 241-U-110 waste tanks (Carpenter and DeFord 1995b). According to the waste site grouping report (DOE-RL 1997), the site received 791,000 L (209,000 gal) of low-salt, neutral-to-basic condensate. The radionuclide inventory included 18 kg (40 lb) of uranium, 0.1 g of plutonium, and minor amounts of cesium-137 (0.4 Ci) and strontium-90 (0.04 Ci).

An area of contaminated soil related to waste site 200-W-67 (adjacent to the 216-U-13 french drain) was surface stabilized in 1998.

1.7 DATA QUALITY OBJECTIVE TEAM MEMBERS AND KEY DECISION MAKERS

Tables 1-1, 1-2, and 1-3 identify the DQO scoping team members, DQO workshop team members, and key decision makers, respectively. The scoping team developed the checklist and binder prior to the internal seven-step process. The DQO workshop team members participated in the seven-step DQO process. The key decision makers provided external review of the results of the seven-step process.

Table 1-1. DQO Scoping Team Members.

Name	Organization	Area of Expertise (Role)
Roy Bauer	CHI Environmental Engineering	DQO Facilitator
Janet Badden	CHI Regulatory Support/ Environmental Science	Regulatory Support
Bruce Ford	BHI Site Assessments	BHI Project Manager
Michael Galgoul	CHI D&D Characterization	200-MW-1 OU Lead/DQO Summary Report Author
Jenifer Linville	CHI Regulatory Support/ Environmental Science	Biological/Ecological Issues
Michelle Yates Mandis	CHI Environmental Engineering	Technical Staff, Author, Process Engineering Lead
Dave St. John	CHI AFS & Sample Management	Sampling Data Management/Site Sampling History
Jim Sharpe	CHI Regulatory Support/ Environmental Science	Cultural Issues
Kevin Singleton/David Weekes	CH2M Hill, Inc./CHI Geosciences	Technical Staff, Author, Geosciences Lead
Noe'l Smith-Jackson	CHI Regulatory Support/ Environmental Science	Technical Staff, Author
Wendy Thompson	BHI Environmental Technologies	Sampling/Field Analysis
Rich Weiss	CHI AFS & Sample Management	Radiochemical and Analytical, Data Management
Curt Wittreich	CHI Environmental Engineering	CHI Project Management

BHI = Bechtel Hanford, Inc.
CHI = CH2M HILL Hanford, Inc.
D&D = decontamination and decommissioning

Table 1-2. DQO Workshop Team Members. (2 Pages)

Name	Organization	Area of Expertise (Role)
Roy Bauer	CHI Environmental Engineering	DQO Facilitator
Bruce Ford	BHI Site Assessments	BHI Project Manager
Michael Galgoul	CHI D&D Characterization	200-MW-1 OU Lead
Michelle Yates Mandis	CHI Environmental Engineering	Technical Staff/Author, Process Engineering Lead
Roger Ovink	CHI Regulatory Support	DQO Task Lead
Kevin Singleton/ David Weekes	CH2M Hill, Inc./CHI Geosciences	Technical Staff/Author, Geosciences Lead

Table 1-2. DQO Workshop Team Members. (2 Pages)

Name	Organization	Area of Expertise (Role)
Barry Vedder	BHI Regulatory Support	Regulatory Support
Wendy Thompson	BHI Environmental Technologies	Sampling/Field Analysis
Curt Wittreich	CHI Environmental Engineering	CHI Project Management

Table 1-3. DQO Key Decision Makers.

Name	Organization	Area of Expertise (Role)
Craig Cameron	EPA	EPA Project Manager
Bryan Foley	RL	RL Project Manager

EPA = U.S. Environmental Protection Agency
RL = U.S. Department of Energy, Richland Operations Office

1.8 EXISTING REFERENCES

Table 1-4 lists the key sources of existing documents and data collected from previous investigations that were reviewed by the DQO team.

Table 1-4. Existing Documents and Data Sources for the 200-MW-1 Operable Unit. (6 Pages)

Reference	Summary
200 Areas Remedial Investigation/Feasibility Study Implementation Plan – Environmental Restoration Program, DOE/RL-98-28, Rev. 0 (DOE-RL 1999)	Provides background geography, process, waste site, and COC knowledge and strategy for the 200 Areas.
200 Areas Waste Sites Handbook, 3 vols., RHO-CD-673 (Maxfield 1979)	Provides waste site descriptions, releases, waste discharge information, and management reports.
Hanford Engineer Works Technical Manual (T/B Plants), Parts A, B, and C, HW-10475 (GE 1944)	Provides process information on B, T, and U Plant facilities, chemicals used or stored, and operation and maintenance information, including process effluent sampling/analysis methods and theory behind the materials, chemicals, and equipment used during the bismuth-phosphate campaign. Includes general designation of waste streams generated and conclusive evidence that the bismuth-phosphate separation and the lanthanum-fluoride purification processes were strictly inorganic in chemical nature.
Inventory of Chemicals Used at Hanford Site Production Plants and Support Operations (1944-1980), WHC-EP-0172, Rev. 1 (WHC 1990)	Identifies list of chemicals used in processing plants and supporting facilities.

Table 1-4. Existing Documents and Data Sources for the 200-MW-1 Operable Unit. (6 Pages)

Reference	Summary
Uranium Recovery Technical Manual, HW-19140 (GE 1951b)	Provides process information on U Plant facilities, chemicals used or stored, and operations and maintenance information, including process effluent sampling/analysis methods and theory behind the materials, chemicals, and equipment used during the URP campaign. Includes general designation of waste streams generated and conclusive evidence that the URP separation and the supplementary purification processes were strictly inorganic in chemical nature with the exception of TBP diluted in normal hydrocarbon paraffin.
Record of Scavenged TBP Waste (Logbook) (GE 1958)	Provides process information for 200-MW-1 OU waste sites including, operations, trouble shooting, chemicals used, and process effluent sampling data from 1950s. Results of a waste stream designation for the cribs and trenches containing the scavenged and URP waste streams.
An Assessment of the Inventories of the Ferrocyanide Watchlist Tanks, WHC-SD-WM-ER-133 (Borsheim and Simpson 1991)	Provides process information for 200-MW-1 OU waste sites including chemicals used, and modeling of liquid effluents discharged to soil and kept in tanks. Results of a waste stream designation and modeled inventories for the cribs and trenches containing the scavenged and URP waste streams.
Hanford Site Atlas, BHI-01119, Rev. 1 (BHI 1998)	Provides Hanford Site maps.
Pre-Operational Baseline and Site Characterization Report for the Environmental Restoration Disposal, Vols. 1 and 2, BHI-00270, Rev. 1 (BHI 1996)	Includes geological and groundwater information.
Geohydrology of the 218-W-5 Burial Ground, 200-West Area, Hanford Site, PNL-7336 (Bjornstad 1990)	Provides geological information.
Underground Waste Disposal at Hanford Works, HW-671 (Brown and Ruppert 1948)	Provides historical waste site and COC disposal information.
The Underground Disposal of Liquid Wastes at Hanford Works, Washington, HW-17088 (Brown and Ruppert 1950)	Provides historical waste site and COC disposal information.
Vadose Zone Geology of the 241-B, 241-BX, and 241-BY Tank Farms, Hanford Site, South-Central Washington (Stephens et al. 1998)	Provides geological information for B, BX, and BY tank farms. Used for comparison purposes.
Evaluation of Scintillation Probe Profiles from 200 Area Crib Monitoring Wells, ARH-ST-156 (Fecht et al. 1977)	Provides geophysical logs and contaminant distribution data.
Hanford Site Groundwater Monitoring for Fiscal Year 1998, PNNL-12086 (PNNL 1999)	Provides groundwater annual report information.
PNLATLAS/LG-ARCHV/200 East and West	Database for geophysical logging.

Table 1-4. Existing Documents and Data Sources for the 200-MW-1 Operable Unit. (6 Pages)

Reference	Summary
Hydrogeologic Model for the 200-East Groundwater Aggregate Area, WHC-SD-EN-TI-019, Rev. 0 (WHC 1992a)	Provides groundwater and geological information for 200 East Area waste sites.
Hydrogeologic Model for the 200-West Groundwater Aggregate Area, WHC-SD-EN-TI-014, Rev. 0 (WHC 1992b)	Provides groundwater and geological information for 200 West Area waste sites.
Geologic Setting of the Low-Level Burial Grounds, WHC-SD-EN-TI-290, Rev. 0 (WHC 1994)	Provides geological information.
Hanford Site Water Changes – 1950 Through 1980, Data Observation and Evaluation, PNL-5506 (Zimmerman et al. 1986)	Includes groundwater maps of the Hanford Site.
History of Operations (1 January 1944 to 20 March 1945), OUT-1462 (HEW 1945)	Provides historical account of process operations information in the 100, 200, and 300 Areas. Trouble encountered, solutions implemented, chemical inventories, an overview of the daily activities for each process, building construction, functions, maintenance, and sampling, laboratory, and disposal activities.
Removal of Organic Compounds from the "Contaminants of Concern" List for Tank Farm Vadose Zone Characterizations, HNF-5118 (Jones 1999)	Includes COC information.
Hanford Tank Chemical and Radionuclide Inventories: HDW Model, LA-UR-96-3860, Rev. 4 (Agnew et al. 1997)	Provides scavenged and URP process waste and COC comparisons.
U Plant Source Aggregate Area Management Study Report, DOE/RL-91-52, Rev. 0 (DOE-RL 1992b)	Includes process information on U Plant facilities, radionuclides and nonradiological constituents used and discharged, known and suspected contaminants, and a list of COPCs.
T Plant Source Aggregate Area Management Study Report, DOE/RL-91-61, Rev. 0 (DOE-RL 1993e)	Contains waste unit descriptions; maps with locations of waste units; preliminary conceptual site exposure model; summary of waste-producing processes in T Plant; known and suspected contaminants; affected media; results of soil, vadose zone, water, and biota sampling; plant buildings and waste discharge units (e.g., tanks, wells, vaults, ponds, ditches, trenches, septic systems, transfer lines and associated equipment, retention basins, and liquid effluent retention facilities); and site hazard rankings. Includes process history of T Plant aggregate area, waste management operations history, chemical waste inventories estimates, and history of UPRs.

Table 1-4. Existing Documents and Data Sources for the 200-MW-1 Operable Unit. (6 Pages)

Reference	Summary
B Plant Source Aggregate Area Management Study Report, DOE/RL-92-05, Rev. 0 (DOE-RL 1993a)	Contains waste unit descriptions; maps with locations of waste units; preliminary conceptual site exposure model; summary of waste-producing processes in B Plant; known and suspected contaminants; affected media; results of soil, vadose zone, water, and biota sampling; plant buildings and waste discharge units (e.g., tanks, wells, vaults, ponds, ditches, trenches, septic systems, transfer lines and associated equipment, retention basins, and liquid effluent retention facilities); and site hazard rankings. Provides process history of B Plant aggregate area, waste management operations history, chemical waste inventories estimates, and history of UPRs.
S Plant Source Aggregate Area Management Study Report, DOE/RL-91-60, Rev. 0 (DOE-RL 1992a)	Provides process information on S Plant facilities, radionuclides and nonradiological constituents used and discharged, known and suspected contaminants, and a list of COPCs.
Z Plant Source Aggregate Area Management Study Report, DOE/RL-91-58, Rev. 0 (DOE-RL 1992c)	Provides process information on Z Plant facilities, radionuclides and nonradiological constituents used and discharged, known and suspected contaminants, and a list of COPCs.
PUREX Source Aggregate Area Management Study Report, DOE/RL-92-04, Rev. 0 (DOE-RL 1993c)	Provides process information on PUREX Plant facilities, radionuclides and nonradiological constituents used and discharged, known and suspected contaminants, and a list of COPCs.
Semiworks Source Aggregate Area Management Study Report, DOE/RL-92-18, Rev. 0 (DOE-RL 1993d)	Provides process information on Semi-Works Plant facilities, radionuclides and nonradiological constituents used and discharged, known and suspected contaminants, and a list of COPCs.
Technical Baseline Report - Semi-Works Aggregate Area Management Study, WHC-SD-EN-ES-019, Rev. 0 (DeFord 1992)	Provides process history of Semi-Works Plant aggregate area and waste management operations.
Tabulation of Radioactive Liquid Waste Disposal Facilities, HW-33305 (Clukey 1954)	Includes radioactive liquid waste disposal facilities discharge data.
PUREX Technical Manual, HW-31000-DEL (GE 1955a)	Includes PUREX Plant operational descriptions.
Tank Waste Discharge Directly to Soil at the Hanford Site, WHC-MR-0227 (WHC 1991)	Provides descriptions of waste units, site locations, and waste type summaries. Conclusions from previous studies, general model of contaminant distributions for cribs and trenches, and process information overview.
Liquid Radioactive Waste Discharged from B-Plant to Cribs, WHC-SD-WM-ER-575, Rev. 0 (WHC 1996)	Provides history of operations, process information on B Plant source facilities, and chemicals used or stored. Lists COCs and waste site information.

Table 1-4. Existing Documents and Data Sources for the 200-MW-1 Operable Unit. (6 Pages)

Reference	Summary
Phase 1 Remedial Investigation Report for 200-BP-1 Operable Unit, DOE-RL-92-70, Rev. 0 (DOE-RL 1993b)	Describes 200-BP-1 OU data collection, analysis, and results. Includes discussion of the nature and extent of contamination, a baseline risk assessment, and column leach and sorption testing.
Process Waste Disposal Summary – 200 Areas (September 1949 through December 1950), HW-20583 (GE 1951a)	Provides history of operations, process information of source facilities, and chemicals used or stored. Lists COCs and waste site information.
Summary of Liquid Radioactive Wastes Discharged to the Ground – 200 Areas (July 1952 through June 1954), HW-33591 (GE 1954b)	Provides history of operations, process information of source facilities, and chemicals used or stored. Lists COCs and waste site information.
Radioactive Contamination in Liquid Wastes Discharged to Ground at Separation Facilities Through June 1955, HW-38562 (GE 1955b)	Provides history of operations, process information of source facilities, and chemicals used or stored. Lists COCs and waste site information.
200 Areas Disposal Sites for Radioactive Liquid Wastes, ARH-947 (Curren 1972)	Contains waste site and COC information.
Radionuclide Inventories of Liquid Waste Disposal Sites on the Hanford Site, HNF-1744 (FDH 1999)	Contains waste site and COC information.
Recovery of Cesium-137 from Uranium Recovery Process Wastes, HW-31442 (GE 1954a)	Provides history of operations, process information of source facilities, and chemicals used or stored. Lists COC information.
Waste Site Grouping for 200 Areas Soil Investigations, DOE/RL-96-81, Rev. 0 (DOE-RL 1997)	Summarizes site name, location, type status, site and process descriptions, known and suspected contamination, preliminary contaminant distribution conceptual model, site conditions that may affect COC fate and transport, COC mobility in Hanford Site soils, COC distribution and transport to groundwater, and hazards associated with COCs. Includes soil porosity information for each waste site.
WIDS database reports for 200-MW-1	Summarizes site name, location, type, status, site and process descriptions, associated structures, clean-up activities, environmental monitoring description, access requirements, references, regulatory information, and waste information (e.g., type, category, physical state, description, and stabilizing activities).
Tank Characterization Database (http://twins.pnl.gov:8001/TCD/main.html) (LMHC 1999)	Provides inactive miscellaneous underground storage tank search capability for tanks pertaining to 200-TW-1 and 200-TW-2 OU waste sites.
TRAC: A Preliminary Estimation of the Waste Inventories in Hanford Tanks Through 1980, WHC-SD-WM-TI-057 (Jungfleisch 1984)	Lists COCs and general inventory comparisons.
HEIS database	Provides well information and sampling data.

Table 1-4. Existing Documents and Data Sources for the 200-MW-1 Operable Unit. (6 Pages)

Reference	Summary
Interview with R. Hultgren and R. Knight (B Plant, 241-B tank farm operator and health physicist and laboratory, and 241-T tank farm personnel and health physicist)	Provided historical information on operations and practices at B and T Plants.
Drawings: H-2-44511, *Area Map 200 West T Plant Facilities*, Rev. 5, Sheet 126 H-2-44511, *Area Map 200 West T Plant Facilities*, Rev. 9, Sheet 132 H-2-353, *Waste Disposal Cribs 216-T-6, 216-T-B Cribs and Reverse Wells 216-T-3 and T-1*, Rev. 5 H-2-95401, *Ventilation Upgrade Compressor Bldg.*, Rev. 0, Sheets 1 and 2 H-2-32097, *Decontamination Waste Crib Sections and Details*, Rev. 1 H-2-56050, *Underground Rock Cribs 216-1-2, 216-A-3, 216-A-4, 216-A-5*, Sheet 1 H-2-44004, *216-U-3 Crib Details 241-U Steam Condenser Water and Drain Piping*, Sheet 1 H-2-39955, *Structural Compressor House* H-2-44301, *Plot Plan and Piping*, Rev. 4, Sheet 1 H-2-44335, *Outside Lines Key Plan and Details*, Rev. 4 H-2-44356, *Equipment Waste and Process Drains Service and Control Building*, Rev. 3 H-2-1495, *200 West Area Steam Line Plot Plan* H-2-32096, *Decontamination Waste Crib Plans & Profiles*, Rev. 2 H-2-44511, *Area Map 200 West "T"-Plant Facilities*, Rev. 10, Sheet 140 H-2-44511, *Area Map 200 West "T"-Plant Facilities*, Rev. 5, Sheet 186	Contain construction "as-built" drawings of individual waste sites.

HEIS = Hanford Environmental Information System
TBP = tributyl phosphate

1.9 CONTAMINANTS OF CONCERN

Table 1-5 represents the complete unconstrained set of COPCs that were (or could have been) discharged to the 200-MW-1 waste sites. The master COPC list was evaluated against a set of exclusion rationale to determine a final list of representative site specific COCs. The evaluation rationale is presented in Appendix B. Based on a review of process, operational, and waste discharge information from various references (Table 1-4), the chemical behavior of the constituents was evaluated. The rationale for process knowledge indicates that the 200-MW-1 OU waste streams were predominantly liquid effluents. Waste streams discharged to sites within this group are generally characterized by low volumes and low levels of contamination. Organic contaminants are not listed, and only small quantities of inorganics (including sodium dichromate) are noted in the inventories.

Table 1-5. Sources of Contamination, COPCs, and Affected Media for the 200-MW-1 Operable Unit.

See Appendix B, Table B-4.

The first step in the evaluation process involved extracting known toxic materials from the master COPC list for placement in the final COC list. Inorganic salts and acids represent a large group of constituents in the waste sites being evaluated. Because laboratory analyses are generally not acid- or compound-specific, the acids and inorganic salts were excluded from further consideration. Instead, the readily detected cations and anions (e.g., metals, fluorides, and nitrates) associated with the acids and inorganic salts serve as the target constituents for those compounds. This logic recognizes the small volumes of radiological and nonradiological constituents released into large-volume aqueous discharges.

The analytical approach employed for this project generally targets the significant risk drivers that are representative of the waste constituents present. The general suite-type analytical techniques yield results on many metals and organic compounds, providing a cost-effective approach for the known toxic materials that could be present.

The COPCs in the following categories were excluded from further consideration:

- Short-lived radionuclides with half-lives less than 3 years
- Radionuclides that constitute less than 1% of the fission product inventory and for which historical sampling indicates nondetection
- Naturally occurring isotopes that were not increased above background levels as a result of Hanford Site operations

- Constituents with atomic mass numbers greater than or equal to 242 that represent less than 1% of the actinide activities
- Progeny radionuclides that build insignificant activities within 50 years and/or for which parent/progeny relationships exist that permit progeny estimation
- Constituents that would be neutralized and/or decomposed by facility processes
- Chemicals in a gaseous state that cannot accumulate in soil media
- Chemicals used in minor quantities relative to the bulk production chemicals consumed in the normal processes; these chemicals are not likely to be present in toxic or high concentrations
- Chemicals that are not persistent in the environment due to biological degradation or other natural mitigating features.

Table 1-6 includes the list of COPCs that were excluded and the specific rational of exclusions for each radionuclide/nonradionuclides.

Table 1-6. 200-MW-1 Operable Unit COPC Exclusions and Justifications.

See Appendix B, Table B-5.

Table 1-7 includes the final list of COCs for the 200-MW-1 OU, with the rationale for inclusion for each of the COCs.

Table 1-7. 200-MW-1 Operable Unit Final COC List.

See Appendix B.

1.10 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND PRELIMINARY REMEDIATION GOALS

Table 1-8 defines the ARARs and preliminary remediation goals (PRGs) for each of the COCs.

Table 1-8. List of Preliminary ARARs and PRGs.

COCs	Preliminary ARARs	PRGs
Radionuclides Inside the 200 Area Land-Use Boundary [a]		
Shallow zone (0 to 4.6 m [0 to 15 ft] bgs)	500 mrem/yr above background via industrial land-use scenario while under DOE control; 15 mrem/yr above background at the end of the exclusive-use period if DOE control is relinquished; 4 mrem/yr above background to groundwater; or no additional groundwater degradation.[b]	Contaminant-specific; RESRAD modeling[c]
Vadose zone	4 mrem/yr above background to groundwater, or no additional groundwater degradation.[b]	MCLs, state and Federal ambient water QC criteria; alternatively, site-specific modeling using STOMP model
Nonradiological Constituents Inside the 200 Area Land-Use Boundary		
Shallow zone (0 to 4.6 m [0 to 15 ft] bgs)	MTCA Method C	Chemical-specific
Vadose zone	MTCA criteria	Alternatively, site-specific modeling using STOMP model
TRU Waste Definition		
Vadose zone	Radioactive waste containing more than 100 nCi of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years except for (1) high-level radioactive waste; (2) waste that the Secretary of Energy has determined, with the concurrence of the Administrator of the EPA, does not need the degree of isolation required by the 40 CFR 191 disposal regulations; or (3) waste that the U.S. Nuclear Regulatory Commission has approved on a case-by-case basis in accordance with 10 CFR 61.[d]	Contaminant-specific
Greater Than Class C		
Vadose zone	Radioactive waste containing concentrations in excess of 10 CFR 61.55 levels.	Contaminant-specific

[a] Based on *Final Hanford Comprehensive Land Use Plan Environmental Impact Statement* (DOE 1999) (see Figure 1-1).
[b] Radionuclide standards are not final and will be agreed upon in the ROD.
[c] The RESidual RADioactivity dose model (RESRAD) has been used for similar waste sites and will be used as a minimum for direct exposure. If more appropriate models are developed, they will be evaluated for use.
[d] Working definition of TRU waste, as stated in DOE O 435.1.
MCL = maximum contamination level
STOMP = subsurface transport over multiple phases (Nichols et al. 1997)

1.11 RISK AND EXPOSURE CONSIDERATIONS

Table 1-9 lists the general exposure scenarios.

Table 1-9. General Exposure Scenarios.

Scenario No.	General Exposure Scenario Description
1	Industrial land-use scenario (inside the 200 Area exclusive-use boundary)[a]: The source of contamination in the 200-MW-1 OU is the liquid effluent disposed at the waste sites. The release mechanism is direct radiation exposure to occupational workers near the waste sites (although shielded by stabilizing cover). Ingestion and inhalation of surface or subsurface soils in an occupational scenario do not represent a substantial exposure due to waste site surface stabilization and the limited soil ingestion and inhalation anticipated during excavation activities in an industrial setting (use of dust control measures limits exposures). Downward migration of mobile constituents into the groundwater would not affect occupational workers, as their drinking water source would not be the underlying aquifers. However, the protection of groundwater is a requirement that must be addressed by evaluating potential future impacts. An intruder scenario will be evaluated at 150 years from present for exposure to radionuclides.
	The exposure time is divided into time spent inside and outside an industrial facility: • Building occupancy: 8 hours/day x 0.6 (building occupancy factor), 5 days/week, 50 weeks/yr, for 20 years (of a 75-year lifetime). • Outdoor exposure: 8 hours/day x 0.4 (outdoor exposure factor), 5 days/week, 50 weeks/yr, for 20 years (of a 75-year lifetime). In addition, the building occupancy exposure includes a factor of 0.4 to reduce the ingested dust component due to building ventilation system filtration. The inputs for an intruder scenario are being developed through the Central Plateau risk framework project. Biota that may be exposed to contaminants is this OU will be addressed through the 200 Area ecological evaluation. Remedial actions to address human health concerns can also serve to protect biota.

[a] The *Final Hanford Comprehensive Land Use Plan Environmental Impact Statement* (DOE 1999) (see Figure 1-1) identifies the actual land use within the 200 Area land-use boundary as industrial (exclusive) and would center mainly around waste management activities.

1.12 REGULATORY AND PROJECT DRIVERS

Table 1-10 provides the regulatory milestones and regulatory drivers associated with this project.

Table 1-10. Regulatory Milestones.

Milestone	Due Date	Regulatory Driver
M-13-00L	December 31, 2001	Tri-Party Agreement milestone to submit three 200 Area NPL RI/FS (RFI/CMS) work plans, Draft A versions. Draft A of the 200-MW-1 work plan would serve as one of the three required work plans.

The project milestones and their drivers are listed in Table 1-11.

Table 1-11. Project Milestones.

Milestone	Due Date	Driver
Conduct decision maker interviews, global issues meeting	October 29, 2001	DQO schedule
Internal DQO workshop	November 12, 2001	DQO schedule
External DQO workshop	November 16, 2001	DQO schedule
Issue DQO summary report Draft A	December 31, 2001	DQO process documentation to support submittal of the work plan

1.13 PRELIMINARY CONCEPTUAL CONTAMINANT MODEL AND PROBLEM STATEMENT

Table 1-12 combines the relevant background information into a concise statement of the problem to be resolved.

Table 1-12. Preliminary Conceptual Contaminant Distribution Model Discussion and Concise Statement of the Problem.

Preliminary Conceptual Contaminant Distribution Model[a]:

Waste streams associated with 200 Area miscellaneous streams with low volumes and low levels of contamination were discharged to the 200-MW-1 OU waste sites. The streams contained radionuclides and chemicals associated with major 200 Area processes. Immobile contaminants accumulated in the soils over time, and the mobile contaminants may have reached the groundwater. Gamma logs from boreholes near the waste sites were reviewed when available. Data from these logs indicate a zone of higher contamination at or below the bottom of the cribs, french drains, and trenches. Contamination continued below this zone but decreased with depth. More mobile contaminants were distributed throughout the soil column at residual concentrations for those waste sites that received sufficient volume to impact groundwater.

Figure 1-6 graphically presents the conceptual exposure pathway model. Figures 1-7 through 1-11 graphically present the preliminary conceptual contaminant distribution models for each of the representative waste sites. Each of these waste sites is analogous to other sites in the OUs.

DQO Approach:

The DQO process for the 200-MW-1 OU is being performed to characterize representative waste sites in this OU in support of remedial decision making.

The outcome of the characterization being developed in this DQO process for the representative waste sites will be applied to the other analogous sites. A SAP will be developed after completion of the DQO process, which specifies the sampling and analyses to be performed for characterization of the representative waste sites.

All of the waste sites associated with this OU are located within the 200 Area land-use boundary line and will be evaluated on the basis of future industrial uses.

Problem Statement:

The problem is that contaminants have been discharged to waste sites associated with the 200-MW-1 Miscellaneous Waste OU. To support evaluation of remedial alternatives and remedial decision making in the FS and to verify or refine the conceptual contaminant distribution models, data regarding contaminant concentrations and physical parameters in the representative waste sites are needed.

[a] The preliminary conceptual contaminant distribution model will become the conceptual contaminant distribution model after acceptance of this DQO summary report and will then be applied to the project work plan.

Figure 1-6. 200-MW-1 Conceptual Exposure Pathway Model.

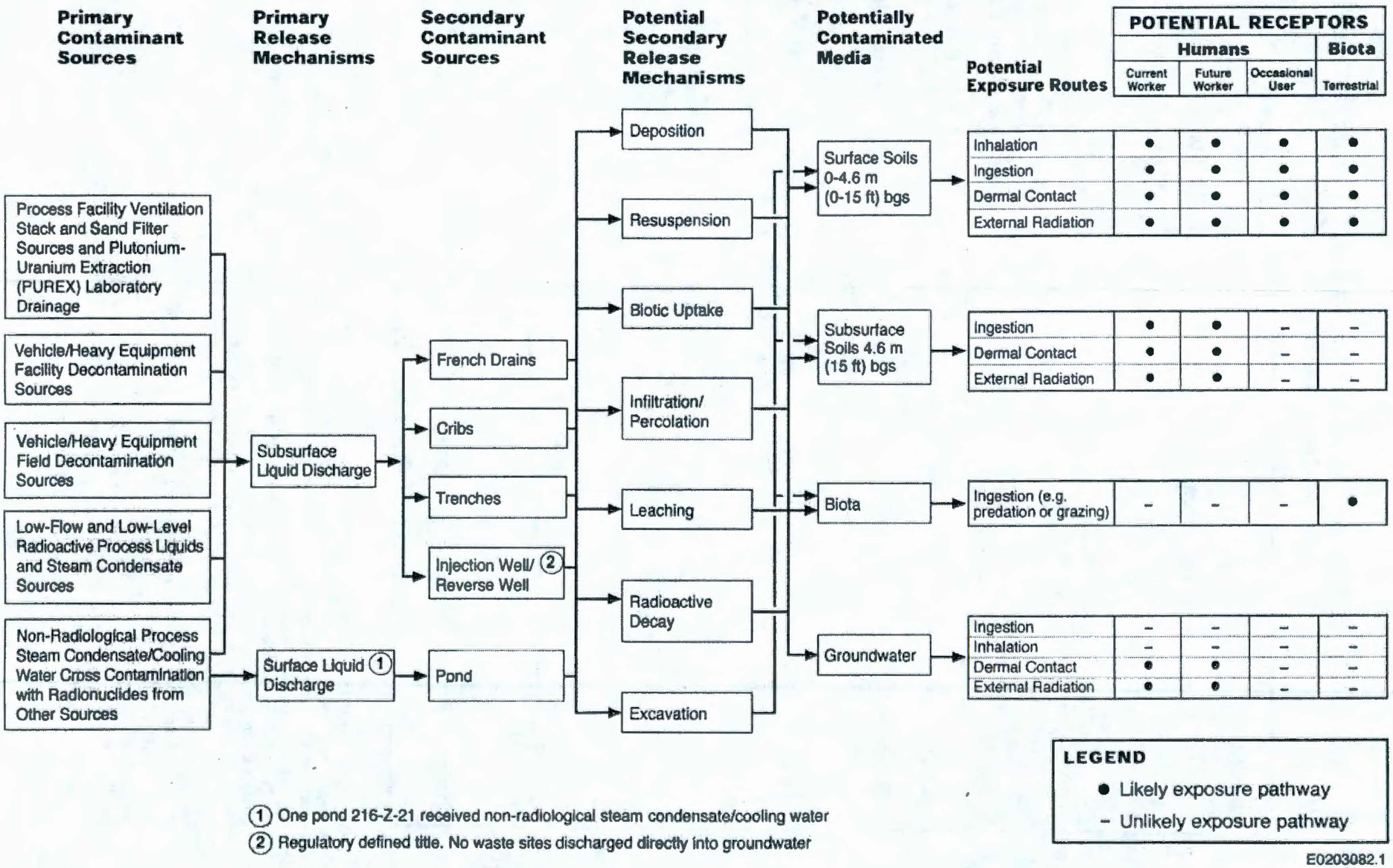
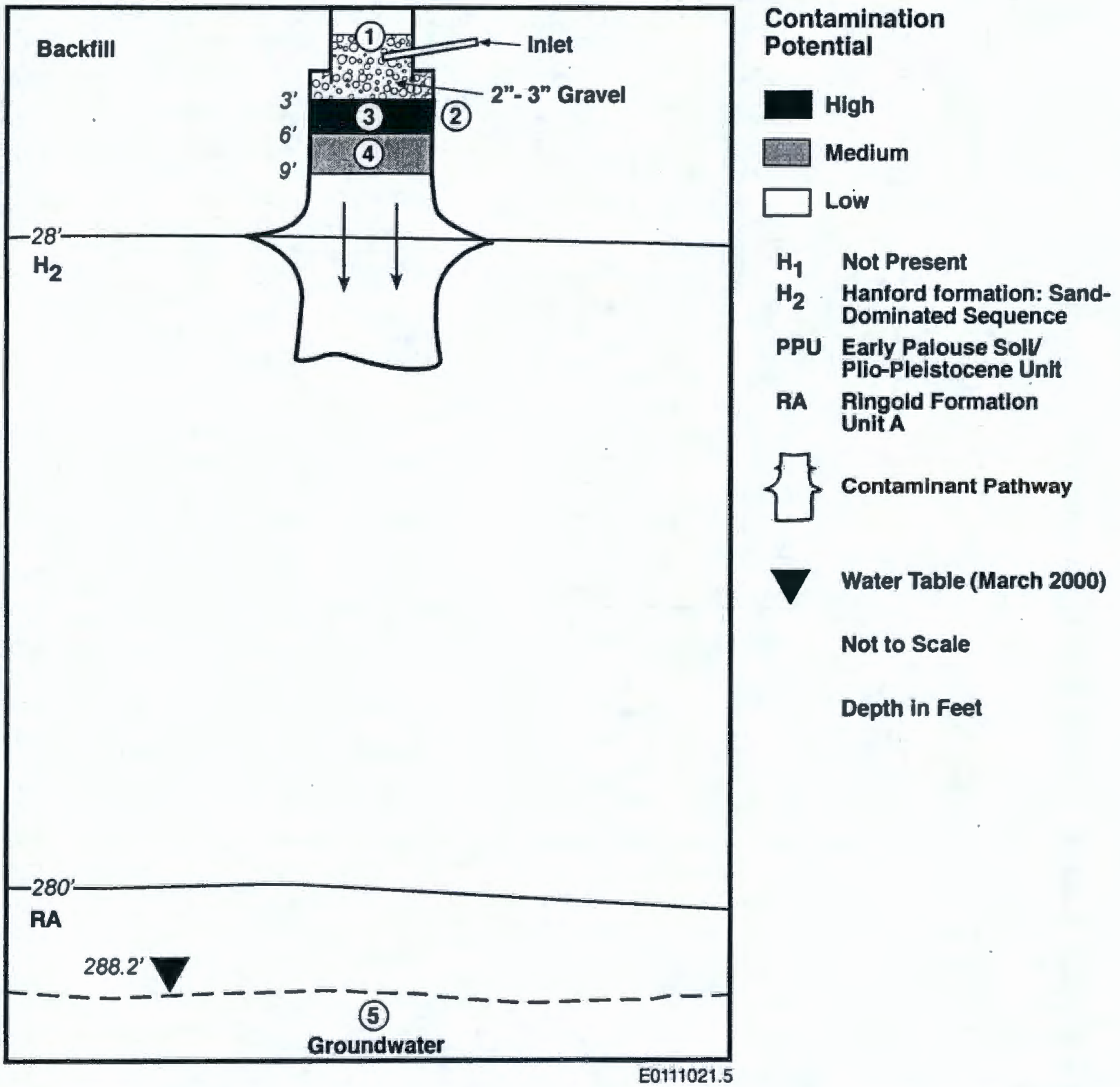
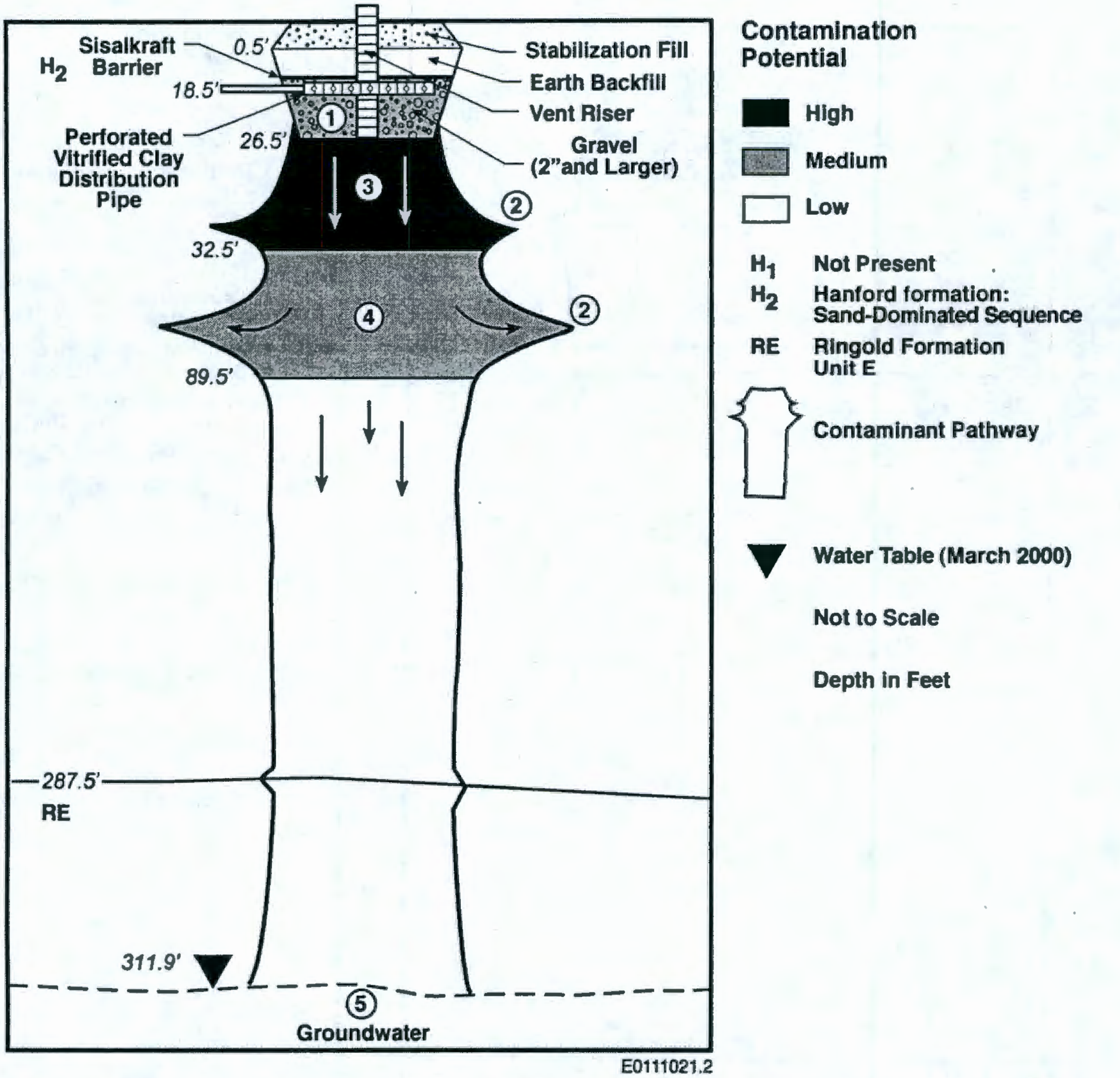


Figure 1-7. Preliminary Conceptual Contaminant Distribution Model for the 200-E-4 French Drain.



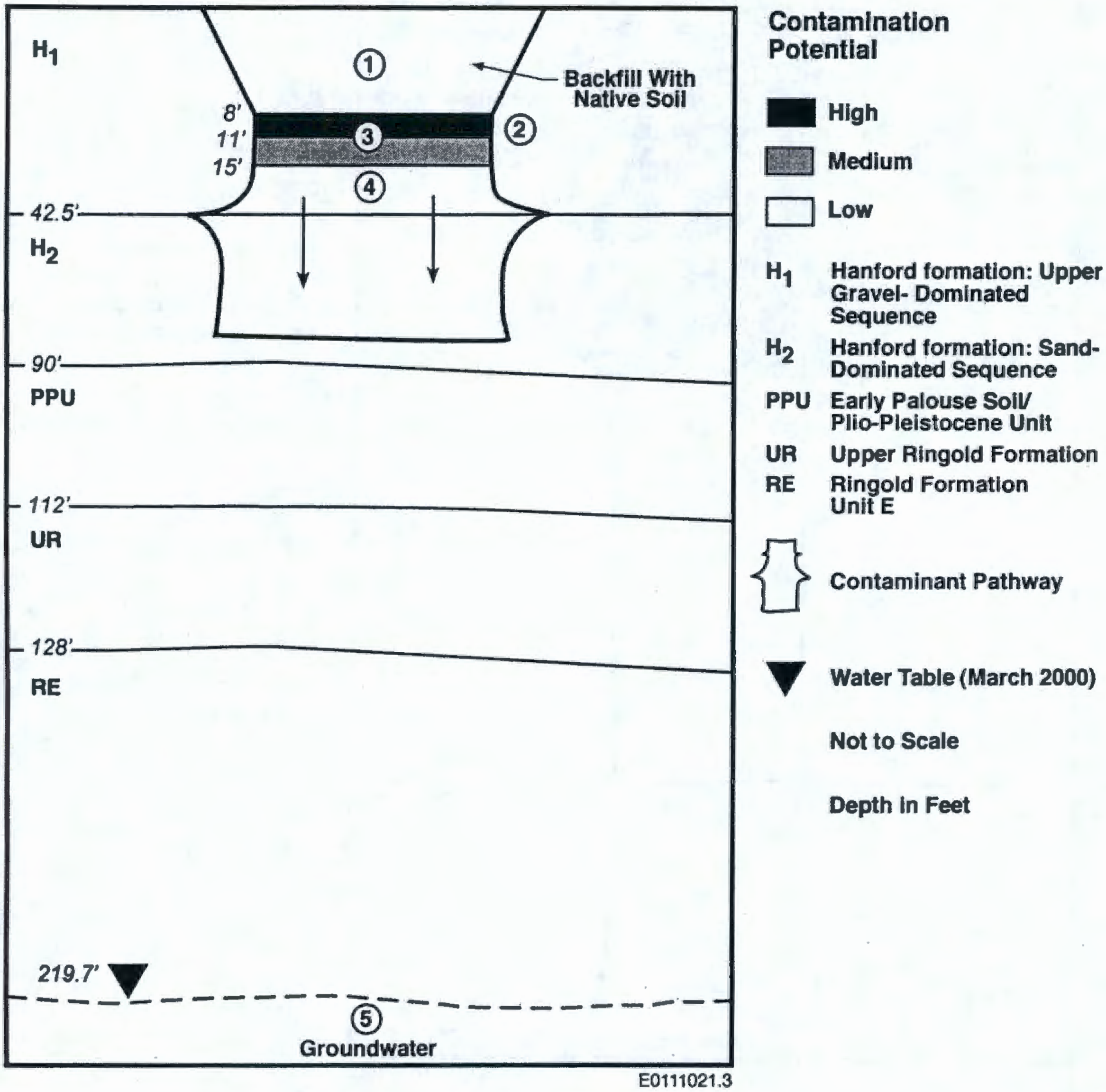
1. Low organic/low inorganic liquid wastes were discharged to the french drain between 1958 and 1983. Any radioactive constituents present are due to cross-contamination from other systems. The volume of wastewater received by the french drain is undetermined but was probably very low because the waste consisted of steam condensate from a valve pit and an equipment room. Limited data are available to evaluate contaminant distribution at this site.
2. After being discharged, wastewater and contaminants migrate vertically downward beneath the french drain within backfill. Little or no lateral spreading occurs; however, the lack of spreading is only partially supported by borehole data. The nearest borehole was 299-E27-126, located about 38 ft to the southwest. Borehole 299-E27-126 was drilled and decommissioned in 1980, and no geophysical logging was performed and no contamination was detected above background levels. The nearest groundwater well is 299-E24-8, located about 409 ft to the southeast.
3. Immobile contaminants (e.g., cesium-137) normally sorb near the point of release (approximately 3 ft bgs). Contaminant concentrations decrease with depth.
4. Mobile contaminants (e.g., nitrate) migrate with the moisture front beneath the french drain.
5. Wastewater and mobile contaminants likely do not impact groundwater because the effluent volume discharged to the soil column is assumed to be less than the soil column pore volume. While iodine-129 exceeds groundwater protection standards beneath the french drain, it is not attributed to this site.

Figure 1-8. Preliminary Conceptual Contaminant Distribution Model for the 216-A-4 Crib.



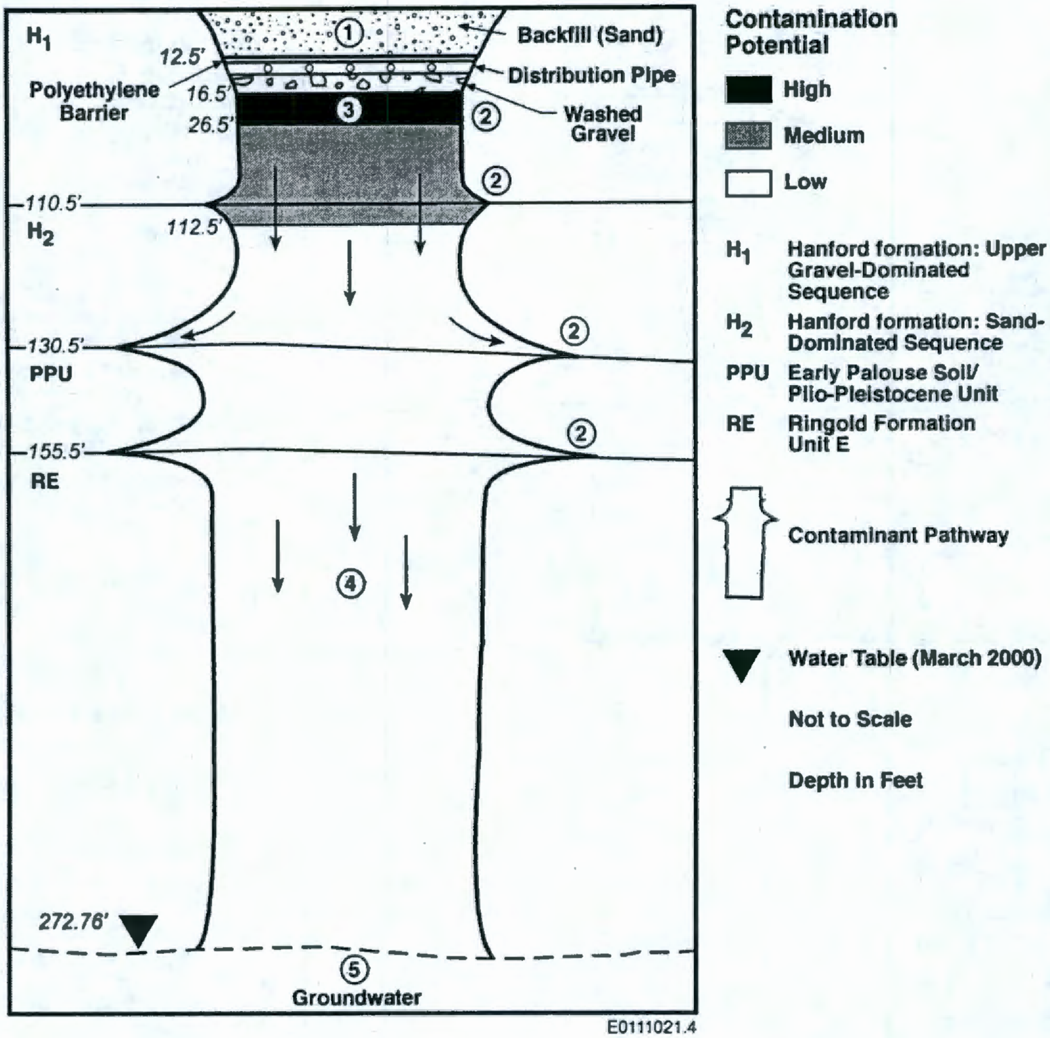
1. Low concentration radioactive and inorganic liquid waste containing uranium, cesium-137, cobalt-60, plutonium-239/240, strontium-90, nitrates, sodium dichromate, and other contaminants was discharged to the crib between 1955 and 1958. The crib received a total volume of 6,210,000 L (1.6 million gal) of liquid waste. In 1958, the crib became plugged, causing liquid to flood the ground surface and contaminate the surface soil. The site is now located within a large area known as the PUREX stabilized area (200-E-103). Only a large green vent riser is visible above the surface.
2. After being discharged, wastewater and contaminants migrate vertically down beneath the crib within H_1, and some lateral spreading occurs. The presence of spreading is supported by geophysical spectral gamma data from well 299-E24-54, located about 6.6 ft to the northeast. No distinct lithologic horizons have been identified associated with the spreading.
3. Immobile contaminants (e.g., cesium-137) normally sorb near the point of release.
4. Mobile contaminants (e.g., nitrate) migrate with the moisture front and may be detected. The activity of cesium-137 decreases with depth, and it is not detected greater than 89.5 ft bgs based on spectral gamma data from well 299-E24-54. Cobalt-60 was detected at low concentrations to a maximum depth of 68.5 ft.
5. Wastewater and mobile contaminants likely impact groundwater since the effluent volume discharged to the soil column (6,210 m^3) is greater than the soil column pore volume (948 m^3). Groundwater concentrations of tritium, iodine-129, and nitrate exceed groundwater protection standards beneath the crib. All of these contaminants may be associated with waste disposal practices at this crib.

Figure 1-9. Preliminary Conceptual Contaminant Distribution Model for the 216-T-13 Trench.



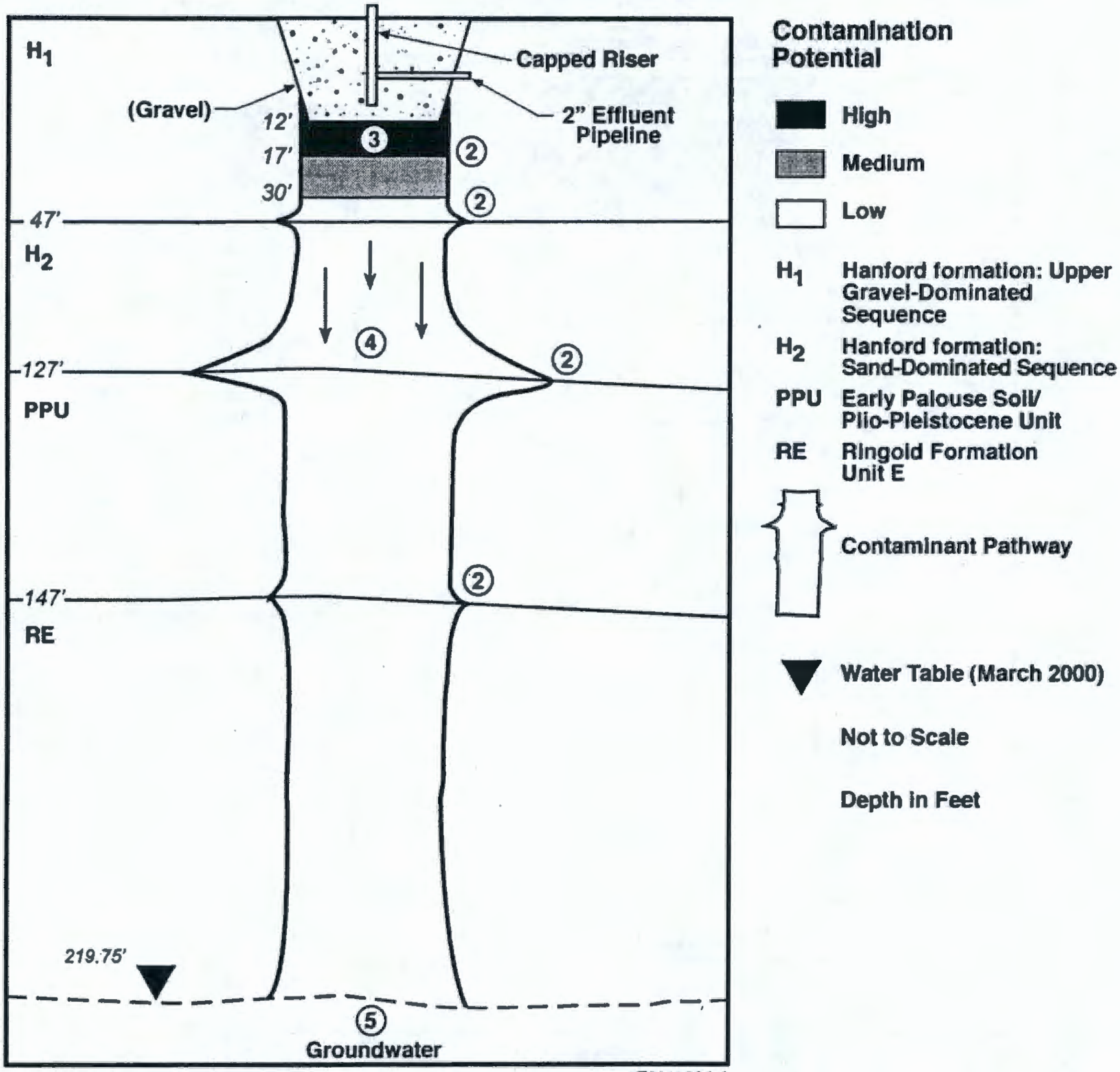
1. Low concentrated radioactive liquid waste containing uranium, cesium-137, strontium-90, plutonium-239/240, and other organic and inorganic contaminants were discharged to the trench between 1954 and 1964 from the decontamination of vehicles. The trench received a total volume of 98,000 L (26,000 gal) of liquid waste. The site was backfilled with soil in 1964. In 1972, approximately 4 yd^3 were excavated from the trench, and the trench was backfilled with soil. Direct data are not available to evaluate contaminant distribution at the site.
2. After being discharged, wastewater and contaminants migrate vertically downward beneath the trench within H_1. Little or no lateral spreading occurs; however, the lack of spreading is only partially supported by geophysical data from well 299-W10-1, located about 85 ft to the south. The geophysical data consist of borehole gross gamma logs obtained during drilling in 1990.
3. Immobile contaminants (e.g., cesium-137) normally sorb near the point of release. Chemicals used to decontaminate equipment may have increased the mobility of contaminants such as cesium-137. Contaminant concentrations decrease with depth.
4. Mobile contaminants (e.g., nitrate) migrate with the moisture front and may be detected to about 80 ft.
5. Wastewater and contaminants from the trench suggest no impact to groundwater because the effluent volume discharged to the soil column (9.8 m^3) is less than the soil column pore volume (716 m^3). While nitrate, trichloroethylene, and carbon tetrachloride exceed groundwater protection standards beneath the trench, only trichloroethylene may have been associated with waste disposal practices at this trench.

Figure 1-10. Preliminary Conceptual Contaminant Distribution Model for the 216-T-33 Crib.



1. Low concentration radioactive liquid waste containing uranium, cesium-137, strontium-90, plutonium-239/240 and other organic and inorganic contaminants were discharged to the crib between January 1963 and February 1963. The crib is reported to have received a total volume of 1,900,000 L (500,000 gal) of equipment decontamination liquid waste. Direct data are not available to evaluate contaminant distribution at this site.
2. After being discharged, liquid wastewater and contaminants migrate vertically downward beneath the crib within H_1. Little or no lateral spreading occurs; however, the lack of spreading is only partially supported by geophysical data from well 299-W11-14, located about 30 ft to the north. The geophysical data consist of borehole gross gamma logs obtained from the well in 1968, 1976, and 1987. Spectral gamma logging has not been performed. Wastewater intersects the H_2 at approximately 105 ft bgs, and minor spreading of wastewater contaminants may occur associated with this unit. Waste liquid and more mobile contaminants intersect the Plio-Pleistocene Unit, approximately 125 ft bgs; lateral spreading of wastewater and contaminants may occur associated with this unit. If spreading occurs, it is to the southeast based on the topography of the Plio-Pleistocene Unit. Sorption is expected in the Plio-Pleistocene Unit. Effluent waste liquid and more mobile contaminants intersect the Ringold Unit E at approximately 150 ft bgs. Lateral spreading of wastewater and contaminants may occur associated with this unit.
3. Immobile contaminants (e.g., cesium-137) normally sorb near the point of release. Chemicals used to decontaminate equipment may have increased the mobility of contaminants (e.g., cesium-137). Contaminant concentrations decreased with depth.
4. Mobile contaminants (e.g., nitrate) migrate with the moisture front beneath the crib and may be detected in low concentrations in the water table.

Figure 1-11. Preliminary Conceptual Contaminant Distribution Model for the 216-U-3 French Drain.



E0111021.1

1. Low salt, neutral/basic, low organic radioactive liquid waste containing uranium, cesium-137, strontium-90, plutonium-239/240, and other contaminants were discharged to the french drain between 1954 and 1955. The primary gamma-emitters are uranium and cesium. The french drain received a total volume of 791,000 L (209,000 gal) of wastewater. Limited data are available to evaluate contaminant distribution at this site.
2. After being discharged, wastewater and contaminants migrate vertically downward beneath the french drain within H_1. Little or no lateral spreading occurs; however, the lack of spreading is only partially supported by borehole data. The nearest well is 299-W19-1, located about 120 ft to the east. The geophysical data consist of gross gamma logs obtained in 1987. No spectral gamma logs have been run. Wastewater intersects the H_2 at approximately 47 ft bgs. Minor spreading of wastewater contaminants may occur associated with this unit. Effluent and more mobile contaminants intersect the Plio-Pleistocene Unit at approximately 127 ft bgs, and lateral spreading of wastewater and contaminants may occur associated with this unit. If spreading occurs, it is to the southeast based on the topography of the Plio-Pleistocene Unit. Sorption is expected in the Plio-Pleistocene Unit. Effluent and more mobile contaminants intersect the Ringold Unit E at approximately 147 ft bgs. Lateral spreading of wastewater and contaminants may occur associated with this unit.
3. Immobile contaminants (e.g., cesium-137) normally sorb near the point of release. Contaminant concentrations decrease with depth.
4. Mobile contaminants (e.g., nitrate) migrate with the moisture front beneath the french drain and may be detected in low concentrations in the water table.
5. Wastewater and contaminants likely impact groundwater because the effluent volume discharge to the soil column (791 m^3) is greater than the soil column pore volume (39 m^3). While carbon tetrachloride exceeds groundwater protection standards beneath the french drain, it is not attributed to this waste site.

2.0 STEP 2 – IDENTIFY THE DECISION

The purpose of DQO Step 2 is to define the principal study questions (PSQs) that need to be resolved to address the problems identified in DQO Step 1 and the alternative actions (AAs) that would result from resolution of the PSQs. The PSQs and AAs are then combined into decision statements (DSs) that express a choice among AAs. Table 2-1 presents the task-specific PSQs, AAs, and resulting DSs. This table also provides a qualitative assessment of the severity of the consequences of taking an AA if it is incorrect. This assessment takes into consideration human health and the environment (flora/fauna) and political, economic, and legal ramifications. The severity of the consequences is expressed as low, moderate, or severe.

Table 2-1. Summary of DQO Step 2 Information. (2 Pages)

PSQ-AA #	Alternative Action	Consequences of Erroneous Actions	Severity of Consequences
PSQ #1 – Are the contaminant concentrations TRU waste or greater than Class C[a]?			
1-1	Evaluate special remedial alternatives in a FS.	Special remedial alternatives for the waste sites will be unnecessarily developed during the FS. The remedial alternative will unnecessarily incorporate costly and difficult processes for handling TRU waste definition or greater than Class C contaminated soil.	Low
1-2	Evaluate conventional remedial action alternatives in a FS.	The FS and associated remedial action will not plan for special remedial alternatives necessary for handling TRU waste definition or greater than Class C contaminated soils. These soils might be incorrectly managed and disposed. Workers could be exposed to unacceptable levels of radioactively contaminated soils during remediation.	Moderate (Additional samples will be collected during the confirmatory sampling phase to confirm waste profiles.)
DS #1 – Determine whether the contaminant concentrations are TRU waste definition or greater than Class C and evaluate special remedial alternatives in a FS, or evaluate conventional remedial alternatives in a FS.			
PSQ #2 – Is the soil radiologically contaminated?[a]			
2-1	Evaluate remedial alternatives in a FS.	The site may be inappropriately remediated resulting in unnecessary expenditure of funds.	Low
2-2	Evaluate the site for closure with no remedial action.	The site may inappropriately be closed without remedial action, increasing risks of potential exposure to workers and the environment.	Moderate (Additional samples will be collected during the confirmatory sampling phase to confirm waste profiles.)
DS #2 – Determine whether the soil is radiologically contaminated and evaluate remedial alternatives in a FS, or evaluate the site for closure with no remedial action.			

Table 2-1. Summary of DQO Step 2 Information. (2 Pages)

PSQ-AA #	Alternative Action	Consequences of Erroneous Actions	Severity of Consequences
PSQ #3 – Is the soil chemically contaminated[a]?			
3-1	Evaluate remedial alternatives in a FS.	The site may be inappropriately remediated resulting in unnecessary expenditure of funds.	Low
3-2	Evaluate the site for closure with no remedial action.	The site may inappropriately be closed without remedial action, increasing risks of potential exposure to workers and the environment.	Moderate
DS #3 – Determine whether the soil is chemically contaminated and evaluate remedial alternatives in a FS, or evaluate the site for closure with no remedial action.			

[a] Refer to Table 1-9 for scenario-specific ARARs and PRGs.

3.0 STEP 3 – IDENTIFY THE INPUTS TO THE DECISION

The purpose of DQO Step 3 is to identify the types of data needed to resolve each of the DSs identified in DQO Step 2. The data may already exist or may be derived from computational or surveying/sampling and analysis methods. Analytical performance requirements (e.g., practical quantitation limit [PQL], precision, and accuracy) are also provided in this step for any new data that need to be collected.

3.1 INFORMATION REQUIRED TO RESOLVE DECISION STATEMENTS

Table 3-1 specifies the information (data) required to resolve each of the DSs identified in Table 2-1 and identifies whether the data already exist. For the data that are identified as existing, the source references for the data have been provided with a qualitative assessment regarding whether or not the data are of sufficient quality to resolve the corresponding DS.

Table 3-1. Required Information and Reference Sources. (3 Pages)

PSQ #	Required Information Category	Do Data Exist? (Y/N)	Source Reference	Are Available Data of Sufficient Quality and Quantity to Support RI/FS Process? (Y/N)				Are Additional Data Required to Support RI/FS Process? (Y/N)			
				U-3	T-13/33	E-4	A-4	U-3	T-13/33	E-4	A-4
1 and 2	Soil radiological data	Y	*T Plant Source Aggregate Area Management Study Report*, DOE/RL-91-61, Rev. 0 (DOE-RL 1993e).	[a]	N	[a]	[a]	Y[b]	Y	Y[b]	Y[b]
			U Plant Source Aggregate Area Management Study Report, DOE/RL-91-52, Rev. 0 (DOE-RL 1992b).	N	[a]	[a]	[a]	Y	Y[b]	Y[b]	Y[b]
			PUREX Plant Source Aggregate Area Management Study Report, DOE/RL-92-04, Rev. 0 (DOE-RL 1993c).	[a]	[a]	[a]	N	Y[b]	Y[b]	Y[b]	Y
			Inventory of Chemicals Used at Hanford Site Production Plants and Support Operations (1944-1980), WHC-EP-0172, Rev. 1 (WHC 1990).	N	N	N	N	Y	Y	Y	Y
			Evaluation of Scintillation Probe Profiles from 200 Area Crib Monitoring Wells, ARH-ST-156 (Fecht et al. 1977). Provides scintillation logs with gross gamma readings for boreholes located near the waste sites.	N	N	[a]	N	Y	Y	Y	Y
			Duratek geophysical logging project files, which provide borehole geophysical logging data for gamma-emitting radionuclides.	N	N	N	N	Y	Y	Y	Y
			Semiworks Source Aggregate Area Management Study Report, DOE/RL-92-18, Rev. 0 (DOE-RL 1993d)	[a]	[a]	N	[a]	Y[b]	Y[b]	Y	Y[b]
			Waste Site Grouping for 200 Areas Soil Investigations, DOE/RL-96-81, Rev. 0 (DOE-RL 1997). Provides existing information for the wastes sent to these OUs.	N	N	N	N	Y	Y	Y	Y

Table 3-1. Required Information and Reference Sources. (3 Pages)

PSQ #	Required Information Category	Do Data Exist? (Y/N)	Source Reference	Are Available Data of Sufficient Quality and Quantity to Support RI/FS Process? (Y/N)				Are Additional Data Required to Support RI/FS Process? (Y/N)			
				U-3	T-13/33	E-4	A-4	U-3	T-13/33	E-4	A-4
3	Soil nonradiological sample data	Y	*Waste Site Grouping for 200 Areas Soil Investigations*, DOE/RL-96-81, Rev. 0 (DOE-RL 1997). Provides existing information for the wastes sent to these OUs.	N	N	N	N	Y	Y	Y	Y
			HEIS database (from PUREX V-11 tank characterization for transfer to the Effluent Treatment Facility).	[a]	[a]	[a]	N	Y[b]	Y[b]	Y[b]	Y
N/A	Groundwater data	Y	See Section 1-4.	Groundwater data cannot be used to validate a vadose zone preliminary conceptual contaminant distribution model.							
1, 2, and 3	Physical properties moisture content, particle size distribution, and lithology	Y	*Hydrogeologic Model for the 200-East Groundwater Aggregate Area*, WHC-SD-EN-TI-014, Rev. 0 (WHC 1992a). Presents site-specific data for 200 East Area that can be used to calculate soil density, hydraulic conductivity, and porosity.	[a]	[a]	N	N	Y[b]	Y[b]	Y	Y
			Hydrogeologic Model for the 200-West Groundwater Aggregate Area, WHC-SD-EN-TI-290, Rev. 0 (WHC 1992b). Presents site-specific data for 200 West Area that can be used to calculate soil density, hydraulic conductivity, and porosity.	N	N	[a]	[a]	Y	Y	Y[b]	Y[b]

Table 3-1. Required Information and Reference Sources. (3 Pages)

PSQ #	Required Information Category	Do Data Exist? (Y/N)	Source Reference	Are Available Data of Sufficient Quality and Quantity to Support RI/FS Process? (Y/N)				Are Additional Data Required to Support RI/FS Process? (Y/N)			
				U-3	T-13/33	E-4	A-4	U-3	T-13/33	E-4	A-4
1, 2, and 3	Distribution coefficients	Y	*Composite Analysis for Low-Level Waste Disposal in the 200 Area Plateau of the Hanford Site*, PNNL-11800 (PNNL 1998). Provides 200 Area distribution coefficients for various waste stream types and Hanford soils.	Y	Y	Y	Y	N	N	N	N
			Geochemical Data Package for the Hanford Immobilized Low-Activity Tank Waste Performance Assessment (ILAW PA), PNNL-13037, Rev. 1 (Kaplan and Serne 2000). Provides 200 Area distribution coefficients for various waste stream types and Hanford soils.	Y	Y	Y	Y	N	N	N	N
			Phase I Remedial Investigation Report for 200-BP-1 Operable Unit, DOE/RL-92-70. Rev. 0 (DOE-RL 1993b). Provides 200 Area distribution coefficients for Hanford soils and groundwater.	Y	Y	Y	Y	N	N	N	N
1 and 2	RESRAD input data	Y	*Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD, Version 5.0*, ANL-EAD-LD-2 (ANL 1993). Input parameters are defined in this manual that can be determined based on existing information or RESRAD defaults.	N/A	N/A	N/A	N/A	Y	Y	Y	Y

[a] Document does not pertain to this waste site; no site-specific information included for the site.
[b] Decision on additional data is not relevant for the document, as no site-specific information for this waste site is included in this document.
N/A = not applicable

3.2 BASIS FOR SETTING THE PRELIMINARY ACTION LEVEL

The preliminary action level is the threshold value that provides the criterion for choosing between AAs. Table 3-2 identifies the basis (i.e., regulatory threshold or risk-based) for establishing the preliminary action level for each of the COCs. The numerical value for the action level is defined in DQO Step 5.

Table 3-2. Basis for Setting Preliminary Action Level.

DS #	COCs	Basis for Setting Preliminary Action Level
1	TRU-contaminated soils	DOE's definition for TRU waste (DOE O 435.1).
	Greater than Class C	10 CFR 61.55
2	Radiological COCs	Radiological lookup values for shallow zone (i.e., less than 4.6 m [15 ft]) soils based on RESRAD analyses for the applicable scenarios. Deep zone (i.e., greater than 4.6 m [15 ft] deep) lookup values will be determined using RESRAD, STOMP, or another model.
3	Nonradiological COCs	MTCA Method C cleanup levels with contaminant-specific variations.

3.3 COMPUTATIONAL AND SURVEY/ANALYTICAL METHODS

Table 3-3 identifies the DSs where existing data either do not exist or are of insufficient quality to resolve the DSs. For these DSs, Table 3-3 presents computational and/or surveying/sampling methods that could be used to obtain the required data.

Table 3-3. Information Required to Resolve the Decision Statements.[a] (2 Pages)

DS #	Remedial Investigation Variable	Required Data	Computational Methods	Survey/Analytical Methods
1 and 2	Concentrations of radiological COCs in vadose zone soils	• Alpha, beta, and gamma COC concentrations in soils for evaluation against ARARs and PRGs • Location data (vertical extent of COCs within waste site boundaries)	• RESRAD – analytical modeling method for human health dose assessment • STOMP or other analytical code – analytical modeling through vadose zone to groundwater	• Field screening with radiological detection equipment • Geophysical borehole logging with downhole radiological detectors • Soil sampling and laboratory analysis

Table 3-3. Information Required to Resolve the Decision Statements.[a] (2 Pages)

DS #	Remedial Investigation Variable	Required Data	Computational Methods	Survey/Analytical Methods
3 and 4	Concentrations of nonradiological COCs in vadose zone soils	• Nonradiological (e.g., inorganic metals and anions, and SVOCs) COC concentrations in soils for evaluation against ARARs and PRGs • Location data (vertical extent of COCs within waste site boundaries)	• MTCA risk assessment • STOMP or other analytical code – analytical modeling through vadose zone to groundwater	• Soil sampling and laboratory analysis
All	Physical properties in vadose zone soils	• Moisture content, bulk density, particle size distribution	• Direct comparison to existing models to determine conductivity	• Soil sampling and laboratory analysis

[a] See Table 3-5 for additional information.
SVOC = semi-volatile organic compound

Table 3-4 presents details on the computational methods identified in Table 3-3. These details include the source and/or author of the computational method and information on how the method could be applied to this study.

Table 3-4. Details on Identified Computational Methods.

DS #	Computational Method	Source/ Author	Application to Study	Satisfy Input Req't?
1 and 2	RESRAD	Argonne National Laboratory	RESRAD will be used to estimate direct human radiation exposure to account for radioactive decay.	Yes
1, 2, and 3	STOMP code or other analytical codes	PNNL	Estimates the migration of all contaminants (radiological and nonradiological) through the vadose zone to groundwater. The model requires site-specific geohydrologic soil properties such as hydraulic conductivity, moisture, etc. Other codes may be identified and used based on specific site conditions and requirements.	Yes

PNNL = Pacific Northwest National Laboratory

Table 3-5 identifies each of the survey and/or analytical methods that may be used to provide the required information needed to resolve each of the DSs. The possible limitations associated with each of these methods are also provided.

Table 3-5. Potentially Appropriate Survey and/or Analytical Methods. (3 Pages)

Media	Remediation Variable	Potentially Appropriate Survey/Analytical Method	Possible Limitations
Field Screening			
Fine-grained materials, structures	Site location; underground structures or interferences	GPR	GPR is a radar-reflection surface geophysical survey technique that detects contrasts in di-electric constants in the below-grade environments from the surface. Requires subjective interpretation of the reflected signals. Lack of reflective below-grade surfaces or the presence of interfering matrices can complicate or invalidate the findings. The presence of nearby buildings and utilities can interfere with reflected signals. Fines (e.g., clay and heavy fly ash) can act as a reflector to the radar signal.
Fine-grained materials, structures	Site location; underground structures or interferences	EMI	EMI is a surface geophysical survey technique that measures electrical conductivity in below-grade soils based on detected changes in electrical fields. The results of EMI are generally used to support the interpretation of GPR surveys. Nearby buildings and utilities can cause interferences.
Vadose zone soils	Gross and isotopic gamma emissions	Cone penetrometer; NaI detector logging	A closed-end rod is pushed into the soil to the desired depth. A small-diameter NaI detector (or other suitable detector) is used to log the gross gamma response with depth. The cone penetrometer is not effective in cobbly or rocky soils.
Vadose zone soils	Gross and isotopic gamma emissions	Direct push; NaI detector logging	A small-diameter casing is pushed into the soil to the desired depth. A small-diameter NaI detector (or other suitable detector) is used to log the gamma response with depth. Direct-push methods (e.g., GeoProbe®) may be ineffective in cobbly or rocky soils.

Table 3-5. Potentially Appropriate Survey and/or Analytical Methods. (3 Pages)

Media	Remediation Variable	Potentially Appropriate Survey/Analytical Method	Possible Limitations
	Gamma emissions from fission products, Am-241 and Pu-239	Borehole SGL with HPGe detector	Gamma-ray logging provides the concentration profiles of gamma-emitting radionuclides such as Am-241, Pu-239, and many fission products in a borehole environment. It is considered by some to be more accurate than sampling and laboratory assay because the assay is performed in situ with less disturbance of the sample, there is higher vertical spatial resolution, and the sample size is much larger. This method may also be more economical than traditional sampling and analysis. This method does not assess radionuclides or daughter products that do not emit gamma rays. The gamma energies from these isotopes are at the low end of the spectrum, which results in high numerical minimum detectable activities and possible matrix effects from other isotopes. This technique requires the use of a single casing (installed by drilling or driving) in contact with the soil formation.
	Neutron emissions from plutonium	Borehole passive neutron logging	Passive neutron logging provides indication of the presence of neutron-emitting isotopes. Because of the very low incidence of spontaneous Pu fission and alpha-N reactions, the passive neutron profile is orders of magnitude lower than the gamma emissions.
	Active neutron emissions from transuranics	Borehole passive/active neutron-logging methods	This technique uses source materials or generators to release neutrons into the soil formation. Passive detectors measure the response to the neutron flux as a means of detecting specific transuranic constituents. Although neutron activation methods have been developed, they are not expected to be useful for this initial characterization effort. At present, these techniques are too expensive and time consuming, and logistical problems are associated with the handling of intense sources or generators.
	Vertical moisture profile	Borehole neutron-neutron moisture logging	Neutron-neutron moisture logs can be used to determine current moisture content profiles of the subsurface through new or existing boreholes. The moisture profiles are often directly correlated to contaminant concentrations, sediment grain size, composition, or subsurface structural features. For this project, the moisture profile may be useful for helping determine the location of contamination and/or the location of the ditch and establish geologic conditions to support contaminant fate and transport modeling. It may also be correlated to reflections identified in ground-probing radar surveys.

Table 3-5. Potentially Appropriate Survey and/or Analytical Methods. (3 Pages)

Media	Remediation Variable	Potentially Appropriate Survey/Analytical Method	Possible Limitations
Laboratory Samples			
Vadose zone soils	All COCs and physical properties	Laboratory analysis	Highly contaminated samples require use of onsite laboratories, with associated impacts (e.g., high cost, reduced analyte lists, matrix effects, degraded detection limits, and long turnaround times). Lower contamination levels allow use of offsite laboratories, avoiding these limitations. Physical property analysis will include bulk density, moisture content, and particle size distribution.

GeoProbe® is a registered trademark of GeoProbe Systems, Salinas, Kansas.
EMI = electromagnetic imaging
GPR = ground-penetrating radar
HPGe = high-purity germanium
NaI = sodium iodide
SGL = spectral gamma logging

3.4 ANALYTICAL PERFORMANCE REQUIREMENTS

Table 3-6 defines the analytical performance requirements for the data that need to be collected to resolve each of the DSs. These performance requirements include the PQL and the precision and accuracy requirements for each of the COCs.

Table 3-6. Analytical Performance Requirements – Shallow and Deep Zone Soils. (5 Pages)

COCs	CAS #	Preliminary Action Level [a]			Name/Analytical Technology [c]	Required Target Quantitation Limits [d]				Precision Water	Accuracy Water	Precision Soil	Accuracy Soil
		15 mrem/yr [b] (pCi/g)	500 mrem/yr [b] (pCi/g)	GW Protection [b] (pCi/g)		Water Low Activity (pCi/L)	Water High Activity (pCi/L)	Soil-Other Low Activity (pCi/g)	Soil-Other High Activity (pCi/g)				
Americium-241	14596-10-2	335	112,000	N/A	Americium isotopic – AEA	1	400	1	4,000	±20%	80-120%	±35%	65-135%
Cesium-137	10045-97-3	23.4	780	N/A	GEA	15	200	0.1	2,000	±20%	80-120%	±35%	65-135%
Cobalt-60	10198-40-0	4.90	164	N/A	GEA	25	200	0.05	2,000	±20%	80-120%	±35%	65-135%
Europium-152	14683-23-9	11.4	388	N/A	GEA	50	200	0.1	2,000	±20%	70-130%	±35%	70-130%
Europium-154	15585-10-1	10.3	345	N/A	GEA	50	200	0.1	2,000	±20%	70-130%	±35%	70-130%
Europium-155	14391-16-3	426	14,200	N/A	GEA	50	200	0.1	2,000	±20%	70-130%	±35%	70-130%
Iodine-129	15046-84-1	--	--	--	Chemical separation low-energy photon spectroscopy	5	N/A	2	N/A	±20%	70-130%	±35%	70-130%
Plutonium-238	13981-16-3	470	15,700	N/A	Plutonium isotopic – AEA	1	130	1	1,300	±20%	80-120%	±35%	65-135%
Plutonium-239/240	Pu-239/240	425	14,200	N/A	Plutonium isotopic – AEA	1	130	1	1,300	±20%	80-120%	±35%	65-135%
Strontium-90	Rad-Sr	2,410	80,300	N/A	Total radioactive strontium – GPC	2	80	1	800	±20%	80-120%	±35%	65-135%
Technetium-99	14133-76-7	412,000	13,700,000	171	Technetium-99 – liquid scintillation	15	400	15	4,000	±20%	80-120%	±35%	65-135%
Tritium (H-3)	10028-17-8	66,900	2,230,000	4,100	Tritium – liquid scintillation	400	400	400	400	±20%	80-120%	±35%	65-135%
Uranium-233/234	13966-29-5	2,660	88,800	39.5	Uranium isotopic – AEA (pCi) ICPMS (mg)	1	0.002 mg/L	1	0.02 mg/kg	±20%	80-120%	±35%	65-135%
Uranium-235/236	15117-96-1	101	3,370	3.92	Uranium isotopic – AEA (pCi) ICPMS (mg)	1	0.002 mg/L	1	0.02 mg/kg	±20%	80-120%	±35%	65-135%
Uranium-238	U-238	504	16,800	38.1	Uranium isotopic – AEA (pCi) ICPMS (mg)	1	0.002 mg/L	1	0.02 mg/kg	±20%	80-120%	±35%	65-135%

Table A-7. Analytical Performance Requirements – Shallow and Deep Zone Soils. (5 Pages)

COCs	CAS #	Preliminary Action Level [a]			Name/Analytical Technology	Required Target Quantitation Limits [d]				Precision Water	Accuracy Water	Precision Soil	Accuracy Soil
		MTCA Method C [e] (mg/kg)	GW Protection [f] (mg/kg)	Terrestrial Biota Protection [g] (mg/kg)		Water Low Conc. (mg/L)	Water High Conc. (mg/L)	Soil-Other Low Conc. (mg/kg)	Soil-Other High Conc. (mg/kg)				
Metals													
Cadmium	7440-43-9	139 [h]	0.81 [i]	4	Metals – 6010 – ICP	0.005	0.01	0.5	1	j	j	j	j
					Metals – 6010 [c] – ICP (trace)	0.005	N/A	0.5	N/A	j	j	j	j
Chromium (total)	7440-47-3	Unlimited	2,000 [f]	42	Metals – 6010 – ICP	0.01	0.01	1	2	j	j	j	j
					Metals – 6010 – ICP (trace)	0.01	N/A	1	N/A	j	j	j	j
Chromium VI	18540-29-9	21 [h]	7.7 [k]	42	Chromium (hexavalent) – 7196 – colorimetric	0.01	4	0.5	200	j	j	j	j
Copper	7440-50-8	130,000	22 [i]	50	Metals – 6010 – ICP	0.025	0.025	2.5	2.5	j	j	j	j
Lead	7439-92-1	1,000 [l]	840 [k]	50	Metals – 6010 – ICP	0.1	0.2	10	20	j	j	j	j
					Metals – 6010 – ICP (trace)	0.01	N/A	1	N/A	j	j	j	j
Mercury	7439-97-6	1,050	0.33 [i]	0.33 [l]	Mercury – 7470 – CVAA	0.0005	0.005	N/A	N/A	j	j	j	j
					Mercury – 7471 – CVAA	N/A	N/A	0.2	0.2	j	j	j	j
Silver	7440-22-4	17,500	0.88 [f]	2	Metals – 6010 – ICP	0.02	0.02	2	2	j	j	j	j
					Metals – 6010 – ICP (trace)	0.005	N/A	0.5	N/A	j	j	j	j
Uranium (total)	7440-61-1	10,500 [m]	115	5	Uranium total – kinetic phosphorescence analysis	0.0001	0.02	1	0.2	±20%	80-120%	±35%	65-135%
Inorganics													
Cyanide	57-12-5	70,000	0.80 [f]	N/A	Total cyanide – 9010 – colorimetric	0.005	0.005	0.5	0.5	j	j	j	j
Fluoride	16984-48-8	210,000	16 [f]	N/A	Anions – 300.0 – IC	0.5	5	5	5	j	j	j	j
Nitrate	14797-55-8	Unlimited	40 [f]	N/A	Anions – 300.0 – IC	0.25	10	2.5	40	j	j	j	j
Nitrite	14797-65-0	350,000	4 [f]	N/A	Anions – 300.0 – IC	0.25	15	2.5	20	j	j	j	j
Phosphate	14265-44-2	N/A	N/A	N/A	Anions – 300.0 – IC	0.5	15	5	40	j	j	j	j
Sulfate	14808-79-8	N/A	1,000 [f]	N/A	Anions – 300.0 – IC	0.5	15	5	40	j	j	j	j
Organics													
Acetone (2-propanone)	67-64-1	350,000	3.21	N/A	Volatile organics – 8260 – GCMS	0.02	0.02	0.02	0.02	j	j	j	j
Benzene	71-43-2	2,390	2.42	N/A	Volatile organics – 8260 – GCMS	0.005	0.005	0.005	0.005	j	j	j	j
n-butyl alcohol	71-36-3	350,000	6.62	N/A	GC organic – 8015	5	5	5	5	j	j	j	j

Table A-7. Analytical Performance Requirements – Shallow and Deep Zone Soils. (5 Pages)

COCs	CAS #	Preliminary Action Level [b]			Name/Analytical Technology	Required Target Quantitation Limits [d]				Precision Water	Accuracy Water	Precision Soil	Accuracy Soil
		MTCA Method C [e] (mg/kg)	GW Protection [f] (mg/kg)	Terrestrial Biota Protection [g] (mg/kg)		Water Low Conc. (mg/L)	Water High Conc. (mg/L)	Soil-Other Low Conc. (mg/kg)	Soil-Other High Conc. (mg/kg)				
Butyl benzene; n	104-51-8	N/A	N/A	N/A	Volatile organics – 8260 – GCMS	0.005	N/A	0.005	N/A	N/A	N/A	N/A	N/A
Dichloroethane; 1,1	75-34-3	350,000	4.37	N/A	Volatile organics – 8260 – GCMS	0.01	0.01	0.01	0.01	[j]	[j]	[j]	[j]
Dichloroethane; 1,2	107-06-2	1,440	0.005 [e]	N/A	Volatile organics – 8260 – GCMS	0.005	0.005	0.005	0.005	[j]	[j]	[j]	[j]
Dichloroethylene; 1,2- (trans)	156-60-5	31,500	0.36 [f]	N/A	Volatile organics – 8260 – GCMS	0.001	0.001	0.001	0.001	[j]	[j]	[j]	[j]
Dichloroethylene; 1,2-cis-	156-59-2	31,500	0.36 [f]	N/A	Volatile organics – 8260 – GCMS	0.001	0.001	0.001	0.001	[j]	[j]	[j]	[j]
Ethylbenzene	100-41-4	350,000	6.91	N/A	Volatile organics – 8260 – GCMS	0.005	0.005	0.005	0.005	[j]	[j]	[j]	[j]
Methyl ethyl ketone (MEK; 2-butanone)	78-93-3	Unlimited	N/A	N/A	Volatile organics – 8260 – GCMS	0.01	0.01	0.01	0.01	[j]	[j]	[j]	[j]
Methyl isobutyl ketone (MIBK hexone)	108-10-1	280,000	N/A	N/A	Volatile organics – 8260 – GCMS	0.01	0.01	0.01	0.01	[j]	[j]	[j]	[j]
Methylene chloride (dichloromethane)	75-09-2	17,500	0.022 [f]	N/A	Volatile organics – 8260 – GCMS	0.005	0.005	0.005	0.005	[j]	[j]	[j]	[j]
PCBs	1336-36-3	10 [i]	0.0165 [e]	0.65	PCBs – 8082 – GC	0.0005	0.005	0.0165	0.1	[j]	[j]	[j]	[j]
Tetrachloroethylene	127-18-4	2,570	0.0091	N/A	Volatile organics – 8260 – GCMS	0.005	0.005	0.005	0.005	[j]	[j]	[j]	[j]
Toluene	108-88-3	70,000	7.3 [f]	200	Volatile organics – 8260 – GCMS	0.005	0.005	0.005	0.005	[j]	[j]	[j]	[j]
Tributyl phosphate	126-73-8	N/A	N/A	N/A	Semi-volatiles – 8270 – GCMS	0.1	0.5	3.3	5	[j]	[j]	[j]	[j]
Trichlorethane; 1,1,1	71-55-6	Unlimited	57	N/A	Volatile organics – 8260 – GCMS	0.005	0.005	0.005	0.005	[j]	[j]	[j]	[j]
Trichloroethylene	79-01-6	11,900	0.0263	N/A	Volatile organics – 8260 – GCMS	0.005	0.005	0.005	0.005	[j]	[j]	[j]	[j]
Xylene (total)	1330-20-7	Unlimited	135	N/A	Volatile organics – 8260 – GCMS	0.005	0.005	0.005	0.005	[j]	[j]	[j]	[j]

Table A-7. Analytical Performance Requirements – Shallow and Deep Zone Soils. (5 Pages)

COCs	CAS #	Preliminary Action Level [a]			Name/Analytical Technology	Required Target Quantitation Limits [d]				Precision Water	Accuracy Water	Precision Soil	Accuracy Soil
		MTCA Method C [e] (mg/kg)	GW Protection [f] (mg/kg)	Terrestrial Biota Protection [g] (mg/kg)		Water Low Conc. (mg/L)	Water High Conc. (mg/L)	Soil-Other Low Conc. (mg/kg)	Soil-Other High Conc. (mg/kg)				
Total petroleum hydrocarbons – diesel to oil range (kerosene)	68334-30-5	2,000 [i]	2,000 [i]	200	WTPH-D [c]	0.5	0.5	5	5	j	j	j	j
Total petroleum hydrocarbons – gasoline range	8006-61-9	30 [i]	30 [i]	100	WTPH-G [c]	0.5	0.5	5	5	j	j	j	j
Normal paraffin hydrocarbons	8008-20-6	2,000 [i]	2,000 [i]	200	Nonhalogenated VOA – 8015M – GC modified for hydrocarbons	0.5	0.5	5	5	j	j	j	j
Normal paraffins (grease; heavy oils)	8008-20-6	2,000 [i]	2,000 [i]	N/A	Oil and grease (total recoverable) – 413.N [b]	2	N/A	200	N/A	j	j	j	j
Field Screening Measurements													
pH	N/A	N/A	N/A	N/A	TBD	TBD		TBD		TBD	TBD	TBD	TBD
Soil Physical Properties													
Bulk density	N/A	N/A	N/A	N/A	D2937, or BHI-EE-05, Procedure 3.9	N/A		wt%		N/A	N/A	N/A	N/A
Lithology	N/A	N/A	N/A	N/A	BHI-EE-01, Procedure 7.0	N/A		Descriptive		N/A	N/A	N/A	N/A
Moisture content	N/A	N/A	N/A	N/A	D2216	N/A		wt%		N/A	N/A	N/A	N/A
Particle size distribution	N/A	N/A	N/A	N/A	D422	N/A		wt%		N/A	N/A	N/A	N/A

Table A-7. Analytical Performance Requirements – Shallow and Deep Zone Soils. (5 Pages)

COCs	CAS #	Preliminary Action Level [a]			Name/Analytical Technology	Required Target Quantitation Limits [d]				Precision Water	Accuracy Water	Precision Soil	Accuracy Soil
		MTCA Method C[e] (mg/kg)	GW Protection[f] (mg/kg)	Terrestrial Biota Protection[g] (mg/kg)		Water Low Conc. (mg/L)	Water High Conc. (mg/L)	Soil-Other Low Conc. (mg/kg)	Soil-Other High Conc. (mg/kg)				

[a]The preliminary action level is the regulatory or risk-based value used to determine appropriate analytical requirements (e.g., detection limits). Remedial action levels will be proposed in the FS, will be finalized in the record of decision, and will drive remediation of the sites.
[b]15 mrem/yr = nonrad worker industrial exposure scenario; 2,000 hrs/yr onsite, 60% indoors, 40% outdoors. 500 mrem/yr = rad-worker industrial scenario; 2,000 hrs/yr onsite, 60% indoors, 40% outdoors. GW = groundwater protection radionuclide values based on RESRAD modeling of drinking water exposure with the entire vadose zone presumed to be contaminated. Groundwater protection may be evaluated using the STOMP code or another model to predict movement of contaminants through the vadose zone.
[c]All four-digit numbers refer to *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods* (EPA 1986).
[d]Water values for sampling quality control (e.g., equipment blanks/rinses) or drainable liquid (if recovered). For both water and soil mediums, matrix effects may impact on a specific sample basis.
[e]*Model Toxics Control Act* (MTCA) Method C industrial soil values for direct exposure from the CLARC Version 3.1 tables, updated August 2001 (Ecology 2001).
[f]Calculated using MTCA Method B drinking water standards as inputs to the MTCA three-phase model for protection of drinking water (*Washington Administrative Code* [WAC] 173-340-747[4], amended February 12, 2001), except as noted.
[g]Value is the lowest concentration for each analyte (adjusted for background) from Tables 749-2 and 749-3 of WAC 173-340-900, amended February 12, 2001.
[h]Calculated using MTCA air cleanup standards from WAC 173-340-750(3)(a)(ii)(B), page 210, equation 750-2, with Washington State Department of Health mass loading of particulates in air of 10^{-4} g/m^3.
[i]Cleanup value is less than Hanford Site soil background. Therefore, the soil background concentration is used as the preliminary action level.
[j]Precision and accuracy requirements as identified and defined in the referenced procedures implemented by laboratory analysis and QA procedures.
[k]Calculated using standards for surface water protection (40 CFR 131 and WAC 173-201A-040) as inputs to the MTCA three-phase model for protection of drinking water (WAC 173-340-747[4], February 12, 2001).
[l]Based on MTCA Method A values from Tables 740-1 and 745-1 of WAC 173-340-900, amended February 12, 2001.
[m]Value based upon nickel or uranium soluble salts value.
[n]Because the calculated groundwater protection action level is less than the soil detection limit, the calculated value is replaced with the required target quantitation limit required of the laboratory.
[o]From "Analytical Methods for Petroleum Hydrocarbons," Publication No. ECY 97-602, June 1997, Washington State Department of Ecology.
[p]From *Methods for Chemical Analysis of Water and Wastes*, EPA-600/4-79-020, March 1983, United States Environmental Protection Agency.

AEA = alpha energy analysis
CAS = Chemical Abstract Services
CVAA = cold vapor atomic absorption
GC = gas chromatograph
GCMS = gas chromatograph/mass spectrometry
GPC = gas proportional counter
GW = groundwater
IC = ion chromatography
ICPMS = inductively coupled plasma mass spectrometer
N/A = not applicable
TBD = to be determined
VOA = volatile organic analysis

4.0 STEP 4 – DEFINE THE BOUNDARIES OF THE STUDY

4.1 OBJECTIVE

The primary objective of DQO Step 4 is for the DQO team to identify the spatial, temporal, and practical constraints on the sampling design and to consider the consequences. This objective (in terms of the spatial, temporal, and practical constraints) ensures that the sampling design results in the collection of data that accurately reflect the true condition of the site and/or populations being studied.

4.2 WORKSHEETS FOR STEP 4 – DEFINE THE BOUNDARIES OF THE STUDY

Table 4-1 defines the population of interest to clarify what the samples are intended to represent. The characteristics that define the population of interest are also identified.

Table 4-1. Characteristics that Define the Population of Interest.

DS #	Population of Interest	Characteristics
Cribs, French Drains, and Trenches		
1, 2, and 3	Vadose zone soils	Concentrations of transuranic radionuclides, other radionuclides, metals, and limited organic constituents; physical properties including moisture content, bulk density, and grain size distribution.

Table 4-2 defines the spatial boundaries of the decision and the domain or geographic area (or volume) within which all decisions must apply (in some cases, this may be defined by the OU). The domain is a region distinctly marked by some physical features (i.e., volume, length, width, and boundary).

Table 4-2. Geographic Boundaries of the Investigation.

DS #	Geographic Boundaries of the Investigation
1, 2, and 3	The geographic boundaries for the investigation are the boundaries of the individual representative waste sites.

When appropriate, the population is divided into strata that have relatively homogeneous characteristics. The DQO team must systematically evaluate process knowledge, historical data, and plant configurations to present evidence of a logic that supports alignment of the population into strata with homogeneous characteristics. Table 4-3 identifies the strata with homogeneous characteristics. The zones are indistinct and are rough approximations based on the lack of boreholes near the waste sites (in most cases) and the relatively low quantities of contaminants received by each site.

Table 4-3. Zones with Homogeneous Characteristics.

DS #	Population of Interest	Zone	Homogeneous Characteristic Logic
Cribs, French Drains, and Specific Retention Trenches			
1, 2, and 3	Vadose zone soils	Clean or very low concentration stabilizing fill over waste site	Not expected to be contaminated. Fill will be field screened for contamination at all sites during characterization activities.
		High potential for detectable contamination layer[a]	The particulates and high distribution coefficient contaminants were sorbed and/or filtered out of the liquid flow via the soils at the bottom of the excavated crib/trench. This zone is expected to contain the highest concentrations of contaminants and to have decreasing concentrations with depth. The odds of encountering contamination are high. May also contain residual concentrations of mobile constituents.
		Medium potential for detectable contamination layer[a]	A medium concentration layer was formed immediately beneath the expected high concentration layer. In this zone, finer particulates and moderate distribution coefficient contaminants from the liquid waste streams were filtered and sorbed. High volumes of disposed liquids may have carried some immobile constituents into this zone, and residual concentrations of mobile constituents may also be present. It is likely contamination will be encountered. This zone is expected to have decreasing concentrations with depth as more immobile constituents filter and to sorb out with the passing of the wetting front.[b]
		Low potential for detectable contamination layer[a]	This zone is expected to contain low to no concentrations of mobile contaminants from the source to the groundwater table. Concentrations are expected to remain fairly constant through the impacted zone because the majority of the contaminants have been flushed through the system, leaving residual concentrations.

[a] The thickness is not specified.
[b] The wetted front may have reached groundwater for crib sites. It is not known if groundwater was impacted by the discharges to the french drain or trench sites.

The temporal boundaries of the decision are defined in Table 4-4.

Table 4-4. Temporal Boundaries of the Investigation.

DS #	Timeframe	When to Collect Data
Field Screening		
1, 2, and 3	N/A	Avoid extreme hot/cold months due to impacts on worker efficiency and equipment effectiveness. Inclement weather may impact sample quality.
Laboratory Samples		
1, 2, and 3	N/A	Avoid extreme hot/cold months and inclement weather that have potential to impact sample integrity and soil sampling operations.

N/A = not applicable

4.3 SCALE OF DECISION MAKING

Table 4-5 defines the scale of decision making for each DS. The scale of decision making is defined as the smallest, most appropriate subsets of the population (subpopulation) for which decisions will be made based on the spatial or temporal boundaries of the area under investigation.

Table 4-5. Scale of Decision Making.

DS #	Population of Interest	Geographic Boundary	Temporal Boundary		Spatial Scale of Decision Making
			Timeframe	When to Collect Data	
1, 2, and 3	Vadose zone soils	Boundaries of the individual representative waste sites	N/A	Avoid extreme hot/cold months and inclement weather that have potential to impact sample integrity and soil sampling operations.	Vadose zone soils

N/A = not applicable

The zones of homogeneous characteristics in Table 4-3 identify strata within the representative waste site. However, the spatial scale of decision making is the vadose zone soils from the ground surface to the water table. The data support remedial decision making that will consider the vertical distribution of contaminants throughout the entire vadose zone.

4.4 PRACTICAL CONSTRAINTS

Table 4-6 identifies all of the practical constraints that may impact the data collection effort. These constraints include physical barriers, difficult sample matrices, high radiation areas, or any other condition that will need to be taken into consideration to design and schedule the sampling program.

Table 4-6. Practical Constraints on Data Collection.

Boreholes may not obtain sufficient volumes of sample media if the sampled zone is 0.6 m (2 ft) thick or less. Advancement of borehole casing may smear contamination downhole. **Other Constraints:** Health and safety constraints may be imposed during characterization sampling to ensure that as low as reasonably achievable issues are properly addressed when sampling radiologically contaminated soils.

5.0 STEP 5 – DEVELOP A DECISION RULE

The purpose of DQO Step 5 is initially to define the statistical parameter of interest (i.e., maximum, mean, or 95% upper confidence level [UCL]) that will be compared to the action level. The statistical parameter of interest specifies the characteristic or attribute that a decision maker would like to know about the population. The preliminary action level for each of the COCs is also identified in DQO Step 5. When this is established, a decision rule (DR) is developed for each DS in the form of an "IF…THEN…" statement that incorporates the parameter of interest, the scale of decision making, the preliminary action level, and the AAs that would result from resolution of the decision. Note that the scale of decision making and AAs were identified earlier in DQO Steps 4 and 2, respectively.

5.1 INPUTS NEEDED TO DEVELOP DECISION RULES

Tables 5-1, 5-2, and 5-3 present the information needed to formulate the DRs in Section 5.2. This information includes the DSs and AAs identified in DQO Step 2, the scale of decision making identified in DQO Step 4, and the statistical parameters of interest and preliminary action levels for each of the COCs.

Table 5-1. Decision Statements.

DS #	Decision Statement
1	Determine whether the contaminant concentrations are TRU waste definition or greater than Class C and evaluate special remedial alternatives in a FS, or evaluate conventional remedial alternatives in a FS.
2	Determine whether the soil is radiologically contaminated and evaluate remedial alternatives in a FS, or evaluate the site for closure with no remedial action.
3	Determine whether the soil is chemically contaminated and evaluate remedial alternatives in a FS, or evaluate the site for closure with no remedial action.

Table 5-2. Inputs Needed to Develop Decision Rules.

DS #	COCs	Parameter of Interest	Scale of Decision Making	Preliminary Action Levels
1	Transuranic radionuclides	Soil sampling; maximum detected values	Vadose zone soils	≥100 nCi/g
	Greater than Class C radionuclides			10 CFR 61.55 values
2	Radionuclides			RESRAD lookup values and TBD through other modeling; radionuclide concentrations equating to a dose limit of 15 mrem/yr and 500 mrem/yr
3	Nonradiological constituents			MTCA and other regulatory levels (identified in Table 3-6)
2 and 3	Soil and physical properties			N/A

N/A = not applicable
TBD = to be determined

The AAs identified in DQO Step 2 are summarized in Table 5-3.

Table 5-3. Alternative Actions.

PSQ #	AA #	Alternative Actions
1	1	Evaluate special remedial alternatives in a FS.
	2	Evaluate conventional remedial alternatives in a FS.
2	1	Evaluate remedial alternatives in a FS.
	2	Evaluate the site for closure with no remedial action.
3	1	Evaluate remedial alternatives in FS.
	2	Evaluate the site for closure with no remedial action.

5.2 DECISION RULES

The output of DQO Step 5 and the previous DQO steps are combined into "IF...THEN" DRs that incorporate the parameter of interest, the scale of decision making, the action level, and the actions that would result from resolution of the decision. The DRs are listed in Table 5-4.

Table 5-4. Decision Rules.

DR #	Decision Rule
1	If the true maximum (as estimated by the maximum detected sample values) activity of radionuclides within the soil samples in each of the applicable strata[a] is greater than or equal to 100 nCi/g (TRU waste definition) or the greater than Class C definition, evaluate special remedial alternatives in a FS; otherwise, evaluate conventional remedial alternatives in a FS.
2	If the true maximum (as estimated by the maximum detected sample values) activity of radionuclides within the soil samples in each of the applicable strata[a] results in a radiological dose greater than or equal to 15 to 500 mrem/yr above background, evaluate remedial alternatives in a FS; otherwise, evaluate the site for closure with no remedial action.
3	If the true maximum (as estimated by the maximum detected sample values) concentration of chemical constituents within the soil samples in each of the applicable strata[a] is greater than or equal to the preliminary action levels in Table 3-6, evaluate remedial alternatives in a FS; otherwise, evaluate the site for closure with no remedial action.

[a] The applicable strata include the highest contaminant concentration layers, the moderate-to-low contaminant concentration layers, and the low contaminant concentration layers.

6.0 STEP 6 – SPECIFY TOLERABLE LIMITS ON DECISION ERRORS

Because analytical data can only estimate the true condition of the site under investigation, decisions that are made based on measurement data could potentially be in error (i.e., decision error). For this reason, the primary objective of DQO Step 6 is to determine which DSs (if any) requires a statistically based sample design. For those DSs requiring a statistically based sample design, DQO Step 6 defines tolerable limits on the probability of making a decision error.

6.1 STATISTICAL VERSUS NON-STATISTICAL SAMPLING DESIGN

Table 6-1 provides a summary of the information used to support the selection between a statistical versus a non-statistical sampling design for each DS. The factors that were taken into consideration in making this selection included the timeframe over which each of the DSs applies, the qualitative consequences of an inadequate sampling design, and the accessibility of the site if resampling is required.

Table 6-1. Statistical Versus Nonstatistical Sampling Design.

DS #	Timeframe (Years)	Qualitative Consequences of Inadequate Sampling Design (Low/Moderate/Severe)	Resampling Access After Remedial Investigation (Accessible/Inaccessible)	Proposed Sampling Design (Statistical/ Nonstatistical)
1, 2, and 3	N/A	Low to moderate	Accessible	Nonstatistical

N/A = not applicable

6.2 NONSTATISTICAL DESIGNS

A biased (or focused) sampling approach, which targets the maximum potential contamination within a waste site, is considered appropriate for the waste sites in the 200-MW-1 OU. Contaminant distributions are expected to follow relatively predictable patterns based on process knowledge and existing environmental data.

For the DSs to be resolved using a nonstatistical design, there is no need to define the "gray region" or the tolerable limits on decision error because these only apply to statistical designs. The nature of the waste sites to be investigated in the RI supports the use of focused sampling, as identified in *Washington State Department of Ecology Toxics Cleanup Program Guidance on Sampling and Data Analysis Methods* (Ecology 1995). This guidance document defines "focused sampling" as selective sampling of areas where potential or suspected soil contamination can reliably be expected to be found if a release of a hazardous substance has occurred. The relatively small crib structures to be investigated released contaminants in a point-source manner. Contaminants released through a small crib would likely impact the soil immediately beneath the crib with minimal lateral spread; therefore, focusing the RI sampling through the crib will ensure sample collection within the area of greatest impact associated with the discharge.

7.0 STEP 7 – OPTIMIZE THE DESIGN

7.1 PURPOSE

The purpose of DQO Step 7 is to identify the most resource-effective design for generating data to support decisions while maintaining the desired degree of precision and accuracy. When determining an optimal design, the following activities should be performed:

- Review the DQO outputs from the previous DQO steps and the existing environmental data.
- Develop general data collection design alternatives.
- Select the sampling design (e.g., techniques, locations, or numbers/volumes) that most cost effectively satisfies the project's goals.
- Document the operational details and theoretical assumptions of the selected design.

7.2 WORKSHEETS FOR STEP 7 – OPTIMIZE THE DESIGN

Table 7-1 identifies information in relation to determining the data collection design.

Table 7-1. Determine Data Collection Design.

Decision	Statistical	Nonstatistical	Rationale
All	N/A	Nonstatistical sampling design	Judgmental data collection design is applicable to the investigation because preliminary data suggest that the highest levels of contamination are located relative to release points or the bottom of waste sites. The relative size of the waste sites presents a point-source-type disposal, focusing the area of investigation on the distribution of contaminants with depth. Consequences of erroneous decisions are not severe. Characterization sampling results will be verified by confirmatory sampling of analogous sites during the confirmatory and remedial design phase.

N/A = not applicable

Table 7-2 is used to develop general data collection design alternatives. If the data collection design for a given decision will be nonstatistical, determine what type of nonstatistical design is appropriate (i.e., haphazard or judgmental).

Table 7-2. Determine Nonstatistical Sampling Design.

DR #	Haphazard	Judgmental
All	None	Professional judgmental sampling design is indicated.

The data collection design alternatives for this project are described in Table 7-3.

Table 7-3. Methods for Collection of Data at Depth. (2 Pages)

Method	Description
Trenching or test pit sampling	Excavation with backhoe or excavator. This technique provides grab samples taken directly from the soil column (approximate 0.3-m [1-ft] intervals) or from the excavator bucket. Because this technique creates a trench, direct inspection of the exposed soil column is possible. This method is not well suited for soils contaminated with alpha-emitting radionuclides because of direct exposure to personnel, equipment, wind, and weather.
Cone penetrometer or direct-push sampling	A closed-end rod is pushed into the soil to the desired depth, where a removable tip is displaced and a small volume of soil is retrieved. Because of the small volume of soil retrieved, multiple samples would be required to meet sample volume requirements for a large analyte list. The cone penetrometer and other direct-push methods are easily stopped by cobbles, rocks, or other features in the soil column. The resulting hole can be geophysically logged, providing information on gamma-emitting radionuclides and moisture content.
Auger drilling and sampling	Grab samples may be collected from the auger fitting during drilling, or split tube samples may be collected with the aid of hollow-stem auger "flights." To achieve laboratory analysis sample volume needs for large analytical lists, a 0.6-m (2-ft) core sample from a 13-cm (5-in.)-diameter sampler is typically needed. Running a sample tube down the hollow center of the flight retrieves split-tube samples. This method is not well suited to drilling in soils contaminated with alpha-emitting radionuclides because of contamination control limitations. The auger split-spoon samples are typically 6 cm (2.5 in.) in diameter.
Cable tool drilling and sampling	This slow drilling method is particularly useful in highly contaminated areas because potential contamination releases can be more easily controlled. This drilling method allows collection of grab samples from the drive barrel or split spoon. To achieve adequate laboratory analysis sample volumes for large analytical lists, a 0.6-m (2-ft)-long core sample from a 13-cm (5-in.)-diameter sampler is typically needed. DOE-owned, controlled cable tool rigs are available onsite for use in highly contaminated areas. In alpha-contaminated soils, significant contamination controls are required.
Diesel hammer drilling	The diesel hammer is a dual-string, reverse-air circulation drilling method. The potential impacts of this drilling method include degraded sample quality and increased contaminant release potential. Because of the introduction of air to the sample media, affects on analytical results for volatile organics and increased potential for dust result from this technique may occur.

Table 7-3. Methods for Collection of Data at Depth. (2 Pages)

Method	Description
Sonic drilling and sampling	Sonic drilling can quickly advance either borehole casings or sample tubes. Samples are retrieved similar to split-spoon sample collection during a cable tool operation. To achieve adequate laboratory analysis sample volumes, a 0.6-m (2-ft)-long core sample is typically needed from a 13-cm (5-in.)-diameter sampler. Sonic drilling is much faster than cable tool drilling, but the technique generates a significant amount of heat, which can alter samples (e.g., liberate volatile organics from the sampled soils) and the surrounding formation. In alpha-contaminated soils, significant contamination controls are required and may be difficult to implement because of the nature of the equipment and operations.
Air rotary drilling and sampling	Air rotary drilling is much faster than other drilling techniques. Grab samples and split-spoon samples may be taken using this method. In addition, most rotary drill rigs can be configured to collect core samples. To achieve adequate laboratory analysis sample volumes, a 0.6-m (2-ft)-long core sample is typically needed from a 13-cm (5-in.)-diameter sampler. This technique may introduce air into the soil, potentially altering the sample quality and formation moisture levels.

The design options are evaluated based on cost and ability to meet the DQO constraints. The results of the trade-off analyses should lead to one of two outcomes: (1) the selection of a design that most efficiently meets all of the DQO constraints, or (2) the modification of one or more outputs from DQO Steps 1 through 6 and the selection of a design that meets the new constraints.

The key features of the selected design are then documented, including (for example) the following:

- Maps outlining sample locations, strata, and inaccessible areas
- Directions for selecting sample locations (if the selection is not necessary or appropriate at this time)
- Order in which samples should be collected (if important)
- Stopping rules
- Special sample collection methods
- Special analytical methods.

7.3 SAMPLING OBJECTIVES

The characterization objectives identified in Section 1.3 result in the following characterization goals:

- Determine the presence and location of the TRU waste definition (≥100 nCig) and Class C definition materials associated with the worst-case locations at the 200-E-4 french drain, 216-T-13 Trench, 216-T-33 Crib, and 216-U-3 french drain.
- Determine the types and concentrations of radiological and nonradionuclide constituents with depth at worst-case locations in the 200-E-4 french drain, 216-A-4 Crib, 216-T-13 Trench, 216-T-33 Crib, and 216-U-3 french drain.
- Geophysically log planned boreholes.
- Analyze soils for physical properties to support modeling efforts.

7.4 SAMPLING DESIGN

7.4.1 Summary of Sampling Activities

A summary of the sampling activities is presented in Table 7-4.

Table 7-4. Key Features of the 200-MW-1 Sampling Design. (9 Pages)

Sample Collection Methodology	Key Features of Design	Basis for Sampling Design
200-E-4 French Drain		
Surface geophysical surveys (GPR and EMI)	Perform GPR and/or EMI over the general area of french drain.	Surface geophysical surveys used to locate french drain and subsurface features. Geophysics techniques are expected to distinctly identify the french drain locations.
Test pit characterization	Hand excavate to bottom of structure. Locate test pit directly adjacent to the french drain at the location with the highest contamination potential. Location will be based upon interpretation of the surface geophysical results and structure drawing.	

Table 7-4. Key Features of the 200-MW-1 Sampling Design. (9 Pages)

Sample Collection Methodology	Key Features of Design	Basis for Sampling Design
	Collect soil samples at the bottom of the french drain at the soil interface and within vadose zone to 4.6 m (15 ft).	Soil samples will be used to determine COC concentrations beneath the french drain and in the vadose zone. Sampling provides data for remedial action decision making and will be used to verify the preliminary conceptual contaminant distribution model.
	Collect soil samples as follows: • 3 to 4 ft • 9 to 10 ft • 14 to 15 ft	Sampled because: • Potential high contamination in drain excavation bottom soil • Potential medium/low contamination • MTCA compliance sample.
	Collect bulk density and grain-size distribution samples at major changes in lithology. Moisture samples will be collected with the other physical samples.	Soil physical properties (e.g., moisture content, grain-size distribution, and bulk density) will be used to support numerical modeling.
	Collect field QC samples.	Field QC samples are collected to evaluate the potential for cross-contamination and laboratory performance.
216-A-4 Crib		
Surface geophysical surveys (GPR and EMI)	Perform GPR and/or EMI over the general area of crib location.	Surface geophysical surveys used to locate crib and subsurface features. Geophysics techniques are expected to distinctly identify the crib location.
Borehole characterization	Install one vadose zone borehole within the crib boundaries at the head end (the location with the highest contamination potential) avoiding subsurface structures. Field location will be based upon interpretation of the surface geophysical results and structure drawings. Borehole will be drilled to the water table.	Drill borehole to allow soil sampling with depth and to support geophysical logging with spectral gamma and neutron moisture tools.
	Collect soil samples at the top of the crib (if soil is available), within the crib at the kraft paper/sand/gravel interface, at the bottom of the crib at the gravel/soil interface, and within vadose zone to water table.	Soil samples will be used to determine type and concentration of COCs beneath the crib in the vadose zone. Sampling provides data for remedial action decision making, to confirm the preliminary conceptual contaminant distribution model, and to support numerical modeling efforts.

Table 7-4. Key Features of the 200-MW-1 Sampling Design. (9 Pages)

Sample Collection Methodology	Key Features of Design	Basis for Sampling Design
	Samples are collected as follows: • 5 to 7.5 ft • 12.5 to 15 ft • 22 to 24.5 ft • 30 to 32.5 ft • 32.5 to 35 ft • 37.5 to 40 ft • 62.5 to 65 ft • 97.5 to 100 ft • 147.5 to 150 ft • 197.5 to 200 ft • 287 to 289.5 ft • 312.5 to 315 ft	Sampled because: • Due to 1958 overflow on ground (UPR 200-E-13) • MTCA compliance sample • Sand immediately below crib liner • Potential high contamination in soil immediately below crib • Potential high contamination • Potential high contamination • Possible contamination increase based on geophysical log • Possible contamination increase based on geophysical log • Potential low contamination • Potential low contamination • Potential low contamination; stratigraphic change • Potential low contamination; capillary fringe.
	Collect bulk density and grain-size distribution samples at major changes in lithology. Moisture samples will be collected along with the other physical samples.	Soil physical properties (e.g., moisture content, grain-size distribution, and bulk density) will be used to support numerical modeling.
	Collect field QC samples	Field QC samples are collected to evaluate the potential for cross-contamination and a laboratory performance.
	Perform borehole spectral logging from the surface to groundwater.	SGL logging will be performed to verify gamma-emitting contamination and to refine the preliminary conceptual contaminant distribution model. Cesium-137 will be the main target isotope for the SGL because of its prevalence and ease in identification; other gamma-emitting radionuclides may be detected if present.
	Perform neutron moisture logging from surface to groundwater.	Collect soil moisture data to support numerical modeling.

Table 7-4. Key Features of the 200-MW-1 Sampling Design. (9 Pages)

Sample Collection Methodology	Key Features of Design	Basis for Sampling Design
216-T-13 Trench		
Surface geophysical surveys (GPR and EMI)	Perform GPR and/or EMI over the general area of trench.	Surface geophysical surveys used to locate trench and subsurface features. Geophysics techniques are expected to distinctly identify the trench locations.
Test pit characterization	Locate test pit across the trench at the location with the highest contamination potential. Location will be based upon interpretation of the surface geophysical results to determine center section of the trench.	
	Collect soil samples within the trench, at the bottom of the trench at the soil interface to 25 ft below grade surface.	Soil samples will be used to determine COC concentrations beneath the trench and in the vadose zone. Sampling provides data for remedial action decision making and will be used to verify the preliminary conceptual contaminant distribution model.
	Samples are collected at: • 8 to 9 ft • 10 to 11 ft • 12 to 13 ft • 14 to 15 ft • 19 to 20 ft • 24 to 25 ft	Sampled because: • Potential high contamination at bottom of trench • Potential high contamination • Potential medium contamination • MTCA compliance sample • Potential low contamination • Potential no detection.
	Collect field QC samples.	Field QC samples are collected to evaluate the potential for cross-contamination and laboratory performers.
	Collect bulk density and grain-size distribution samples at major changes in lithology. Collect moisture samples with the other physical property samples.	Soil physical properties (e.g., moisture content, grain-size distribution, and bulk density) will be used to support modeling.
	If field screening shows contamination at 25 ft, a probe rod or drive casing will be placed in the area directly adjacent to the test pit and logged with a detector with the sensitivity required to determine how far contamination is present below 25 ft.	If contamination is present below 25 ft based on logging, an evaluation will be performed to determine if a borehole should be installed.

Table 7-4. Key Features of the 200-MW-1 Sampling Design. (9 Pages)

Sample Collection Methodology	Key Features of Design	Basis for Sampling Design
216-T-33 Crib		
Surface geophysical surveys (GPR and EMI)	Perform GPR and/or EMI over the general area of crib location.	Surface geophysical surveys used to locate crib and subsurface features. Geophysics techniques are expected to distinctly identify the crib location.
Borehole characterization	Install one vadose zone borehole within the crib boundaries at the head end (the location with the highest contamination potential), avoiding subsurface structures. Field location will be based upon interpretation of the surface geophysical results and structure drawings. Borehole will be drilled to the water table.	Drill borehole to allow soil sampling with depth and to support geophysical logging with spectral gamma and neutron moisture tools. The depth of drilling and associated soil sampling will be based on site-specific conditions. Because deep contamination has not been observed or information does not exist, sampling to groundwater may not be necessary. In this case, the drilling and sampling depth will be determined based on the observational approach. At a minimum, samples will be collected to the Plio-Pleistocene Unit, if present, and at a maximum, to the water table. The Plio-Pleistocene Unit is expected to be a zone of higher moisture content and where contaminants would tend to concentrate. Decisions to collect samples past the Plio-Pleistocene Unit will be based on field screening of retrieved soil samples or drill cuttings for radioactive concentration.
	Collect soil samples at the bottom of the crib at the gravel/soil interface, and within vadose zone to water table.	Soil samples will be used to determine type and concentration of COCs beneath the crib in the vadose zone. Sampling provides data for remedial action decision making, to confirm the preliminary conceptual contaminant distribution model, and to support numerical modeling efforts.

Table 7-4. Key Features of the 200-MW-1 Sampling Design. (9 Pages)

Sample Collection Methodology	Key Features of Design	Basis for Sampling Design
	Samples are collected at:	Sampled because:
	• 10 to 12.5 ft	• Potential high contamination at crib bottom
	• 12.5 to 15 ft	• MTCA compliance sample
	• 17.5 to 20 ft	• Potential high contamination
	• 22.5 to 25 ft	• Potential medium contamination
	• 27.5 to 30 ft	• Potential medium contamination
	• 47.5 to 50 ft	• Potential medium contamination
	• 105 to 107.5 ft	• Potential medium contamination; lithologic change
	125 to 127.5 ft	• Potential low contamination; stratigraphic change
	• 150 to 152.5 ft	• Potential low contamination; stratigraphic change
	• 197.5 to 200 ft	• Potential low contamination
	• 269.5 to 272 ft	• Potential low contamination; capillary fringe.
		Soil samples will be collected down to and within the Plio-Pleistocene Unit. The soil samples/drill cutting from the Plio-Pleistocene Unit will be screened using a hand-held rate meter with a gamma detector. If contamination is above three times background, drilling and sampling will resume (as specified in the sampling and analysis plan) to the next sample interval until contamination is less than three times background. The three-times-background criterion is considered appropriate to minimize the potential for a false positive. If contamination is less than three times background, the borehole will be logged with the SGL system to confirm that significant contamination is not present prior to abandoning the borehole. These decisions will be made in the field by the site geologist.
	Collect field QC samples.	Field QC samples are collected to evaluate the potential for cross-contamination and laboratory performance.

Table 7-4. Key Features of the 200-MW-1 Sampling Design. (9 Pages)

Sample Collection Methodology	Key Features of Design	Basis for Sampling Design
	Perform borehole spectral logging from the surface to groundwater.	SGL logging will be performed to verify gamma-emitting contamination and to refine the preliminary conceptual contaminant distribution model. Cesium-137 will be the main target isotope for the SGL because of its prevalence and ease in identification; other gamma-emitting radionuclides may be detected if present.
	Perform neutron moisture logging from surface to groundwater.	Collect soil moisture data to support numerical modeling.
Borehole spectral logging in existing wells	Perform borehole spectral logging and neutron moisture logging in accessible boreholes and groundwater wells near the cribs. BHI well status records indicate that the 299-W-11-14 is accessible and will provide useful information on contaminant distribution.	This well represents data collection points near the waste site. Logging of this well will provide additional updated site-specific information on contaminant distribution, both laterally and vertically.
216-U-3 French Drain		
Surface geophysical surveys (GPR and EMI)	Perform GPR and/or EMI over the general area of french drain.	Surface geophysical surveys used to locate french drain and subsurface features. Geophysics techniques should identify the location of the french drain.
Borehole characterization	Drill one deep borehole to groundwater near the discharge point. Selection of the borehole location will be based upon interpretation of the surface geophysical data and the structure drawing.	Drill borehole for borehole soil sampling and to support geophysical logging with a spectral gamma detector. The depth of drilling and associated soil sampling will be based on site-specific conditions. Since deep contamination has not been observed or no information exists, sampling to groundwater may not be necessary. In this case, the drilling and sampling depth will be determined based on the observational approach. At a minimum, samples will be collected to the Plio-Pleistocene Unit, if present, and at a maximum, to the water table. The Plio-Pleistocene Unit is expected to be a zone of higher moisture content and where contaminants would tend to concentrate. Decisions to collect samples past the Plio-Pleistocene Unit will be based on field screening of retrieved soil samples or drill cuttings for radioactive concentration.

Table 7-4. Key Features of the 200-MW-1 Sampling Design. (9 Pages)

Sample Collection Methodology	Key Features of Design	Basis for Sampling Design
	Collect soil samples at the bottom of the french drain at the gravel/soil interface, and within vadose zone to water table.	Soil samples will be used to determine COC concentrations beneath the french drain and in the vadose zone. Sampling provides data for remedial action decision making and will be used to verify the preliminary conceptual contaminant distribution model.
	Collect bulk density and grain-size distribution samples at major changes in lithology. Collect moisture samples with other physical property samples.	Soil physical properties (e.g., moisture content, grain-size distribution and lithology) will be used to support modeling.
	Samples are collected at: • 12.5 to 15 ft • 15 to 17.5 ft • 17.5 to 20 ft • 22.5 to 25 ft • 35 to 37.5 ft • 47 to 49.5 ft • 97.5 to 100 ft • 127 to 129.5 ft • 147 to 149.5 ft • 214.5 to 217 ft	Sampled because: • Potential high contamination in drain excavation bottom soil • MTCA compliance sample • Potential medium contamination • Potential medium contamination • Potential low contamination • Potential low contamination; lithologic change • Potential low contamination • Potential low contamination; stratigraphic change • Potential low contamination; stratigraphic change • Potential low contamination; capillary fringe. Soil samples will be collected down to and within the Plio-Pleistocene Unit. The soil samples/drill cutting from the Plio-Pleistocene Unit will be screened using a hand-held rate meter with a gamma detector. If contamination is above three-times-background, drilling and sampling will resume (as specified in the sampling and analysis plan) to the next sample interval until contamination is less than three times background. The three-times-background criterion is considered appropriate to minimize the potential for a false positive. If contamination is less than three times background, the borehole will be logged with the SGL system to confirm that significant contamination is not present prior to abandoning the borehole. These decisions will be made in the field by the site geologist.

Table 7-4. Key Features of the 200-MW-1 Sampling Design. (9 Pages)

Sample Collection Methodology	Key Features of Design	Basis for Sampling Design
	Collect field QC samples.	Field QC samples are collected to evaluate the potential for cross-contamination and laboratory performance.
	Perform SGL for the entire length of the borehole.	SGL will be performed to verify zones of gamma-emitting contamination and to refine preliminary conceptual contaminant distribution model.
	Perform neutron moisture logging for the entire length of the borehole.	Collect soil moisture data to expand the database and to support modeling.

7.5 POTENTIAL SAMPLE DESIGN LIMITATIONS

Drilling impediments (e.g., boulders) may be encountered and/or insufficient sample volumes may be retrieved from the split-spoon samplers. The prioritization of analyses when an insufficient sample volume is collected to complete all required analyses shall be as follows:

- Volatile organics
- Inductively coupled plasma metals
- Anions
- Gamma energy analysis (GEA)
- Alpha energy analysis
- Strontium-90.

Any remaining analyses will be performed based on the remaining sample volume:

- Because the potential exists for significant concentrations of radiological COCs, samples may need to be analyzed in an onsite laboratory. In this case, expected impacts include high analytical costs, degradation of detection limits, reduced analyte lists, and long turnaround times. The presence of transuranics at TRU waste definition concentrations would also significantly impact the handling and management of waste. Sample volumes may be reduced if the radiation levels are high for the samples.

- Geophysical logging of existing boreholes is dependent on accessibility and configuration of the boreholes. If the specified boreholes are not properly configured or available for logging, other boreholes may be considered or the logging program may be reduced.

8.0 REFERENCES

10 CFR 20, "Standards for Protection Against Radiation," *Code of Federal Regulations*, as amended.

10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste," *Code of Federal Regulations*, as amended.

10 CFR 835, "Radiation Protection for Occupational Workers," *Code of Federal Regulations*, as amended.

40 CFR 131, "Water Quality Standards," *Code of Federal Regulations*, as amended.

40 CFR 191, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Wastes," *Code of Federal Regulations*, as amended.

Agnew, S. F., J. Boyer, R. S. Corbin, T. B. Duran, J. R. Fitzpatrick, K. S. Jurgensen, T. P. Ortiz, and B. L. Young, 1997, *Hanford Tank Chemical and Radionuclide Inventories: HDW Model*, LA-UR-96-3860, Rev. 4, Los Alamos National Laboratory, Los Alamos, New Mexico.

ANL, 1993, *Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD, Version 5.0*, RESRAD v5.82, Argonne National Laboratory, Argonne, Illinois.

ARH, 1970, *Radioactive Contamination in Liquid Wastes Discharged to Ground Within the Chemical Separations Area Control Zone Through 1969*, ARH-1608, Atlantic Richfield Hanford Company, Richland, Washington.

ARH, 1973, *Radioactivity in Gaseous Waste Discharged from the Separation Facility During 1972*, Parts 1 through 4, ARH-2757, Atlantic Richfield Hanford Company, Richland, Washington.

Baldridge, K. F., 1959, *Radioactive Contamination in Liquid Wastes Discharged to Ground at Separations Facility Through December 1958*, HW-59359, General Electric Company, Richland, Washington.

BHI, 1996, *Pre-Operational Baseline and Site Characterization Report for the Environmental Restoration Disposal Facility*, Vols. 1 and 2, BHI-00270, Rev. 1, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1998, *Hanford Site Atlas*, BHI-01119, Rev. 1, Bechtel Hanford, Inc., Richland, Washington.

BHI-EE-01, *Environmental Investigations Procedures*, Bechtel Hanford, Inc., Richland, Washington.

BHI-EE-05, *Field Screening Procedures*, Bechtel Hanford, Inc., Richland, Washington.

Bjornstad, B. N., 1990, *Geohydrology of the 218-W-5 Burial Ground, 200-West Area, Hanford Site*, PNL-7336, Pacific Northwest Laboratory, Richland, Washington.

Borsheim, G. L., and B. C. Simpson, 1991, *An Assessment of the Inventories of the Ferrocyanide Watchlist Tanks,* WHC-SD-WM-ER-133, Westinghouse Hanford Company, Richland, Washington.

Brown, M. J., M. J. Pool, and S. P. Thomas, 1990, *Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas*, WHC-EP-0141-2, Westinghouse Hanford Company, Richland, Washington.

Brown, R. E., and H. G. Ruppert, 1948, *Underground Waste Disposal at Hanford Works,* HW-671, General Electric Hanford Company, Richland, Washington.

Brown, R. E., and H. G. Ruppert, 1950, *The Underground Disposal of Liquid Wastes at the Hanford Works, Washington*, HW-17088, General Electric Hanford Company, Richland, Washington.

Carpenter, R. W., and D. H. DeFord, 1995a, *T Plant Aggregate Area Management Study Technical Baseline Report*, BHI-00177, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

Carpenter, R. W., and D. H. DeFord, 1995b, *U Plant Aggregate Area Management Study Technical Baseline Report*, BHI-00174, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

Clukey, H. V., 1954, *Tabulation of Radioactive Liquid Waste Disposal Facilities*, HW-33305, General Electric Company, Richland, Washington.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. 9601, et seq.

Curren, E. F., 1972, *200 Areas Disposal Sites for Radioactive Liquid Wastes,* ARH-947, Atlantic Richfield Hanford Company, Richland, Washington.

DeFord, D. H., 1992, *Technical Baseline Report - Semi-Works Aggregate Area Management Study*, WHC-SD-EN-ES-019, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

DOE, 1999, *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement*, DOE/EIS-0222-F, U.S. Department of Energy, Washington, D.C.

DOE O 435.1, *Radioactive Waste Management*, U.S. Department of Energy, Washington, D.C.

DOE-RL, 1992a, *S Plant Aggregate Area Management Study Report*, DOE/RL-91-60, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1992b, *U Plant Source Aggregate Area Management Study Report*, DOE/RL-91-52, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1992c, *Z Plant Source Aggregate Area Management Study Report*, DOE/RL-91-58, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1993a, *B Plant Source Aggregate Area Management Study Report*, DOE/RL-92-05, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1993b, *Phase I Remedial Investigation Report for 200-BP-1 Operable Unit,* Vols. 1 and 2, DOE/RL-92-70, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1993c, *PUREX Plant Aggregate Area Management Study Report*, DOE/RL-92-04, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1993d, *Semiworks Aggregate Area Management Study Report*, DOE/RL-92-18, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1993e, *T Plant Source Aggregate Area Management Study Report*, DOE/RL-91-61, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1997, *Waste Site Grouping for 200 Areas Soil Investigations,* DOE/RL-96-81, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1999, *200 Areas Remedial Investigation/Feasibility Study Implementation Plan – Environmental Restoration Program*, DOE/RL-98-28, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2000, *Phase 1 RCRA Facility Investigation/Corrective Measures Study Work Plan for Single-Shell Tank Waste Management Areas*, DOE/RL-96-36, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology, 1995, *Washington State Department of Ecology Toxics Cleanup Program Guidance on Sampling and Data Analysis Methods*, Publication No. 4-49, Washington State Department of Ecology, Olympia, Washington.

Ecology, 2001, *Cleanup Levels and Risk Calculations under the Model Toxics Control Act Cleanup Regulation, CLARC Version 3,* Publication No. 94-145, updated August 2001, Washington State Department of Ecology, Olympia, Washington.

Ecology, EPA, and DOE, 1998, *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement), 2 vols., as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

EPA, 1986, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*, SW-846, 3rd edition, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1994, *Guidance for Data Quality Objectives Process*, EPA QA/G-4, U.S. Environmental Protection Agency, Washington, D.C.

FDH, 1999, *Radionuclide Inventory of Liquid Waste Disposal Sites on the Hanford Site*, HW-1744, Fluor Daniel Hanford, Inc., Richland, Washington.

Fecht, K. R., G. V. Last, and K. R. Price, 1977, *Evaluation of Scintillation Probe Profiles from 200 Area Crib Monitoring Wells,* ARH-ST-156, Atlantic Richfield Hanford Company, Richland, Washington.

GE, 1944, *Hanford Engineer Works Technical Manual (T/B Plants),* Parts A, B, and C, HW-10475, General Electric Company, Richland, Washington.

GE, 1951a, *Process Waste Disposal Summary – 200 Areas (September 1949 through December 1950)*, HW-20583, General Electric Company, Richland, Washington.

GE, 1951b, *Uranium Recovery Technical Manual,* HW-19140, General Electric Company, Richland, Washington.

GE, 1954a, *Recovery of Cesium-137 from Uranium Recovery Process Wastes*, HW-31442, General Electric Company, Richland, Washington.

GE, 1954b, *Summary of Liquid Radioactive Wastes Discharged to the Ground – 200 Areas (July 1952 Through June 1954)*, HW-33591, General Electric Company, Richland, Washington.

GE, 1955a, *PUREX Technical Manual*, HW-31000-DEL, General Electric Company, Richland, Washington.

GE, 1955b, *Radioactive Contaminants in Liquid Wastes Discharged to Ground at Separation Facilities Through June 1955*, HW-38562, General Electric Company, Richland, Washington.

GE, 1958, *Record of Scavenged TBP Waste (Logbook),* General Electric Company, Richland, Washington.

GE, 1960, *Decontamination*, HW-63110, General Electric Company, Richland, Washington.

HEW, 1945, *History of Operations (1 January 1944 to 20 March 1945),* OUT-1462, Hanford Engineer Works, Richland, Washington.

Jones, T. E., 1999, *Removal of Organic Compounds from the "Contaminants of Concern" List for Tank Farm Vadose Zone Characterization*, HNF-5118, Lockheed Martin Hanford Corporation, Richland, Washington.

Jungfleisch, F. M., 1984, *TRAC: A Preliminary Estimation of the Waste Inventories in Hanford Tanks Through 1980*, WHC-SD-WM-TI-057, Rockwell Hanford Operations, Richland, Washington.

Kaplan, D. I., and R. J. Serne, 2000, *Geochemical Data Package for the Hanford Immobilized Low-Activity Tank Waste Performance Assessment (ILAW PA)*, PNNL-13037, Rev. 1, Pacific Northwest National Laboratory, Richland, Washington.

LMHC, 1999, *Tank Characterization Database* (http://twins.pnl.gov:8001/TCD/ main.html), Lockheed Martin Hanford Corporation, Richland, Washington.

Lungren, L. L., 1970, *Study of ARHCO Radioactive Gaseous and Liquid Effluent Release Points to the Environs from 200 Area Facilities*, ARH-1172, Atlantic Richfield Hanford Company, Richland, Washington.

Maxfield, H. L., 1979, *200 Areas Waste Sites Handbook*, 3 vols., RHO-CD-673, Rockwell Hanford Operations, Richland, Washington.

Miskho, A. G., 1996, *Listed Waste History at Hanford Facility TSD Units*, WHC-MR-01517, Westinghouse Hanford Company, Richland, Washington.

Nichols, W. E., N. J. Aimo, M. Oostrom, and M. D. White, 1997, *STOMP – Subsurface Transport Over Multiple Phases: Application Guide*, PNNL-11216, Pacific Northwest National Laboratory, Richland, Washington.

PNNL, 1998, *Composite Analysis for Low-Level Disposal in the 200 Area Plateau of the Hanford Site*, PNNL-11800, Pacific Northwest National Laboratory, Richland, Washington.

PNNL, 1999, *Hanford Site Groundwater Monitoring for Fiscal Year 1998*, PNNL-12086, Pacific Northwest National Laboratory, Richland, Washington.

Resource Conservation and Recovery Act of 1976, 42 U.S.C. 6901, et seq.

RHO, 1985, *200 Area Fact Book*, TRAC-0238 (RHO-92001941), Rockwell Hanford Operations, Richland, Washington.

Stenner, R. D., K. H. Cramer, and K. A. Higley, 1988, *Hazard Ranking System Evaluation of CERCLA Inactive Waste Sites at Hanford*, 3 vols., PNL-6456, Pacific Northwest Laboratory, Richland, Washington.

Stephens, D. B. & Associates, 1998, *Vadose Zone Geology of the 214-B, 241-BX, and 241-BY Tank Farms, Hanford Site Hanford Site, South-Central Washington*, Stephens & Associates, Richland, Washington.

WAC 173-201A, "Water Quality Standards for Surface Waters of the State of Washington," *Washington Administrative Code*, as amended.

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code,* as amended.

WAC 173-340, "Model Toxics Control Act – Cleanup," *Washington Administrative Code*, as amended.

WHC, 1990, *Inventory of Chemical Used at Hanford Site Production Plants and Support Operations*, WHC-EP-0172, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

WHC, 1991, *Tank Waste Discharge Directly to Soil at the Hanford Site*, WHC-MR-0227, Westinghouse Hanford Company, Richland, Washington.

WHC, 1992a, *Hydrogeologic Model for the 200-East Groundwater Aggregate Area*, WHC-SD-EN-TI-019, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC, 1992b, *Hydrogeologic Model for the 200-West Groundwater Aggregate Area*, WHC-SD-EN-TI-014, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC, 1994, *Geologic Setting of the Low-Level Burial Grounds*, WHC-SD-EN-TI-290, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC, 1996, *Liquid Radioactive Waste Discharged from B-Plant to Cribs*, WHC-SD-WM-ER-575, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Zimmerman, D. A., A. E. Reisenauer, G. D. Black, and M. A. Young, 1986, *Hanford Site Water Changes – 1950 through 1980, Data Observation and Evaluation,* PNL-5506, Pacific Northwest Laboratory, Richland, Washington.

APPENDIX A

200-MW-1 OPERABLE UNIT SITES REVIEW PROCESS

TABLE OF CONTENTS

FIGURE

TABLES

Table of Contents

APPENDIX A

200-MW-1 OPERABLE UNIT SITES REVIEW PROCESS

A.1 STRATEGY

Because the remaining 200-MW-1 Operable Unit (OU) radioactive liquid waste disposal sites did not fit within other well defined waste site groupings (DOE-RL 1997, 1999a) and additional waste sites have also been added to the OU (as part of the process defined in the *Tri-Party Agreement Handbook Management Procedures*, Guideline Number TPA-MP-14, "Maintenance of the Waste Information Data System [WIDS]" [DOE-RL 1998]), it was necessary to review all of the WIDS sites currently identified with the 200-MW-1 OU prior to selecting representative sites for the OU. The selection approach was designed to ensure that waste sites added to the 200-MW-1 OU in the future fit into the subgroups for which representative sites have been selected. Figure A-1 shows the site review flow diagram.

Five WIDS categories were identified that represent the 200-MW-1 OU waste sites. The results of this sorting (based on the WIDS status as of November 8, 2001) are shown in Tables A-1 through A-5 as follows:

- WIDS Classification Status Rejected Sites (Table A-1)
- WIDS Classification Status Proposed Rejected Sites (Table A-2)
- WIDS Reclassification Status Rejected Sites (Table A-3)
- WIDS Classification Status 216/218 Regulatory Authority Sites (Table A-4)

  NOTE: The 216/218 regulatory authority sites included in Table A-4 are steam condensate surface discharge sites. The steam condensate consisted of sanitary water that had been sent through a water softener system to remove minerals (calcium and magnesium), which was then introduced into boilers to produce steam. This steam was superheated before distribution to facilities for heating and process use. Steam condensate from the steam distribution lines was released to these sites. When used for heating purposes, this was a seasonal discharge. In addition to sanitary water, the condensate contained nonregulated chemicals that were added to dechlorinate the water, prevent scale, and control corrosion of the boilers.

- WIDS Classification Status 200-MW-1 OU *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) past-practice Waste Sites (Table A-5).

Table A-5 was reviewed to remove the waste sites not technically appropriate for inclusion with the 200-MW-1 OU based on the intent of the *Waste Site Grouping for 200 Areas Soil Investigations* report (DOE-RL 1997) and the *200 Areas Remedial Investigation/Feasibility Study Implementation Plan – Environmental Restoration Program* (hereinafter referred to as the

Implementation Plan) (DOE-RL 1999). The waste sites removed are assigned to an appropriate waste group OU in Table A-6.

The CERCLA past-practice sites identified (Table 2-1) were then reviewed based on their configuration for receiving waste, source of the waste stream, and expected contaminants to identify appropriate subgroups of sites from which representative sites would be selected for characterization.

Waste sites within the 200-MW-1 OU mainly include cribs, french drains, and trenches. While a few waste sites are identified as injection/reverse wells, their construction is similar to that of a french drain. Only one pond is included in the 200-MW-1 OU, and it received condensate from Z Plant ventilation equipment. The footprint of the pond was similar to that of the cribs within the OU; it, therefore, is not considered as a significantly different waste receiving structure.

After reviewing the process history for each waste site, the following subgroups were developed, based on the types and amount of waste received:

- Process facility ventilation stack and sand filter sources. This group also contains the 216-A-4 Crib, which received ventilation, as well as Plutonium-Uranium Extraction (PUREX) Facility laboratory drainage that was routed through the PUREX canyon U cell tanks to the crib.
- Vehicle/heavy equipment facility decontamination sources.
- Vehicle/heavy equipment field decontamination source.
- Low-level radioactive process or steam condensate sources, which were primarily discharged to french drains.
- Nonradiological process steam condensate with radiological contaminants from cross-contamination from other sources.

Table A-7 presents these waste site subgroups. The representative sites were then selected from each subgroup based on the approach outlined in the Implementation Plan (DOE-RL 1999). The following representative sites were selected:

- 200-E-4 french drain for the nonradiological process steam condensate with cross-contamination sources
- 216-A-4 Crib for process facility ventilation stack and sand filter source
- 216-T-13 Trench for vehicle/heavy equipment field decontamination source
- 216-T-33 Crib for vehicle/heavy equipment facility decontamination sources
- 216-U-3 french drain for low-level radioactive process or steam condensate sources.

The representative sites originally identified for the 200-MW-1 OU in the waste site grouping report (DOE-RL 1997) (216-A-4 Crib, 216-T-33 Crib, and 216-U-3 french drain) were all selected to remain as representative sites for the work plan.

A.2 REFERENCES

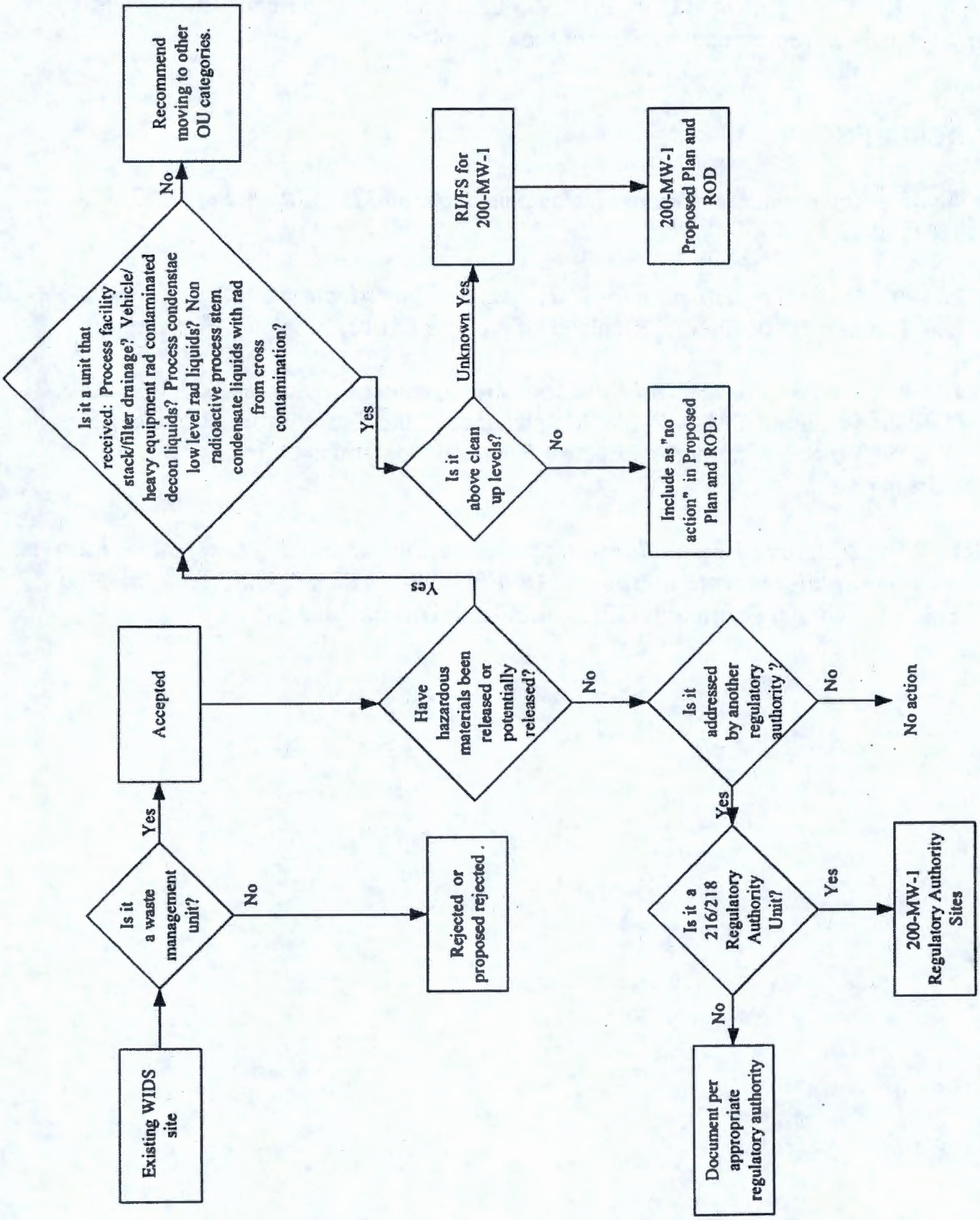
Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. 9601, et seq.

DOE-RL, 1997, *Waste Site Grouping for 200 Areas Soil Investigations,* DOE/RL-96-81, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1998, *Tri-Party Agreement Handbook Management Procedures*, RL-TPA-90-0001, Guideline Number TPA-MP-14, "Maintenance of the Waste Information Data System (WIDS)," U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1999, *200 Areas Remedial Investigation/Feasibility Study Implementation Plan – Environmental Restoration Program*, DOE/RL-98-28, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Figure A-1. 200-MW-1 Operable Unit Site Review Flow Diagram.[a]



[a] Based on RL-TPA-90-001(DOE-RL 1998)
ROD = Record of Decision
RI/FS = remedial investigation/feasibility study

Table A-1. WIDS Classification Rejected Sites.

Site Code	Site Names	Site Type	Previous OU	Comments
600-267	600-267, weather station 90-day storage pad	Storage pad (<90 day)	N/A	Drums/barrels/buckets/cans
200-E-108	200-E-108, well drilling laydown yard pit	Depression/pit (nonspecific)	N/A	
200-E-119	200-E-119, 225-B west side 90-day pad	Storage pad (<90 day)	N/A	Drums/barrels/buckets/cans
200-W-74	200-W-74, 90-day storage area east side of 622-F	Storage pad (<90 day)	N/A	Drums/barrels/buckets/cans

NA = not applicable

Table A-2. WIDS Classification Proposed Rejected Sites.

Site Code	Site Names	Site Type	Previous OU	Comments
600-254	600-254, abandoned 251-W substation mineral oil underground pipelines	Product piping	200-NO-1	Oil
616-WS-1	616-WS-1, 616 NDWSF french drain	French drain	200-IU-5	Storm run-off
200-W-19	200-W-19, steam line asbestos release	Unplanned release	200-RO-2	Asbestos (friable)
200-W-65	200-W-65, concrete vault northwest of WRAP, water pumping station vault, abandoned water system pump vault	Control structure	200-ZP-3	Miscellaneous trash and debris
200-E-61	200-E-61, 202A Building stormwater run-off, miscellaneous stream #467	Injection/reverse well	200-PO-2	Storm run-off

NDWSF = Nonradioactive Dangerous Waste Storage Facility
WRAP = Waste Receiving and Processing (Facility)

Table A-3. WIDS Reclass Status Rejected Sites. (2 Pages)

Site Code	Site Names	Site Type	Previous OU	Comments
209-E-WS-1	209-E-WS-1, 209-E french drain	French drain	200-SO-1	Steam condensate
216-B-56	216-B-56, 216-B-56 Crib	Crib	200-BP-6	Process effluent
216-B-61	216-B-61, 216-B-61 Crib	Crib	200-BP-1	Steam condensate
2704-E-HWSA	2704-E HWSA, 2704-E hazardous waste storage area	Storage pad (<90 day)	200-SS-1	Barrels/drums/buckets/cans
2718-E-WS-1	2718-E-WS-1, 2718 french drains	French drain	200-SO-1	Water
UPR-200-E-13	UPR-200-E-13, overflow from 216-A-4, UN-200-E-13, UPR-200-E-15	Unplanned release	200-PO-2	Process effluent
UPR-200-E-15	UPR-200-E-15, overflow at 216-A-4, UN-200-E-15, UPR-200-E-13	Unplanned release	200-PO-2	Process effluent
UPR-200-W-30	216-S-12, UPR-200-W-30, 291-S stack wash sump, REDOX stack flush trench	Trench	200-RO-3	Water
200-E-32	200-E-32, 226-B pad east side 90-day waste accumulation area	Storage pad (<90 day)	200-BP-6	
200-E-40	200-E-40, PUREX sample gallery 90-day waste accumulation area	Storage pad (<90 day)	200-PO-2	
200-E-33	200-E-33, PUREX 214-A 90-day waste accumulation areas	Storage pad (<90 day)	200-PO-2	
200-E-34	200-E-34, PUREX high-level waste room 90-day waste accumulation area	Storage pad (<90 day)	200-PO-2	
200-E-35	200-E-35, 209-E 90-day waste accumulation area, 209-EA	Storage pad (<90 day)	200-SO-1	
200-E-36	200-E-36, 241-AZ 90-day waste accumulation area	Storage pad (<90 day)	200-PO-2	
200-W-47	200-W-47, 211-T storage pad 90-day waste accumulation area	Storage pad (<90 day)	200-TP-4	
600-215	600-215, 6265A 90-day waste accumulation area	Storage pad (<90 day)	200-IU-5	Barrels/drums/buckets/cans
200-E-50	200-E-50, 284-E brine pit, 284-E salt dissolving pit and brine pump pit	Sump	200-SS-1	Demolition and inert waste
200-W-60	200-W-60, 284-W brine pit, 284-W salt dissolving pit and brine pump pit	Sump	200-SS-2	Demolition and inert waste
200-W-61	200-W-61, 284 powerhouse coal ramp washdown pit, 200 West powerhouse coal ramp washdown pit, miscellaneous stream #471	Depression/pit (nonspecific)	200-SS-2	Water

Table A-3. WIDS Reclass Status Rejected Sites. (2 Pages)

Site Code	Site Names	Site Type	Previous OU	Comments
200-E-51	200-E-51, 284-E powerhouse coal ramp washdown pit, 200 East powerhouse coal ramp washdown pit, miscellaneous stream #177	Depression/pit (nonspecific)	200-SS-1	Water
200-W-50	200-W-50, 2706-T 90-day waste accumulation area	Storage pad (<90 day)	200-TP-4	
200-E-39	200-E-39, PUREX Room 52, hood 32, 90-day waste accumulation area	Storage pad (<90 day)	200-PO-2	

REDOX = Reduction-Oxidation (Plant)

Table A-4. 216/218 Regulatory Authority Sites.[a] (3 Pages)

Site Code	Site Names	Site Type	Previous OU	Comments
200-E-62	200-E-62, 202A Building steam condensate, miscellaneous stream #71, injection well (Z)	Injection/reverse well	200-PO-2	Steam condensate
200-E-63	200-E-63, line #8801 steam condensate, miscellaneous stream #72, injection well (AA)	Injection/reverse well	200-PO-2	Steam condensate
200-E-64	200-E-64, line #8801 steam condensate, miscellaneous stream #69, injection well (W)	Injection/reverse well	200-PO-2	Steam condensate
200-E-65	200-E-65, 202A Building steam condensate, miscellaneous stream #464, injection well (R)	Injection/reverse well	200-PO-2	Steam condensate
200-E-68	200-E-68, 291A control house steam condensate, miscellaneous stream #59, injection well (L)	Injection/reverse well	200-PO-2	Steam condensate
200-E-69	200-E-69, line #8801 steam condensate, miscellaneous stream #56, injection well (A)	Injection/reverse well	200-PO-2	Steam condensate
200-E-70	200-E-70, line #8801 steam condensate, miscellaneous stream #64, injection well (Q)	Injection/reverse well	200-PO-2	Steam condensate
200-E-71	200-E-71, line #8801 steam condensate, miscellaneous stream #63, injection well (O)	Injection/reverse well	200-PO-2	Steam condensate

Table A-4. 216/218 Regulatory Authority Sites.[a] (3 Pages)

Site Code	Site Names	Site Type	Previous OU	Comments
200-E-72	200-E-72, line #8801 steam condensate, miscellaneous stream #60, injection well (G)	Injection/reverse well	200-PO-2	Steam condensate
200-E-73	200-E-73, line #8801 steam condensate, miscellaneous stream #61, injection well (M)	Injection/reverse well	200-PO-2	Steam condensate
200-E-74	200-E-74, line #8801 steam condensate, miscellaneous stream #62, injection well (N)	Injection/reverse well	200-PO-2	Steam condensate
200-E-75	200-E-75, line #8801 steam condensate, miscellaneous stream #67, injection well (B)	Injection/reverse well	200-PO-2	Steam condensate
200-E-76	200-E-76, line #8801 steam condensate, miscellaneous stream #65, injection well (U)	Injection/reverse well	200-PO-2	Steam condensate
200-E-77	200-E-77, line #8801 steam condensate, miscellaneous stream #70, injection well (S)	Injection/reverse well	200-PO-2	Steam condensate
200-E-78	200-E-78, line #8801 steam condensate, miscellaneous stream #70, injection well (Y)	Injection/reverse well	200-PO-2	Steam condensate
200-E-79	200-E-79, line #8801 steam condensate, miscellaneous stream #66, injection well (T)	Injection/reverse well	200-PO-2	Steam condensate
200-E-80	200-E-80, line #8801 steam condensate, miscellaneous stream #68, injection well (V)	Injection/reverse well	200-PO-2	Steam condensate
200-E-81	200-E-81, MO035 facility water valve, miscellaneous stream #533	Injection/reverse well	200-PO-2	Water valve
200-E-82	200-E-82, steam trap 2P-YARD- MSS-TRP-040, miscellaneous stream #115	Injection/reverse well	200-PO-2	Steam condensate
200-E-84	200-E-84, 202A Building steam condensate, miscellaneous stream #58, injection well (C)	Injection/reverse well	200-PO-2	Steam condensate
200-E-88	200-E-88, B Plant yard steam condensate, miscellaneous stream #3	Injection/reverse well	200-BP-6	Steam condensate
200-E-89	200-E-89, B Plant yard steam condensate, miscellaneous stream #4	Injection/reverse well	200-BP-6	Steam condensate

Table A-4. 216/218 Regulatory Authority Sites.[a] (3 Pages)

Site Code	Site Names	Site Type	Previous OU	Comments
200-E-90	200-E-90, B Plant yard steam condensate, miscellaneous stream #5	Injection/reverse well	200-BP-6	Steam condensate
200-E-91	200-E-91, B Plant yard steam condensate, miscellaneous stream #6	Injection/reverse well	200-BP-6	Steam condensate
200-E-92	200-E-92, B Plant yard steam condensate, miscellaneous stream #7	Injection/reverse well	200-BP-6	Steam condensate
200-E-93	200-E-93, B Plant yard steam condensate, miscellaneous stream #8	Injection/reverse well	200-BP-6	Steam condensate
200-E-94	200-E-94, B Plant yard steam condensate, miscellaneous stream #9	Injection/reverse well	200-BP-6	Steam condensate
200-E-95	200-E-95, 222-B Building steam condensate, miscellaneous stream #308	Injection/reverse well	200-BP-6	Steam condensate
200-E-97	200-E-97, 212-B Building, steam condensate, miscellaneous stream #470	Injection/reverse well	200-BP-6	Steam condensate
200-E-98	200-E-98, 271-B Building ice machine overflow, miscellaneous stream #490	Injection/reverse well	200-BP-6	Steam condensate
200-E-99	200-E-99 steam trap 2P-YARD-MSS-TRP-017, miscellaneous stream #570	Injection/reverse well	200-BP-6	Steam condensate
200-E-100	200-E-100 steam trap 2P-YARD-MSS-TRP-019, miscellaneous stream #571	Injection/reverse well	200-BP-6	Steam condensate

[a] The sites identified in this table have been provided to the regulatory agency for rejection.

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
Process Facility Ventilation Stack and Sand Filter Sources								
216-A-4 Crib (Rep. Site)	216-A-4, 216-A-4 cavern	South of the 202-A Building and east of 216-A-2, inside the PUREX exclusion fence.	1955 to 1958	Laboratory cell drainage from the 202-A Building and 291-A-1 stack drainage. For a detailed description of this site see Section 2.2.3, Representative Sites.	6,210,000 L with U (395 kg), Pu (140 g), Cs-137 (6.93 Ci), Sr-90 (4.39 Ci), NO_3 (300 kg), $Na_2Cr_2O_7$ (110 kg)	5.5 m (18 ft) depth to top of crib, 2.1 m (7 ft) depth of rock bed, 0.3 m (1 ft) gravel, sand and sisal-kraft paper.	6.1 m by 6.1 m (20 ft by 20 ft)	For a detailed description of this site, see Section 2.2.3, Representative Sites.
216-A-41 Crib	216-A-41 Crib, 291-AR stack drain, 296-A-13 stack drain	Northwest of the 296-A-13 stack, west of Buffalo Ave. and north of the 244-AR vault facility.	1968 to 1974	Drainage from the 296-A-13 stack. The stack connected to the 291-AR Filter Building.	10,000 L[a]	2 m (7 ft)	3 m by 3 m (10 ft by 10 ft)	The crib contains six 20-cm by 20-cm by 41-cm (8-in. by 8-in. by 16-in.) bond beam concrete blocks, placed end-to-end to form the dispersion structure 1.2 m (4 ft) below grade. The crib has an inlet pipe from the 296-A-13 stack and a 20-mil polyethylene barrier separating the gravel from the backfill. The site is not marked in the field and the exact location of this unit has not been confirmed. Several temporary buildings are located near the crib at the present time.

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
216-A-21 Crib	216-A-21, 216-A-21 Crib	South of the 202-A Building, inside the PUREX exclusion fence.	1957 to 1965	Until June 1958, the site received sump waste from 293-A Building. From June 1958 to December 1958, the site was inactive. From December 1958 to June 1965, the site received the above effluent, laboratory cell drainage from the 202-A Building, and 291-A-1 stack drainage.	77,900,000 L[a]	N/A	18 m by 5 m (62 ft by 16 ft)	A 10-cm (4 in.) stainless-steel distribution line runs horizontally through the length of the site, 2.1 m (7 ft) below grade. Branching horizontally from this distribution line are four 1.2-m (4-ft) sections of 10-cm (4-in.) tubing. Branching vertically at the same locations are four 2.4-m (8-ft) sections of 10-cm (4-in.) Schedule 40 perforated pipe running to the bottom of the site. The excavation is V-shaped in cross-section with a side slope of 1H:1.5V. The excavation has approximately 1.8 m (6 ft) of gravel fill and was backfilled. The site was surface stabilized in 1999 and posted with URM signs.

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
216-A-27 Crib	216-A-27, 216-A-27 Crib	South of the PUREX Facility, partially inside the double security fence.	1965 to 1970	Sump waste from the 293-A Building, laboratory cell drainage from the 202-A Building, and 291-A-1 stack drainage.	23,200,000 L with U (67.5 kg), Pu (96.5 g), Cs-137 (32.4 Ci), Sr-90 (24.5 Ci)[a]	N/A	61 m by 3 m (200 ft by 10 ft)	A 15-cm (6-in.) perforated pipe is placed horizontally the length of the unit at approximately 3 m (10 ft) below grade. The crib also has a 20-cm (8-in.)-diameter well extending from a concrete pad, a 20-cm (8-in.) vent riser with filter, a 41-cm (16-in.) pipe for a recorder, a 3.8-cm (1.5-in.) sensing bulb well, and a polyethylene barrier. The side slope is 1H:1.5V. The crib is covered with gravel and is marked and posted with URM signs. The crib was monitored by the 299-E17-2 and 299-E17-3 wells.
216-S-12 Trench	216-S-12, UPR-200-W-30, 291-S stack wash sump, REDOX stack flush trench	Northeast of the 202-S (REDOX) Facility, north of 291-S stack.	1954	Liquid waste from 291-S stack flush water.	68,100 L with U (5.94 kg), Pu (1.0 g), Cs-137 (0.43 Ci), Sr-90 (0.41 Ci)	3 m (10 ft)	27 m by 6 m (89 ft by 20 ft)	The unit was constructed in July 1954 to receive flush water containing ammonium nitrate from the 291-S stack complex. The trench was retired when the flush of the 291-S-1 stack was complete, also in July 1954. The trench was deactivated by removing the above-ground piping and then backfilling. The site is surrounded with cement marker posts and chains, and is posted with URM signs.

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
216-B-13 french drain	216-B-13, 216-B-13 french drain, 291-B Crib, 216-B-B, 216-B-13 Crib	South of 221-B and northeast of the 291-B-1 stack.	1945 to 1976	291-B stack drainage.	21,000 L[a]	6 m (20 ft)	6 m by 1 m (20 ft by 3 ft)	The drain is constructed of two 1.22-m (4-ft)-diameter by 1.53-m (5-ft)-long tile pipes, stacked vertically and filled with crushed limestone. The unit has a plywood cover, located 2.44 m (8 ft) below grade. Two and a half tons (2,270 kg) of limestone were used as a base and to fill the tile pipes. The bottom of the drain is 5.5 m (18 ft) below ground surface. In June 1976, the stack drainage was rerouted to a cell drainage sample tank. A single, concrete AC-540 marker is the only site identifier. A URM sign is attached to the concrete post.

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
200-E-55 french drain	200-E-55, effluent drain east of 291-B sand filter, miscellaneous stream #322	East of the east end of the 291-B sand filter (WIDS site 200-E-30).	1948 to 1997	Condensate from the B Plant canyon sand filter and rain water that leaked through the sand filter roof.	N/A	1 m (3 ft)	2 m by 1 m (7 ft by 3 ft)	There are no visual surface features for this drain; it has been marked with a single steel post. The drain is below grade and east of the B Plant sand filter.
216-T-29 french drain	216-T-29, 291-T sand filter sewer, 216-T-29 french drain	Adjacent to the north end of the 291-T sand filter and northeast of the 221-T Building.	1949 to 1964	Canyon air condensate from the 291-T sand filter.	74,000 L[a]	1 m (3 ft)	1 m by 0.2 m (3 ft by 0.7 ft)	The site is part of the sand filter construction. In 1964 the sand filter bypass water seal was removed, deactivating the french drain. The sand filter was deactivated because new air filters were installed in each cell of the 221-T Building. The sand filter bypass water seal was removed, allowing the 221-T Building exhaust air to flow directly to the 291-T-1 stack. The site has a vent riser protruding through the roof of the northwest corner of the sand filter. This is assumed to be the location of the drain. The site is marked and posted as a CA.

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
216-T-31 french drain	216-T-31, 216-T-31 french drain	West of Camden Ave., near the southeast corner of the 241-TX tank farm, on the east side of 241-TX tank farm fence.	1954 to 1962	Steam condensate from a steam line blowout during efforts to unplug a waste line.	N/A	N/A	1 m (3 ft) in diameter	This drain is a registered underground injection well. The unit was in operation in 1954 and abandoned in 1959 after it was contaminated by steam condensate from a steam line blowout during efforts to unplug a waste line. A new steam line was installed in 1959 and a new steam condensate drain was made to replace the contaminated drain. The french drain was exhumed in 1962. The contaminated culvert, gravel and soil were removed and buried in the 200 West Area dry burial ground. The site was released from radiation zone status in February 1962. The site is surrounded by a chain-link fence and is posted with SCA signs.

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
216-A-33 french drain	216-A-33, 216-A-33 dry well, 216-A-26B	Inside the PUREX security fence, south of 202-A, and southwest of the 291-A stack.	1955 to 1964	Bearing coolant waste from the 291-A-1 stack electrical exhaust fans.	N/A	4 m (13 ft)	4 m by 2 m (13 ft by 7 ft)	The site has a 5-cm (2-in.) inlet pipe entering at 1.5 m (5 ft) below grade. Project B-295A constructed the 291-AE Building over the area where this drain was located. The inlet piping was capped and the drain was removed from service in 1964 because water was no longer used as a coolant for electrical fans. The site was deactivated by capping the effluent pipeline to the unit on the south side of the 291-A fan plenum.

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
216-C-2 injection/ reverse well	216-C-2, 291-C dry well, 216-C-2 dry well	Inside the 200-E-41 stabilized area, south of 7th Street in the 200 East Area. It is southeast of the former 291-C-1 stack location, in the Hot Semiworks area.	1953 to 1988	291-C stack drainage and the seal water drainage from the stack ventilation filters. Volume discharged to the unit is unknown.	N/A	12 m (40 ft)	12 m by 0.3 m (39 ft by 0.9 ft)	The dry well was a 30.5-cm (12-in.)-diameter pipe that extended 0.3 m (1 ft) above grade to 12 m (40 ft) below ground surface. The bottom 7.6 m (25 ft) of the pipe was perforated. The drain is surrounded by a concrete collar at grade. A 10-cm (4-in.) stainless-steel, saran-lined inlet pipe connected the unit to the 291-C-1 stack. A second inlet line constructed of 5.1-cm (2-in.) stainless-steel pipe connected to the 291-C-1 stack ventilation filter. The unit was decommissioned in 1988 and buried with the 291-C-1 stack during the demolition activities. The reverse well is no longer visible. It is not separately marked or posted from the surrounding stabilized area (200-E-41) that is posted as URM.
216-B-4 injection/ reverse well	216-B-4, 216-B-4 french drain, 216-B-4 dry well, 216-B-4 reverse well	South of the 221-B Building, east of the 222-B Building and northeast of the 292-B Building	1945 to 1949	Before August 1947, the site received drainage from the 291-B stack. After August 1947, the site received floor drainage from the 292-B Building.	10,000 L[a]	N/A	34 m by 0.2 m (112 ft by 0.7 ft)	The top of the well extends 0.6 m (2 ft) above ground. The site is marked with a single, concrete AC-540 marker post, with a URM sign attached to the post.

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
Vehicle/Heavy Equipment Facility Decontamination Sources								
216-T-33 Crib (Rep. Site)	216-T-33, 216-T-33 Crib	West of 221-T Canyon Building and southwest of 2706-T.	1963	Liquid waste from 2706-T Building.	1,900,000 L with U (5.94 kg), Pu (5.0 g), Cs-137 (0.27 Ci), Sr-90 (0.26 Ci)[a]	3.3 m (10.8 ft) depth to bottom of crib 2 m (6.8 ft) overburden	9 m by 2 m (30 ft by 7 ft)	For a detailed description of this site, see Section 2.2.3, Representative Sites.
216-A-32 Crib	216-A-32, 216-A-32 Crib	Northeast of 202-A, inside the PUREX exclusion fence.	1959 to 1972	202-A canyon crane maintenance facility floor, sink, and shower drainage.	4,000 L	4 m (13 ft) depth of crib 2 m (7 ft) overburden	21 m by 2 m (69 ft by 7 ft)	The site is constructed of 24 m (77.5 ft) of 15-cm (6-in.) perforated vitrified clay pipe, placed horizontally 15 m (5 ft) below grade. Two layers of sisal-kraft paper separate the crib gravel from the overlying earthen backfill. The excavation has a side slope of 1H:1.5V, which is filled to the depth of 1.5 m (5 ft), with 200 m^3 (6,000 ft^3) of gravel fill. The site is currently surrounded with cement posts with URM signs. There is an inner area marked with steel posts, chains, and SCA signs.

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
Vehicle/Heavy Equipment Field Decontamination Sources								
216-T-11 Trench	216-T-11, decontamination trenches, equipment decontamination area	West of 221-T and southwest of the 216-T-33 Crib.	1951 to 1954	Liquid waste disposal of heavy equipment and vehicle decontamination waste.	N/A	2 m (7 ft)	15 m by 3 m (49 ft by 10 ft)	The site consists of a backfilled trench. In 1954, the unit was backfilled, and decontamination operations were transferred to the 269-W garage facility, which discharged to the 216-T-13 Trench. In May 1972, the site was exhumed. All contamination was taken to the 200 West Area dry waste burial ground. The 216-T-9, 216-T-10, and 216-T-11 Trenches were then released from radiation zone status. This is no longer marked or posted.
216-T-13 Trench (Rep. Site)	216-T-13, 269-W regulated garage, 269-W decontamination pit or trench, 216-T-12, 269-W regulated garage decontamination pit	North side of the 241-TY tank farm, just outside the perimeter fence.	1954 to 1964	Vehicle decontamination wastes from the 269-W garage.	N/A	3 m (10 ft)	6.1 m by 6.1 m (20 ft by 20 ft)	For a detailed description of this site, see Section 2.2.3, Representative Sites.

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
216-T-9 Trench	216-T-9, decontamination trenches, equipment decontamination area	West of the 221-T Building and southwest of the 216-T-33 Crib.	1951 to 1954	Subsurface liquid disposal of vehicle decontamination waste from heavy equipment and other vehicles.	N/A	2 m (7 ft)	15 m by 3 m (49 ft by 10 ft)	In May 1972, the site was exhumed. All contamination was taken to the 200 West Area dry waste burial ground. The 216-T-9, 216-T-10, and 216-T-11 Trenches were then released from radiation zone status. This site consists of a backfilled trench. The site is no longer marked or posted.

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
216-U-13 Trench	216-U-13, 216-U-13 Cribs, 216-U-13, vehicle steam cleaning pit	West of the 241-U tank farm.	1952 to 1956	Drainage from equipment steam cleaning and decontamination activities done inside the trenches.	11,400 L with U (0.35 kg), Pu (0.1 g), Cs-137 (4.4×10^{-2} Ci), Sr-90 (4.2×10^{-2} Ci) [a]	6 m (20 ft)	61 m by 6.1 m (200 ft by 20 ft)	The site consisted of two trenches of equal dimensions and operated as a decontamination pit where vehicles were driven down to the decontamination station at the bottom. The pits were used mainly to decontaminate trucks and cranes bearing low levels of radioactive contamination. Several large pumps used in the uranium recovery process were also cleaned here, but the residue was scraped and taken to the 200 West Area burial grounds. The site was deactivated because the decontamination operations were transferred to the 269-W garage equipment decontamination waste pit (216-T-13). The 216-U-13 was found to be free of surface and subsurface radiological contamination, and the area was released from radiological control in 1982. The two trenches are no longer marked or posted.

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
216-T-10 Trench	216-T-10, decontamination trenches, equipment decontamination area	West of the 221-T Building and southwest of the 216-T-33 Crib.	1951 to 1954	Subsurface liquid disposal of heavy equipment and vehicle decontamination waste.	N/A	2 m (7 ft)	15 m by 3 m (49 ft by 10 ft)	In May 1972, the site was exhumed. All contamination was taken to the 200 West Area dry waste burial ground. The 216-T-9, 216-T-10, and 216-T-11 Trenches were then released from radiation zone status. This site consists of a backfilled trench. The site is no longer marked or posted.

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
216-S-18 Trench	216-S-18, 241-SX steam cleaning pit, 216-S-14 steam cleaning pit	North of 13th Street, east of 241-S tank farms, and southwest of 216-S-9 Crib.	1954	Contaminated equipment and contaminated soil from the surrounding area.	98,400 L[a]	2 m (7 ft)	38 m by 4.6 m (125 ft by 16 ft)	The trench was built and retired in October 1954. It was active during the month of October 1954 as a vehicle decontamination pit. The unit is L-shaped, the surface is composed of sand and gravel, and it is 1.2 to 1.8 m (4 to 6 ft) below grade. In 1972, the site was backfilled and released from radiation zone status. During the stabilization of UPR-200-W-165 and UPR-200-W-114 in 1995, contamination specks were found in the shallow trench excavation. The area was posted as a radiation area. The source of the contamination is assumed to be contamination specks form the operation of the 241-S tank farms. In 1997, a small area of contaminated soil remaining from UPR-200-W-114 was pushed into the 216-S-18 Trench depression. The 216-S-18 Trench area was then covered with clean dirt and posted as a URM area.

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
200-E-102 Trench	200-E-102, contaminated soil trench	20.7 m (68 ft) south of the south boundary of 216-A-4 Crib.	1958	UPR-200-E-15	N/A	1 m (3 ft)	24 m by 3 m (79 ft by 10 ft)	The trench was used to bury contaminated soil from an unplanned release (WIDS site UPR-200-E-15). When the 216-A-4 Crib became plugged in 1958, the ground between the 216-A-4 Crib and 291-A turbine house flooded. The contaminated soil was scraped up and placed into a slit trench near the south end of the crib. The trench was covered with 0.3 m (1 ft) clean dirt. The trench is inside the surface stabilized URM area south of PUREX that is known as WIDS site 200-E-103. The trench is not separately marked or posted.
Low-Level Radioactive Process or Steam Condensate Sources								
216-U-3 french drain **(Rep. Site)**	216-U-3, 216-U-11, 216-U-3 french drain	South of the 241-U tank farm on the south side of 16th Street.	1954 to 1955	Condensate from the steam condenser on the 241-U-110 tank.	791,000 L with U (18 kg), Pu (0.1 g), Cs-137 (0.43 Ci), Sr-90 (0.41 Ci)	3.6 m (11.8 ft)	3.6 m by 1.8 m (11.8 ft by 5.9 ft)	For a detailed description of this site, see Section 2.2.3, Representative Sites.

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
216-U-7 french drain	216-U-7, 221-U vessel vent blower pit french drain	Southeast side of the 221-U Building and of the 241-UX-154 diversion box.	1952 to 1957	Liquid wastes from a counting box floor drain during the metal recovery program at the 221-U Building.	7,000 L with U ($1.4x10^{-2}$ kg)	5 m (16 ft)	5 m by 1 m (16 ft by 3 ft)	The drain is constructed of a gravel-filled 76-cm (30-in.)-diameter concrete pipe, set vertically into the ground, extending to a depth of 5 m (16 ft). Gravel fills 1.1 m (3.5 ft) of the pipe. The site was retired when the uranium recovery operations in the 221-U Building were shut down in 1957. In 1998, the contaminated areas on the east side of the 221-U building were surface stabilized with material from the 200 Area ash pit. The area was reposted to URM (see UPR-200-W-138 and UPR-200-W-162).

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
UPR-200-W-138 unplanned release	UPR-200-W-138, 221-U vessel vent blower pit french drain, UN-216-W-11, UN-200-W-138, UN-200-W-22, UPR-200-W-22	Southeast corner of the 221-U Building, near the R-3 entrance; located inside the larger, surface stabilized area (UPR-200-W-162).	1953 to 1953	Ground surface may have been contaminated through the 216-U-7 french drain.	An estimated 140 kg (300 lb) of uranium nitrate hexahydrate solution, containing 14 kg (30 lb) of uranium.[b]	N/A	N/A	Uranyl nitrate hexahydrate solution overflowed into the 221-U Building vessel vent blower pit, then onto the ground through the french drain. The site was described as the ground near the R-3 entrance to the 221-U Building. The area has been surface stabilized and posted with URM signs. In 1998, the contaminated areas on the east side of 221-U were covered with clean backfill material (see UPR-200-W-162). The area was reposted as a URM.
Nonradiological Process Steam Condensate Sources with Radionuclide Cross-Contamination								
216-SX-2 Crib	216-SX-2 Crib	East side of Cooper Ave., adjacent to the 241-SX tank farm.	1952 to 1965	Waste from the 241-SX-701 compressor house.	N/A	N/A	19 m by 8 m (62 ft by 26 ft)	The site is a gravel filled crib topped with a subsurface layer of sisal-kraft paper. In July 2000, the vent risers were sealed as a preventative measure for potential passive radioactive emissions. It is labeled "216-SX-2" on three sides with old-style black and white signs. The crib is currently surrounded by light posts and posted with URM signs.

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
2704-C-WS-1 french drain	2704-C-WS-1, 2704-C french drain, gatehouse french drain	200 East Area at the southwest corner of the 2704-C Building.	1949 to 1998	2704-C Building steam condensate.	N/A	N/A	N/A	The 2704-C Building was originally built in 1949 to support the Hot Semiworks operations. It was a one-story wooden structure, on a cement slab foundation, and was designated as a contaminated facility. The 2704-C Building was demolished in 1998. The area where the building stood is covered with gravel and posted with URM signs. The drain is no longer visible at the location described.
216-Z-13 french drain	216-Z-13, 234-5 dry well #1, 216-Z-13 dry well, miscellaneous stream #261	Northeast of the 291-Z stack.	1949 to 1999	Steam condensate from the 219-Z stack ET-8 exhaust fans and building steam condensate.	N/A	3 m (10 ft) overburden 5 m (16 ft) depth of drain	5 m by 1 m (16 ft by 3 ft)	The drain is constructed of two 90-cm (36-in.)-diameter tile culverts, placed end-to-end in a 4.6-m (15-ft)-deep gravel-backfilled excavation. The site is under 2.7 m (9 ft) of gravel. Two pipes discharged to the french drain, but the miscellaneous stream (#261) to the drain has been eliminated. The site is addressed in the miscellaneous streams best management practices report as a "b" stream (i.e., a stream discharging in a SCA). However, in 2001, the area was not posted as a SCA.

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
216-Z-14 french drain	216-Z-14, 234-5 dry well #2, 216-Z-14 dry well, miscellaneous stream #262	Northwest of the 291-Z stack.	1949 to present	Emergency condensate from the ET-9 exhaust fan and building steam condensate.	N/A	3 m (10 ft) overburden 5 m (16 ft) depth of drain	5 m by 1 m (15 ft by 3 ft)	The drain is constructed of two 90-cm (36-in.)-diameter tile culverts, placed end-to-end in a 4.6-m (15-ft)-deep gravel-backfilled excavation. The site is under 2.7 m (9 ft) of gravel. Two pipes discharge to the french drain. The site is also addressed in the miscellaneous streams best management practices report as a "b" stream (i.e., a stream discharging in a SCA). However, in 2001, the area was not posted a SCA. The drain is marked with a single cement marker post.

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
216-A-11 french drain	216-A-11 french drain, miscellaneous stream #465	Near the southeast corner of the 202-A Building, south of trap pit #1.	1956 to 1972	Steam and equipment leakage that drained from the 202-A Building.	100,000 L[a]	9 m (30 ft)	9 m by 1 m (30 ft by 3 ft)	The drain extends 9 m (30 ft) deep into the ground and is 0.8 m (2.6 ft) in diameter. It is constructed of two concrete pipes, placed vertically end-to-end, placed in a 3-m (10-ft)-diameter excavation, which extends 1.5 m (5 ft) below the bottom of the pipe. The unit is composed of two reinforced-concrete pipes, placed vertically end-to-end. The site is inside a small area delineated by steel posts and chain. A 0.76-m (2.5-ft)-diameter, circular metal cover is visible. One concrete AC-540 marker identifies the site. It is posted as a URM area.
216-A-12 french drain	216-A-12, miscellaneous stream #463	Center of the south side of the 202-A Building, approximately 23 m (75 ft) from the building.	1955 to 1972	Steam condensate, rain water and equipment leakage from the 202-A Building went to a sump in the bottom of pit #3	100,000 L[a]	6 m (20 ft)	6 m by 1 m (20 ft by 1 ft)	The unit is composed of two reinforced-concrete tile pipes, placed vertically end-to-end in a 3-m (10-ft)-diameter excavation, extending 1.5 m (5 ft) below the bottom. Both the drain and the excavation are filled with gravel to the top of the unit and backfilled. The drain has a side slope of 1H:1V. The site is not marked or posted and cannot be visually located.

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
216-A-13 french drain	216-A-13, 216-A-13 french drain, miscellaneous stream #460	Approximately 6 m (20 ft) west and 6 m (20 ft) south of the southwest corner of the 202-A Building.	1956 to 1962	Seal water from the air sampler vacuum pumps in the 202-A Building.	10,000 L[a]	6 m (20 ft)	6 m by 1 m (20 ft by 3 ft)	The drain is constructed of two lengths of 1-m (3-ft)-diameter concrete pipe, placed vertically end-to-end, to a depth of 5.5 m (18 ft). The waste management unit is filled to a depth of 1 m (3 ft) with 5- to 8-cm (2- to 3-in.)-diameter gravel. The base of the drain was over-excavated by at least 0.3 m (1 ft) in all directions and was filled with a bed of gravel. The line to this french drain was cut and capped in 1962. The effluent was diverted to the 216-A-35 drain. The site is not marked or posted and a 1.2-m (45-in.)-diameter metal cover is visible over the drain.

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
216-A-35 french drain	216-A-35 french drain, 216-A-35 dry well	Approximately 9 m (30 ft) south of the west end of the 202-A PUREX Building, south of the 216-A-13 french drain.	1963 to 1966	Seal cooling water from the air sampler vacuum pumps in the 202-A Building. The water was is low in salt, neutral-to-basic, and contained less than 1 Ci total beta activity.	10,000 L[a]	5 m (16 ft)	5 m by 2 m (16 ft by 7 ft)	The site has an inlet pipe located 3.2 m (10.5 ft) below grade. This french drain was a replacement for the 216-A-13 french drain. Disposal to the site was terminated when the effluent flow rate exceeded the infiltration capacity of the soil. The site was deactivated by capping the effluent pipeline to the unit and rerouting the effluent to the 216-A-29 ditch via the 202-A chemical sewer. The drain is a raised cement structure, painted yellow and surrounded with URM signs. The top cover is marked as a confined space.

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
216-A-14 french drain	216-A-14, french drain – vacuum cleaner filter pit, miscellaneous stream #462	South of the center of the 202-A Building, 5.5 m (18 ft) east of the filter pit.	1956 to 1972	Steam condensate, stormwater and equipment leakage from the 202-A Building.	1,000 L[a]	9 m (30 ft)	9 m by 1 m (230 ft by 3 ft)	The unit is composed of two 0.8-m (2.6-ft)-diameter, reinforced-concrete pipes, placed vertically end-to-end, in a 3-m (10-ft)-diameter excavation. The pipes are placed to a depth of 8.8 m (28.8 ft) and the excavation extends below the bottom of the pipe 1.5 m (5 ft). Both the drain and the excavation are filled with 8 cm (3 in.) of gravel to the top. A sump is inside the pit and drains through an underground pipe to the buried french drain. The line to this site was cut and capped in 1962. The effluent was diverted to the 216-A-35 drain. The drain is not marked or posted and has no visible surface features.
216-A-26 french drain	216-A-26, 216-A-26 french drain, 216-A-26B, miscellaneous stream #464	Inside the PUREX security fence, south of the 291-A control house and approximately 4.6 m (15 ft) south of 216-A-26A french drain.	1965 to 1991	Effluent from floor drains inside the 291-A fan house.	N/A	5 m (16 ft)	5 m by 1 m (16 ft by 3 ft)	This drain is constructed of three 1.5-m by 1.2-m (5-ft by 4-ft) clay pipes, placed end-to-end and filled with gravel. It was installed to replace the 216-A-26A french drain. The drain is accessed by a subsurface feeder pipe. The 216-A-26 was removed from service in 1991. There are no visible surface features for this drain.

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
216-A-26A french drain	216-A-26A, 216-A-25 Crib, 216-A-26 french drain, 291-A french drain	Inside the PUREX security fence, south of the 291-A Building.	1959 to 1965	Floor drainage from the 291-A fan control room.	1,000 L[a]	5 m (16 ft)	5 m by 1 m (16 ft by 3 ft)	The construction design of this waste management unit is identical to the 216-A-26 french drain except that the diameter is smaller. In 1965, the site was deactivated by removing the encasement and rerouting the effluent piping to the new 216-A-26 french drain encasement, located 4.6 m (15 ft) south. There are no surface features for this drain.
200-E-25 french drain	200-E-25, 272-BB french drain, insulation shop french drain, miscellaneous stream #659	Approximately 6 m (20 ft) north of the northeast corner of the 272-BB insulation shop.	1971 to 1991	Possibly material used in the 272-BB insulation shop.	Calcium silicate, fiberglass, and silicate. Prior to 1988, it is possible that organic chemicals, oils and grease may have been introduced into the french drain.[b]	N/A	3 m by 0.6 m (10 ft by 2 ft)	The building sink and floor drain were connected to the site by a 5.1-cm (2-in.), Schedule 40 carbon-steel pipe. A 0.4-m (1.5-ft)-diameter grease trap with a removable cover is located on the east side of the 272-BB Building. The floor drain inside the building has been permanently plugged and the sink has been removed. The drain's structure is not visible from the surface. However, the location is marked with an old sign, mounted on two support posts: "ASBESTOS WASTE DISPOSAL SITE – DO NOT EXCAVATE."

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
200-E-4 french drain **(Rep. Site)**	200-E-4, Critical Mass Laboratory dry well north, 209-E north dry well, miscellaneous stream #730	Approximately 7.6 m (25 ft) north of northeast corner of the 209-E Critical Mass Laboratory service building.	1958 to 1959	209-E Critical Mass Laboratory by underground piping.	N/A	N/A	1.2 m (4 ft)	For a detailed description of this site, see Section 2.2.3, Representative Sites.
216-Z-15 french drain	216-Z-15, 234-5 dry well #3, 216-Z-15 dry well, miscellaneous stream #263	Adjacent to the southeast corner of the 2731-Z Building and north of the 291-Z Ventilation Building.	1949 to 1997	Condensate from the S-12 evaporator cooler.	N/A	5 m (16 ft) overburden 7 m (23 ft) depth of drain	7 m by 1 m (23 ft by 3 ft)	Drain consists of two 90-cm (36-in.)-diameter tile culverts, stacked on end, in a 4.9-m (16-ft)-deep gravel, backfilled excavation. The unit is composed of two sections of vitrified clay pipe in a vertical configuration. There is one inlet pipe that is filled with cobbles and the upper end is covered with a wood plank. The site is also addressed in the miscellaneous streams best management practices report as a "b" stream (i.e., a stream discharging in a surface contaminated area). The 216-Z french drain has been inactive and its discharge source has been eliminated, since May 1997. The site is marked with a single concrete marker post that reads "BURIED RADIOACTIVITY - DO NOT EXCAVATE."

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
209-E-WS-2 french drain	209-E-WS-2, Critical Mass Laboratory french drain	Southeast corner of the Critical Mass Laboratory (laboratory wing).	N/A	Condensate from the Critical Mass Laboratory HEPA filters and heat exchange system.	N/A	N/A	1 m (3 ft)	The drain is a 1.2-m (4-ft)-diameter drain in a gravel area southeast of the building. The site is associated with the 209-E Critical Mass Laboratory. It is painted with yellow paint and has a metal cover.
299-E24-111 injection/ reverse well	299-E24-111, experimental test well site, miscellaneous stream #803	Southwest of the PUREX Facility and west of the 216-A-38-1 Crib.	1980 to 2000	Radiological tracers of strontium-85 and cesium-134 were delivered for weekly injections and PNNL injected a potassium bromide tracer.	41,580 L with calcium chloride; calcium nitrate; Cs-134 (T ½ =2.05 years); and Sr-85 (T ½=64.85 days).[b]	N/A	20 m by 0.2 m (66 ft by 0.7 ft)	The site is an injection well surrounded by 32 observation wells. It was installed as an experimental test site, constructed to obtain information about radionuclide movement in soil for data modeling and migration forecasting. Strontium-85 and cesium-134 were used as radioactive tracers. The original test start date was September 22, 1980, ending on February 2, 1981. PNNL scheduled an additional injection experiment at this site in 2000 that added another injection well near the center of the cluster, injected a potassium bromide tracer and collected soil cores. The 299-E24-111 injection well head is located inside a small, posted URM area. A small SCA is located southwest of the well.

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
216-Z-21 pond	216-Z-21, 216-Z-21 seepage basin, PFP cold waste pond	East of the 234-5 complex (outside the Z Plant security fence) and southeast of the 216-Z-9 Trench	1980 to 1995	Effluent from various sources within Z Plant, including high-tank overflow, storm drain run-off, ventilation steam condensate, dry air compressor cooling water, and ventilation air wash spray pans.	N/A	N/A	42 m by 42 m (138 ft by 138 ft)	The site is a large soil bermed depression constructed to receive Z Plant noncontact condensate and stormwater run-off. The site is an unlined seepage basin known as the 207-Z basin. The name created confusion with the 207-Z retention basin (located inside the Z Plant security fence). For this reason, the name was officially changed to 216-Z-21 in June 1987. The basin is currently dry and is not radiologically posted.

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
216-A-38-1 Crib	216-A-38-1, 216-A-38 Crib	Southwest of 202-A Building north of 1st Street. It is located south of the PUREX security fence.	Never activated.	Intended to receive the 202-A process condensate waste discharged to the 216-A-10 Crib (never used).	N/A	11 m (36 ft) depth 10 m (33 ft) overburden	159 m by 5 m (522 ft by 16 ft)	The site contains a 15-cm (6-in.) perforated steel pipe, narrowing to 10 cm (4 in.), placed horizontally 10 cm (33 ft) below grade. The unit also has a 20-cm (8-in.)-diameter inlet pipe, two 8-cm (3-in.) vent risers and filters, two 20-cm (8-in.) gauge wells, a membrane barrier, and a 20-cm (8-in.) bypass line paralleling the distribution line in the southern half of the unit. Ancillary equipment include a proportional sampling pit and the 216-A-5 neutralization tank. The crib was built to replace the 216-A-10 Crib but had not been activated when plans for modifying the PUREX head end process were begun. The planned building addition would have been constructed immediately adjacent to the crib. For this reason, the crib was never activated. The crib was posted as a URM area in 1980 because underground piping had been installed that connected the crib to the PUREX process. No surface contamination has ever been identified during routine surveillance and no stabilization activities occurred at this crib. The site is surrounded by light posts and a chain.

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
200-E-67 injection/ reverse well	200-E-67, 202-A Building steam condensate, miscellaneous stream #494	Adjacent to the south wall of 202-A.	1996	N/A	N/A	N/A	N/A	The drain is located inside of a dome-shaped caisson. The dome-shaped caisson is surrounded by post and chain and is posted with CA signs. The dome is labeled 202-A-417.
Recommended to be Moved to Other OUs								
UPR-200-E-17 unplanned release	UPR-200-E-17, overflow at 216-A-22, UN-200-E-17	North of PUREX, north of the 203-A Building, near the 216-A-28 french drain.	1958	Failed 216-A-22 Crib inlet.	N/A	N/A	N/A	This site is recommended to be moved to the 200-PW-2 OU.
216-A-22 Crib	216-A-22, 216-A-22 french drain, 216-A-22 Crib	Along the north wall of the 203-A Building, north of PUREX.	1955 to 1958	The site received the drainage from the 203-A Building truck loadout apron, the sump waste from the 203-A Building.	10,000 L[a]	3 m (10 ft) depth 2 m (7 ft) overburden	3 m by 5 m (10 ft by 16 ft)	This site is recommended to be moved to the 200-PW-2 OU.
200-E-122 storage	200-E-122, construction forces bullpen, CF bullpen, equipment storage yard	South of B Plant and south of 222-B.	N/A	Radioactively contaminated material is stored inside the fenced area.	N/A	N/A	44 m by 20 m (144 ft by 66 ft)	This site is recommended to be moved to the 200-SW-1 OU.

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
600-268 storage pad (<90 day)	600-268, 200 East pipe yard drum accumulation area, pipe laydown yard accumulation area	Inside the 200 East pipe laydown area, north of the 200 East Area 810 gate.	1995 to 1998	Seventeen drums of mixed and radioactive waste from 200 West Area well drilling activities.	N/A	N/A	15 m by 15 m (49 ft by 49 ft)	This site is recommended to be moved to the 200-SW-2 OU.
200-W-89 foundation	200-W-89, 252-U, U Plant electrical substation, C8S17 substation, U-Cat substation	Near the intersection of Beloit and 16th Street in 200 West Area, east of the 224-U Building.	N/A	The site provided electric utility support to the 221-U and 224-U Facilities.	N/A	N/A	30 m by 30 m (100 ft by 100 ft)	This site is recommended to be moved to the 200-UR-1 OU.
600-260 unplanned release	600-260, roped-off area near meteorological tower	The area between 200 East and 200 West Areas, north of Route 3.	N/A	N/A	N/A	N/A	7 m by 6 m (23 ft by 20 ft)	This site is recommended to be moved to the 200-UR-1 OU.
600-275 foundation	600-275, 218-W-14, igloo site, Army ammo site, regulated storage area	Approximately 1 mi west of the 200 West Area, south of Route 11A.	N/A	The seven Army igloos were originally used for ammunition storage. Later plutonium scrap waste was stored in the igloos.	N/A	N/A	N/A	This site is recommended to be moved to the 200-UR-1 OU.
200-W-64 foundation	200-W-64, 2724-W contaminated laundry facility building foundation	200 West Area, at the corner of Beloit Ave. and 20th Street.	1950 to 1994	The 2724-W Building housed the contaminated laundry facility.	N/A	N/A	42 m by 32 m (138 ft by 105 ft)	This site is recommended to be moved to the 200-UR-1 OU.

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
200-W-17 unplanned release	200-W-17, S Plant Project W-087 aluminum silicate discovery	200 West Area, southwest of REDOX.	N/A	The source of the aluminum silicate at the site is likely the 200-W-1 mud pit.	The waste associated with this site was aluminum silicate.	1 m (3 ft)	1 m by 1 m (3 ft by 3 ft)	This site is recommended to be moved to the 200-SW-1 OU.
200-W-18 unplanned release	200-W-18, S Plant Project W-087 aluminum oxide discovery	200 West Area, southwest of REDOX.	N/A	The source of the aluminum oxide at this site is likely the 200-W-1 mud pit.	The analysis showed the material to be aluminum oxide and calcium.	0.1 m (0.3 ft)	3 m by 0.1 m (10 ft by 0.3)	This site is recommended to be moved to the 200-SW-1 OU.
200-W-86 unplanned release	200-W-86, contamination area around power pole	The site is located northwest of 221-U Building, on a gravel road known as Bridgeport Avenue.	N/A	The Dyncorp Integrated Soil, Vegetation and Animal Control group submitted this site to WIDS as a discovery site.	N/A	N/A	4 m by 4 m (13 ft by 13 ft)	This site is recommended to be moved to the 200-UR-1 OU.
200-W-75 silo	200-W-75, radiological logging system (RLS) calibration silos	West of the 202-S Building, south of the 276-S Building, and north of the 211-S tanks.	N/A	In the late 1970s, test well mockups were used to calibrate "in-well" radionuclide detectors.	Radioactive sources consisting of known quantities of Co-60, Sr-90, Ru-106, and Ce-144 in sealed capsules.	N/A	2 m by 1 m (7 ft by 3 ft)	This site is recommended to be moved to the 200-SW-2 OU.
200-W-80 spoils pile/berm	200-W-80; mound of contaminated soil southwest of T Plant	West of 221-T and northeast of the 241-T-361 settling tank.	N/A	It is possible that the mound was created during a parking lot expansion at T Plant that occurred several years ago.	N/A	N/A	16 m by 14 m (42 ft by 45 ft)	This site is recommended to be moved to the 200-UR-1 OU.
200-E-85 injection/ reverse well	200-E-85, 202-A Building pump seal water, miscellaneous stream #459	Adjacent to the north wall of 2712-A Building, south of 202-A.	N/A	Pump seal water.	N/A	N/A	N/A	This site is recommended to be moved to the 216/218 injection/reverse well regulatory authority category.

Table A-5. Summary of Information for 200-MW-1 Waste Sites Reviewed in Work Plan. (32 Pages)

Site Code Type	Site Names	Location	Dates of Operation	Source Facility	Contaminant Inventory/Volume Released	Depth	Waste Site Dimensions	General Description
200-E-101 depression/ pit (nonspecific)	200-E-101, 200 East deep lysimeter site	Southeast of 200 East Area, within the 100-B/C radiologically controlled area.	N/A	N/A	Short-lived radioisotopes may have been injected as tracers in early experiments.	N/A	18 m by 3 m (59 ft by 10 ft)	The site is recommended to be moved to the 200-UR-1 OU.
600-262 Crib	600-262, West Lake test crib	East of Route 4 North, southwest of West Lake.	1959 to 1962	N/A	95,760.00 L, calcium nitrate, strontium-85[b]	0.6 m (2 ft)	0.6 m by 0.6 m (2 ft by 2 ft)	The site is recommended to be moved to the 200-UR-1 OU.
600-37 french drain	600-37, Brown's wells, Johnson's wells	Southeast of 200 West Area, at the southern boundary.	N/A	Assumed to be raw water. However sampling testing should be conducted in the unit.	N/A	N/A	3 m by 2 m (10 ft by 7 ft)	The site is recommended to be moved to the 200-UR-1 OU.

[a] *Waste Site Grouping for 200 Areas Soil Investigations*, DOE/RL-96-81, Rev. 0 (DOE-RL 1997).
[b] From WIDS database.

CA = contamination area
HEPA = high-efficiency particulate air
N/A = not available
PFP = Plutonium Finishing Plant
PNNL = Pacific Northwest National Laboratory
SCA = surface contamination area
URM = underground radiation area

Table A-6. 200-MW-1 Site Removal Rationale. (2 Pages)

Site Code	New OU	Rationale
216-A-22 Crib	200-PW-2	This site operated during the time that PUREX was in production mode. The drainage from the 203-A Building to the site was redirected to the 216-A-28 french drain in December 1958. The 216-A-28 Crib is justifiably placed in the 200-PW-2 Uranium-Rich Process Condensate/Process Waste Group. Based on the description of the units, their identical sources, and the fact that they both operated during the time PUREX was in production mode, they clearly should be approached the same from an expected remedy and, therefore, should be in the same OU.
UPR-200-E-17 unplanned release	200-PW-2	Sufficient splashing occurred when the 216-A-22 Crib inlet failed, causing the ground on top of the crib to become yellow with uranium. Because the 216-A-22 Crib is being moved to 200-PW-2, it is also appropriate to move the associated UPR.
200-E-122 storage	200-SW-1	This site is a construction laydown yard; therefore, the nonradiological landfills and dumps OU is the most logical for this site. The postings refer to potential due to contaminated material wrapped and stored there and not a release to the soil.
600-268 storage pad (<90 day)	200-SW-2	This site belongs in the radiological landfills and dumps waste OU.
200-W-89 foundation	200-UR-1	This site should be in an unplanned release OU, not the 200-MW-1 OU.
600-260 unplanned release	200-UR-1	This site is a roped-off area near meteorological tower. It should be in an unplanned release OU, not the 200-MW-1 OU.
600-275 foundation	200-UR-1	This regulated storage area should be in an unplanned release OU, not in the 200-MW-1 OU.
200-W-64 foundation	200-UR-1	This site should be in an unplanned release OU, not in the 200-MW-1 OU.
200-W-17 unplanned release	200-SW-1	This site should be included in the 200-SW-1 OU (not the 200-MW-1 OU) because the waste associated with this site was aluminum silicate, likely resulting from drilling mud at the 200-W-1 OU.
200-W-18 unplanned release	200-SW-1	This site should be included in the 200-SW-1 OU (not the 200-MW-1 OU) because the waste associated with this site was aluminum silicate, likely resulting from drilling mud at the 200-W-1 OU.
200-W-86 unplanned release	200-UR-1	This site is a small, graveled SCA around an active (currently in use) power pole, near the intersection of the U Plant railroad and Bridgeport Avenue. This site should be in an unplanned release OU rather than the 200-MW-1 OU.

Table A-6. 200-MW-1 Site Removal Rationale. (2 Pages)

Site Code	New OU	Rationale
200-W-75 silo	200-SW-2	This site should be included in 200-SW-1 since it consists of four calibration silos that contain radioactive sources. The four underground Radiological Logging System equipment calibration silos are located west of the 202-S building, south of the 276-S building and north of the 211-S tanks. One calibration silo is located west of the 211-S tanks, across an asphalt access road. The calibration mockups were constructed of a steel container approximately 2.4 m (8 ft) deep filled with soil. Tubes containing radioactive sources were inserted into the soil at distances of 2.5, 7.6, 15, 30, 46, and 61 cm from the well casing that was located in the center of the mockup. The mockup silo was buried so that a Radiological Logging System vehicle could drive up to the calibration silo and drop its logging probe into the center well casing.
200-W-80 spoils pile/berm	200-UR-1	This site is a mound of contaminated soil southwest of T Plant. It should be included in an unplanned release OU (not in the 200-MW-1 OU) because the debris associated with this site appears to be from parking lot work rather than liquid waste site disposal.
200-E-85 injection/reverse well	216/218 Regulatory Authority	This site received only condensate and should be included with 216/218 regulatory authority sites.
200-E-101 depression/pit (nonspecific)	200-UR-1	This site was a field lysimeter used to measure natural precipitation infiltration. While short-lived radionuclides may have been used as part of a test, it was not a liquid waste disposal site. The site should be moved into the 200-UR-1 OU.
600-262 Crib	200-UR-1	This site was a test crib injected with short-lived radionuclides to determine soil capacity. Because it is not a liquid waste discharge site, it should be included in the 200-UR-1 OU.
600-37 french drain	200-UR-1	This site was not a liquid waste discharge site and should be included in the 200-UR-1 OU.

Table A-7. 200-MW-1 Operable Unit Subgroup Sites. (2 Pages)

Process Facility Ventilation Stack and Sand Filter Sources	Vehicle/Heavy Equipment Facility Decontamination Sources	Vehicle/Heavy Equipment Field Decontamination Sources	Low-Level Radioactive Process or Steam Condensate Sources	Nonradiological Process Steam Condensate Sources with Radionuclide Cross-Contamination Sources
216-A-4[a] Crib	**216-T-33**[b] Crib	216-T-11 Trench	**216-U-3**[d] french drain	**200-E-4**[e] french drain (Critical Mass Laboratory)
216-A-41 Crib	216-A-32 Crib	**216-T-13**[c] Trench	216-U-7 french drain	200-E-25 french drain (272 insulation shop)
216-A-21 Crib		216-T-9 Trench	UPR-200-W-138	216-SX-2 french drain
216-A-27 Crib		216-U-13 Trench		2704-C-WS-1 french drain (Semi-Works gate house)
216-S-12 Trench		216-T-10 Trench		216-Z-13 french drain (ET-8 exhaust fan)
216-B-13 french drain (stack drainage)		216-S-18 Trench		216-Z-14 french drain (ET-9 exhaust fan)
200-E-55 french drain (291-B sand filter)		2200-E-102 Trench		216-A-11 french drain (202-A steam trap pit #1)
216-T-29 french drain (sand filter)				216-A-12 french drain (202-A steam trap pit #3)
216-T-31 french drain (241-TX farm steam condensate contaminated by line cleanout)				216-A-13 and 216-A-35 (seal water air sampler vacuum pumps) french drains
216-A-33 french drain				216-A-14 french drain (vacuum cleaner filter/blower pit)
216-C-2 injection/reverse well				216-A-26 and 216-A-26A (floor drainage 291-A fan control house) french drains
216-B-4 injection/reverse well				216-Z-15 french drain (S12 evaporative cooler)
				209-E-WS-2 french drain (Critical Mass Laboratory)
				299-E24-111 injection/reverse well
				216-Z-21 pond
				216-A-38 Crib
				200-E-67 injection/reverse well

Table A-7. 200-MW-1 Operable Unit Subgroup Sites. (2 Pages)

Process Facility Ventilation Stack and Sand Filter Sources	Vehicle/Heavy Equipment Facility Decontamination Sources	Vehicle/Heavy Equipment Field Decontamination Sources	Low-Level Radioactive Process or Steam Condensate Sources	Nonradiological Process Steam Condensate Sources with Radionuclide Cross-Contamination Sources

[a] 216-A-4 is the representative site of the process facility ventilation stack and sand filter sources subgroup for this OU. (Also recommended by the Implementation Plan [DOE-RL 1999].)

[b] 216-T-33 is the representative site of the vehicle/heavy equipment facility decontamination subgroup for this OU. (Also recommended by the Implementation Plan [DOE-RL 1999].)

[c] 216-T-13 is the representative site of the vehicle/heavy equipment field decontamination subgroup for this OU.

[d] 216-U-3 is the representative site of the low-level radioactive process or steam condensate sources subgroup for this OU. (Also recommended by the Implementation Plan [DOE-RL 1999].)

[e] 200-E-4 is the representative site of the nonradiological process steam condensate with radiation from cross-contamination from other sources subgroup for this OU.

APPENDIX B

200-MW-1 OPERABLE UNIT CONTAMINANTS OF CONCERN PROCESS

TABLE OF CONTENTS

TABLES

APPENDIX B

200-MW-1 OPERABLE UNIT CONTAMINANTS OF CONCERN PROCESS

B.1 BACKGROUND

Tables 3-4, 3-5, and 3-6 from the *200 Areas Remedial Investigation/Feasibility Study Implementation Plan – Environmental Restoration Program* (hereinafter referred to as the Implementation Plan) (DOE-RL 1999) were used as the starting point to develop the contaminant of concern (COC) list for the 200-MW-1 Miscellaneous Waste Group Operable Unit (OU). The rationale for the development of the tables is presented in this appendix, as well as a discussion of other potential chemicals that may be present.

B.1.1 Radionuclides

Potential radionuclide contaminants are listed in Table B-1. Note that although samarium-151 has received little attention in the past, it becomes a significant fraction of total fission product activity after approximately 25 years of decay and will remain significant for up to 1,000 years (i.e., 100-year half-life). The necessity for analysis of samarium-151 is being evaluated at this time.

All other radionuclides potentially present in the 200 Areas that are not included in Table B-1are excluded from the table for one of the following reasons:

- Directly tied to the isotopes identified above as descendent daughters (e.g., strontiom-90 daughter yttrium-90) and may be calculated from the parent activity
- Fission/neutron activation products with less than 0.01% of the cesium-137 or strontium-90 activity (e.g., iodine-129 or selenium-79) that cannot be readily separated from the major fission product activity contributors for analysis
- Alpha-emitting isotopes of the same element in concentrations less than 1% of the primary isotope (e.g., plutonium-242 in plutonium-239) that cannot be resolved during analysis.

It is assumed that very small amounts of additional activity potentially present from radionuclides that are not analyzed for will have no significant effects on remediation decisions.

B.1.2 Inorganic Chemicals

Most of the chemicals used in 200 Area processing activities were inorganic. The potential inorganic COCs are listed in Table B-2. Analyses for inorganic chemicals do not routinely determine chemical compounds (e.g., sodium nitrate) but are used to determine the ionic building blocks that comprise the compounds (e.g., sodium and nitrate separately). Analyses for metals routinely detect a suite of metals that include many relatively innocuous metals (e.g., sodium, iron, or aluminum) that were introduced in large quantities in the 200 Areas. These inorganic chemicals have not been included in Table B-2 because even massive concentration levels are not expected to impact remediation decisions.

B.1.3 Organic Chemicals

Unlike inorganic chemical analyses, most organic chemical analyses determine specific chemical compounds (or compound groups such as polychlorinated biphenyls [PCBs]). Table B-3 lists the potential organic COCs in the 200 Areas.

B.1.4 Other Chemicals

Chemicals loosely identified as "complexants" were used in the 200 Areas. These materials range from components of laundry detergents, to boiler water treatment compounds, to specific complexants such as ethylenediaminetetraacetic acid (EDTA), N-hydroxyethylene-diaminetriacetic acid (HEDTA), and citric acid. The largest process use of specific complexants was in the waste fractionation processes that occurred from 1963 through 1983 at B Plant. However, these materials were also used in other facilities for cleanout operations and potentially for cleaning up after plant process upsets. In general, complexants were used to help solubilize materials or assist in keeping components in solution. Most of these compounds are, in themselves, low in toxicity (i.e., most of the complexants used at B Plant are available in food-grade specification). The concern in the 200 Areas is that these materials may increase the solubility of toxic, radioactive, or hazardous materials normally strongly retained on Hanford Site soils. Unfortunately, there are no simple or readily available analytical techniques for detecting complexant compounds in environmental-type samples. Strategies for dealing with complexants will be developed during group-specific data quality objective (DQO) efforts and in the sampling and analysis plans. Consumer products (e.g., Tide and Saniflush), while potentially used, are not included because the quantities are expected to be small.

B.2 STRATEGY

After reviewing the tables provided in the Implementation Plan (DOE-RL 1999), a list of all contaminants of potential concern (COPCs) was developed. The next step in the evaluation process involved extracting known toxic materials from the master COPC list to be included in the final COC list. This will include a review of *Listed Waste History at Hanford Facility TSD Units* (Miskho 1996) to identify listed waste contaminants associated with 200-MW-1 waste sites. An assessment of these contaminants as potential COCs will then be made. Should listed waste contaminants be determined to potentially be present in waste sites in quantities that may require an assessment of human health or ecological risk, then these contaminants will be added as COCs. If, however, the contaminants are not considered to be of concern (e.g., volatile or disposed in small quantities), then they will not be identified as such. Listed waste constituents, however, will be retained as analytes of interest because of issues associated with waste designation and compliance with land disposal restrictions. Inorganic salts and acids represent a large group of constituents in the waste sites being evaluated. Because laboratory analyses are generally not acid- or compound-specific, the acids and inorganic salts were excluded from further consideration. Instead, the readily detected cations and anions (e.g., metals, fluorides, and nitrates) associated with the acids and inorganic salts serve as the target constituents for those compounds. This logic recognizes the small volumes of hazardous and radiological constituents released into large-volume aqueous discharges.

The analytical approach employed for this project generally targets the significant risk drivers that are representative of the waste constituents present. The general suite-type analytical techniques yield results for many metals and organic compounds, providing a cost-effective approach for the known toxic materials that could be present.

The COPCs in the following categories were excluded from further consideration:

- Short-lived radionuclides with half-lives less than 3 years
- Radionuclides that constitute less than 1% of the fission product inventory and for which historical sampling indicates nondetection
- Naturally occurring isotopes that were not increased above background levels as a result of Hanford Site operations
- Constituents with atomic mass numbers greater than or equal to 242 that represent less than 1% of the actinide activities
- Progeny radionuclides that build insignificant activities within 50 years and/or for which parent/progeny relationships exist that permit progeny estimation
- Constituents that would be neutralized and/or decomposed by facility processes
- Chemicals in a gaseous state that cannot accumulate in soil media
- Chemicals used in minute quantities relative to the bulk production chemicals consumed in the normal processes; these chemicals have no suspected introduction to waste streams except in incidental quantities
- Chemicals that are not persistent in the environment due to biological degradation or other natural mitigating features.

The final COCs for the five 200-MW-1 subgroups are presented in Tables B-6 through B-10.

B.3 REFERENCES

Agnew, S. F., J. Boyer, R. S. Corbin, T. B. Duran, J. R. Fitzpatrick, K. S. Jurgensen, T. P. Ortiz, and B. L. Young, 1997, *Hanford Tank Chemical and Radionuclide Inventories: HDW Model*, LA-UR-96-3860, Rev. 4, Los Alamos National Laboratory, Los Alamos, New Mexico.

Borsheim, G. L. and B. C. Simpson, 1991, *An Assessment of the Inventories of the Ferrocyanide Watchlist Tanks,* WHC-SD-WM-ER-133, Westinghouse Hanford Company, Richland, Washington.

DOE-RL, 1999, *200 Areas Remedial Investigation/Feasibility Study Implementation Plan – Environmental Restoration Program*, DOE/RL-98-28, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

FH, 2000, *Submittal of Documentation in Fulfillment of Milestone M-15-37B*, letter FH-000279, to U.S. Department of Energy, Richland Operations Office, dated June 15, 2000, Fluor Hanford, Inc., Richland, Washington.

GE, 1944, *Hanford Engineer Works Technical Manual (T/B Plants),* Parts A, B, and C, HW-10475, General Electric Company, Richland, Washington.

GE, 1951a, *Process Waste Disposal Summary – 200 Areas (September 1949 through December 1950),* HW-20583, General Electric Company, Richland, Washington.

GE, 1951b, *REDOX Technical Manual*, HW-18700-DEL, General Electric Company, Richland, Washington.

HEW, 1945, *History of Operations (1 January 1944 to 20 March 1945),* OUT-1462, Hanford Engineer Works, Richland, Washington.

Kupfer, M. J., A. L. Boldt, B. A. Higley, K. M. Hodgson, L. W. Shelton, B. C. Simpson, R. A. Watrous, M. D. LeClair, G. L. Borsheim, R. T. Winward, R. M. Orme, N. G. Colton, S. L. Lambert, D. E. Place, and W. W. Schulz, 1997, *Standard Inventories of Chemicals and Radionuclides in Hanford Site Tank Wastes*, HNF-SD-WM-TI-740, Rev. 0, Lockheed Martin Hanford Corporation, Richland, Washington.

Mandis, M., 2001, *Discussion Notes with PFP Personnel*, CCN 092730, dated October 22, 2001, Bechtel Hanford, Inc., Richland, Washington.

Miskho, A. G., 1996, *Listed Waste History at Hanford Facility TSD Units*, WHC-MR-01517, Westinghouse Hanford Company, Richland, Washington.

Price, S. M., M. K. Additon, and R. B. Kasper, 1979, *Distribution of Plutonium and Americium Beneath the 216-Z-1A Crib: A Status Report*, RHO-ST-17, Rockwell Hanford Operations, Richland, Washington.

Rohay, V. J., 1994, *1994 Conceptual Model of the Carbon Tetrachloride Contamination in the 200 West Area at the Hanford*, WHC-SD-EN-TI-248, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990, *Inventory of Chemicals Used at Hanford Site Production Plants and Support Operations*, WHC-EP-0172, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

WHC, 1996, *The Plutonium Production Story at the Hanford Site: Processes and Facilities History*, WHC-MR-0521, Westinghouse Hanford Company, Richland, Washington.

Table B-1. Potential Radionuclides of Concern in the 200 Areas.

Radionuclide	Source	Comments
H-3	Neutron activation/ fission	N/A
C-14	Neutron activation	N/A
Co-60	Neutron activation	Approaching practical detection limits for routine analytical technologies.
Ni-63	Neutron activation	N/A
Sr-90	Fission	N/A
Tc-99	Fission	N/A
Cs-137	Fission	N/A
Sm-151	Fission	Currently no analytical methods available for analysis.
Eu-154	Fission	N/A
Eu-155	Fission	N/A
Th-228	Natural	Special case from thorium processing.
Th-232	Natural	Special case from thorium processing.
U-233	Neutron activation	Special case from thorium processing.
U-234	Natural	N/A
U-235	Natural	N/A
U-238	Natural	N/A
Pu-238	Neutron activation	N/A
Pu-239	Neutron activation	N/A
Pu-240	Neutron activation	N/A
Pu-241	Neutron activation	Primarily a beta emitter, routinely addressed via Am-241 (daughter) analysis.
Am-241	Decay of Pu-241	N/A

Source: Table 3-4 of the *200 Areas Remedial Investigation/Feasibility Study Implementation Plan – Environmental Restoration Program* (DOE-RL 1999).
N/A = not applicable

Table B-2. Potential Inorganic Chemicals of Concern in the 200 Areas.

Inorganic Analyte	Primary Source	Comments
Nitrate	All processes	N/A
Sulfate	All processes	N/A
Chloride	All processes	N/A
Fluoride	$BiPO_4$, PUREX, PFP, WESF	N/A
Phosphate	$BiPO_4$, decontamination, laundry	N/A
Mercury	All fuel decladding	N/A
Lead	Shielding – all processes	N/A
Manganese	All processes	Typically from permanganate materials.
Chromium	All processes	From chromates and stainless steel corrosion.
Cadmium	PUREX and 234-5 Z	Neutron poisons.
Cyanide	Tank scavenging	Added as ferrocyanides.
Ammonia	PUREX and waste fractionizaton	N/A
pH	All processes	Measurement of potential high corrosion due to acids or bases.
Asbestos	All processes	Primarily from insulation and building materials.

Source: Table 3-5 of the Implementation Plan (DOE-RL 1999).
$BiPO_4$ = bismuth-phosphate
N/A = not applicable
PUREX = Plutonium-Uranium Extraction (Facility)
PFP = Plutonium Finishing Plant
WESF = Waste Encapsulation and Storage Facility

Table B-3. Potential Organic Chemicals of Concern in the 200 Areas.

Organic Analyte	Primary Source	Comments
Kerosene range hydrocarbons	PUREX, URP, waste fractionation	Covers all pure hydrocarbon (based dilutents including NPH, Shell solvent, kerosene, etc.).
Tributyl phosphate	PUREX, URP, PFP	N/A
Carbon tetrachloride	PFP	Routine volatile organic analysis will identify and quantitate this compound.
Chlorinated solvents	Decontamination activities	Routine volatile organic analysis will identify and quantitate all potential solvents used in the 200 Areas.
Hexone	REDOX	Routine volatile organic analysis will identify and quantitate this compound.
PCBs	All processes	From hydraulic fluids, electrical equipment, and insulation.

Source: Table 3-6 of the Implementation Plan (DOE-RL 1999).
N/A = not applicable
NPH = normal paraffin hydrocarbon
REDOX = Reduction-Oxidation (Facility)
URP = uranium recovery process

Table B-4. Sources of Contamination, COPCs, and Affected Media for the 200-MW-1 Operable Unit. (3 Pages)

Known or Suspected Source of Contamination (Process)	Type of Contamination from Each Source (General Contamination)	Affected Media
Miscellaneous streams discharged from various 200 Area facilities.	Wastes were similar and contained mixed fission products, activation products, transuranics, inorganics and were neutral to basic with low amounts of salts, semi-volatile and volatile organic chemicals.	Shallow soils (0 to 4.6 m [0 to 15 ft] bgs) and deep soils (>4.6 m [>15 ft] bgs) associated with the waste sites and potentially the groundwater beneath the crib waste sites.

Radioactive COPCs			
Americium-241	Europium-154	Plutonium-241	Tellurium-129
Americium-242	Europium-155	Plutonium-242	Thorium-228
Americium-243	Iodine-129	Praseodymium-143	Thorium-232
Antimony-125	Iodine-131	Praseodymium-144	Tin-113
Barium-137m	Lanthanum-140	Promethium-147	Tin-123m
Barium-140	Lead-212	Protactinium-233	Tin-123
Cadmium-113m	Lead-214	Radium-224	Tin-125
Carbon-14	Neodymium-147	Radium-226	Tin-126
Cerium-141	Neptunium-237	Radium-228	Tritium
Cerium-144	Neptunium-239	Rhodium-106	Uranium-232
Cesium-134	Nickel-59	Ruthenium-103	Uranium-233
Cesium-135	Nickel-63	Ruthenium-106	Uranium-234
Cesium-137	Niobium-93m	Samarium-149	Uranium-235
Cobalt-60	Niobium-95	Samarium-151	Uranium-236
Curium-242	Niobium-96	Selenium-79	Uranium-238
Curium-243	Niobium-98	Strontium-89	Yttrium-90
Curium-244	Palladium-107	Strontium-90	Yttrium-91
Curium-245	Plutonium-238	Technetium-99	Zirconium-93
Europium-152	Plutonium-239	Tellurium-129m	Zirconium-95
	Plutonium-240		

Table B-4. Sources of Contamination, COPCs, and Affected Media for the 200-MW-1 Operable Unit. (3 Pages)

<table>
<tr><th>Known or Suspected Source of Contamination (Process)</th><th colspan="2">Type of Contamination from Each Source (General Contamination)</th><th>Affected Media</th></tr>
<tr><td colspan="4">Inorganic Chemical COPCs</td></tr>
<tr>
<td>Aluminum fluoride
Aluminum nitrate
Aluminum nitrate nonahydrate (ANN)
Aluminum nitrate (mono basic)
Aluminum silicate
Aluminum sulfate
Ammonium cerium nitrate
Ammonium fluoride/ ammonium nitrate (AFAN)
Ammonium fluoride
Ammonium fluosilicate
Ammonium hydroxide
Ammonium iron fluoride
Ammonium iron sulfate
Ammonium lanthanum nitrate
Ammonium oxalate
Ammonium sulfate
Anionic resins (sulfates)
Antimony
Arsenic salts
Barium nitrate
Beryllium
Bismuth orthophosphate
Bismuth subnitrate/oxynitrate
Borate(s)
Boric acid
Cadmium nitrate</td>
<td>Calcium carbonate (lime)
Calcium fluoride
Calcium iodide
Calcium nitrate
Chromic acid
Chromous sulfate
Chromium nitrate
Citric fluoride
Cuppric nitrate
Cuppric sulfate
Disodium phosphate
Ferric ammonium sulfate
Ferric hydroxide
Ferric nitrate
Ferrous ammonium sulfate
Ferro/ferric cyanide
Ferrous sulfamate
Ferrous sulfate
Gold
Gallium oxide
Hydrobromic acid
Hydrochloric acid
Hydrogen sulfide
Hydrofluoric acid
Hydroiodic acid
Hydrogen peroxide
Lanthanum fluoride
Lanthanum hydroxide
Lanthanum nitrate
Lead
Lead nitrate</td>
<td>Lead oxide
Lithium chloride
Magnesium nitrate
Magnesium oxide
Magnesium silicate (Mistron)
Manganese nitrate
Manganese oxide
Mercuric nitrate
Mercuric thiocyanate
Mercury
Molybdenum
Nickel nitrate
Nickel sulfate
Nitrous acid
Nitric acid
Periodic acid
Phosphate
Phosphoric acid
Phosphorous pentoxide
Phosphotungstic acid (PTA)
Potassium carbonate
Potassium chloride
Potassium dichromate
Potassium fluoride
Potassium hydroxide
Potassium nitrate
Potassium oxalate
Potassium permanganate
Selenium
Silicon dioxide
Silver iodide</td>
<td>Silver nitrate
Sodium aluminate
Sodium bicarbonate
Sodium bromate
Sodium carbonate
Sodium chloride
Sodium dichromate
Sodium fluoride odium hexametaphosphate (calgon)
Sodium hydrogen sulfate
Sodium hydroxide
Sodium metabismuthate
Sodium nitrate
Sodium nitrite
Sodium oxalate
Sodium persulfate
Sodium silicate
Sodium sulfate
Sodium sulfite
Sodium thiosulfate
Sodium phosphate
Sodium pyrophosphate
Sulfamic acid
Sulfuric acid
Tantalum
Tin
Titanium chloride
Zinc nitrate
Zinc phosphate
Zirconium carbonate gel
Zirconyl nitrate
Zirconyl phosphate</td>
</tr>
</table>

Table B-4. Sources of Contamination, COPCs, and Affected Media for the 200-MW-1 Operable Unit. (3 Pages)

Known or Suspected Source of Contamination (Process)	Type of Contamination from Each Source (General Contamination)	Affected Media
Organic Chemical COPCs		

1,1-dichloroethane (DCA) 1,2-dichloroethane (DCA) 1,1,1-thrichloroethane (TCA) Acetic acid Acetone Alizarin yellow Benzene Bromocresol purple Bromonaphthalene Butanol 2-butanone (methyl ethyl ketone [MEK]) Benzyl alcohol Carbon tetrachloride Cis-1,2-dichloroethylene Chlorobenzene Chloroform Dibutyl butyl phosphonate (DBBP) Dibutyl phosphate (DBP)	Di(2-ethylhexyl) phosphoric acid Dodecane Ethanol Ethyl ether Ethylene diamine tetra-acetate (EDTA) Ethylene glycol Ethylbenzene Formaldehyde Glycerol Glycolic acid Hexone (methyl isobutyl ketone [MIBK]) Hydraulic fluids (greases) Hydrazine Hydroxylamine (HN) Hydroxylamine hydrochloride Hydroxyacetic acid Hydroxyquinoline Isopropyl alcohol	Mandelic acid Methanol Methyl latic acid Methylene chloride Molybdate-citrate reagent Mono-2-ethylhexyl phosphoric acid Monobutyl phosphate Naphtha Napthylamine n-butyl benzene Normal paraffin hydrocarbons (kerosene, Shell solvent, etc.) Polychlorinated biphenyls (PCBs) Pentasodium diethylene triamine penta acetate (DTPA) S-diphenylcarbazide Sodium gluconate Sulfonic acid (chloro) Tartaric acid	Tetrabromoethane Tetrahydrofuran Tetrachloroethylene (PCE) Tetraphenyl boron Thenoyltrifluoroacetone Thymolphthalein Trans-1,2-dichloroethylene Tri-iso-octylamine Tri-n-dodecylamine Tri-n-octylamine Tributyl phosphate (TBP) Trichloroethylene (TCE) Tris (hydroxymethyl) amino methane Trisodium nitrilo triacetate (NTA) Trisodium hydroxyethyl ethylene – diamine triacetate (HEDTA) Toluene Urea Xylene

Table B-5. Table 200-MW-1 Operable Unit COPC Exclusions and Justifications. (19 Pages)

CAS#	COPCs	Analyzed as Ions (as applicable)	Rationale for Exclusion	A-4	T-33	T-13	U-3	E-4
Radioactive COPCs								
14596-10-2	Am-241	N/A	See final COC table.	I	I	I	I	I
13981-54-9	Am-242	N/A	Constituent with atomic mass number greater than or equal to 242 that represents << 1% of the actinide activity (based on ORIGEN2 modeling of Hanford reactor production).	E	E	E	E	E
14993-75-0	Am-243	N/A	Constituent with atomic mass number greater than or equal to 242 that represents << 1% of the actinide activity (based on ORIGEN2 modeling of Hanford reactor production).	E	E	E	E	E
14234-35-6	Sb-125	N/A	Short-lived radionuclide (half-life <3 years).	E	E	E	E	E
N/A	Ba-137m	N/A	Short lived descendent daughter of Cs-137 (COC).	E	E	E	E	E
14798-08-4	Ba-140	N/A	Short-lived radionuclide (half-life <3 years).	E	E	E	E	E
14336-66-4	Cd-113m	N/A	Less than 1% of Cs-137 activity. Insignificant contribution to dose.	E	E	E	E	E
14762-75-5	C-14	N/A	Constituent generated at less than 5E-5 times the Cs-137 activity.	E	E	E	E	E
13967-74-3	Ce-141	N/A	Short-lived radionuclide (half-life <3 years).	E	E	E	E	E
14762-78-8	Ce-144	N/A	Short-lived radionuclide (half-life <3 years).	E	E	E	E	E
13967-70-9	Ce-134	N/A	Short-lived radionuclide (half-life <3 years).	E	E	E	E	E
15726-30-4	Ce-135	N/A	Constituent generated at less than 5E-5 times the Cs-137 activity.	E	E	E	E	E
10045-97-3	Cs-137	N/A	See final COC table.	I	I	I	I	I
10198-40-0	Co-60	N/A	See final COC table.	I	I	I	I	I
15510-73-3	Cm-242	N/A	Constituent with atomic mass number greater than or equal to 242 that represents << 1% of the actinide activity (based on ORIGEN2 modeling of Hanford reactor production).	E	E	E	E	E
15757-87-6	Cm-243	N/A	Constituent with atomic mass number greater than or equal to 242 that represents << 1% of the actinide activity (based on ORIGEN2 modeling of Hanford reactor production).	E	E	E	E	E

Table B-5. Table 200-MW-1 Operable Unit COPC Exclusions and Justifications. (19 Pages)

CAS#	COPCs	Analyzed as Ions (as applicable)	Rationale for Exclusion	A-4	T-33	T-13	U-3	E-4
13981-15-2	Cm-244	N/A	Constituent with atomic mass number greater than or equal to 242 that represents less than 1% of the actinide activity. May be reported via americium isotopic analysis.	E	E	E	E	E
15621-76-8	Cm-245	N/A	Constituent with atomic mass number greater than or equal to 242 that represents << 1% of the actinide activity (based on ORIGEN2 modeling of Hanford reactor production).	E	E	E	E	E
14683-23-9	Eu-152	N/A	See final COC table.	I	I	I	I	I
15585-10-1	Eu-154	N/A	See final COC table.	I	I	I	I	I
14391-16-3	Eu-155	N/A	See final COC table.	I	I	I	I	I
15046-84-1	I-129	N/A	Constituent generated at less than 5E-5 times the Cs-137 activity; historical tank sampling indicates nondetection.	I	E	E	E	E
10043-66-0	I-131	N/A	Short-lived radionuclide (half-life <3 years).	E	E	E	E	E
13981-28-7	La-140	N/A	Short-lived radionuclide (half-life <3 years).	E	E	E	E	E
15092-94-1	Pb-212	N/A	Short-lived radionuclide (half-life <3 years).	E	E	E	E	E
15067-28-4	Pb-214	N/A	Short-lived radionuclide (half-life <3 years).	E	E	E	E	E
14269-74-0	Nd-147	N/A	Short-lived radionuclide (half-life <3 years).	E	E	E	E	E
13994-20-2	Np-237	N/A	Constituent associated with process fuel reprocessing process condensate streams.	I	E	E	I	E
13968-59-7	Np-239	N/A	Short-lived radionuclide (half-life <3 years).	E	E	E	E	E
14336-70-0	Ni-59	N/A	Activity will be <5% of Ni-63 activity.	E	E	E	E	E
13981-37-8	Ni-63	N/A	Activity will be <5% of Cs-137 activity and may be estimated from that isotope.	E	E	E	E	E
N/A	Nb-93m	N/A	Constituent generated at less than 5E-5 times the Cs-137 activity.	E	E	E	E	E
13967-76-5	Nb-95	N/A	Short-lived radionuclide (half-life <3 years).	E	E	E	E	E
15832-32-3	Nb-96	N/A	Short-lived radionuclide (half-life <3 years).	E	E	E	E	E
15700-41-1	Nb-98	N/A	Short-lived radionuclide (half-life <3 years).	E	E	E	E	E

Table B-5. Table 200-MW-1 Operable Unit COPC Exclusions and Justifications. (19 Pages)

CAS#	COPCs	Analyzed as Ions (as applicable)	Rationale for Exclusion	A-4	T-33	T-13	U-3	E-4
17637-99-9	Pd-107	N/A	Constituent generated at less than 5E-5 times the Cs-137 activity.	E	E	E	E	E
13981-16-3	Pu-238	N/A	See final COC tables.	I	I	I	I	I
15117-48-3	Pu-239	N/A	See final COC tables.	I	I	I	I	I
14119-33-6	Pu-240	N/A	See final COC tables.	I	I	I	I	I
14119-32-5	Pu-241	N/A	Not detected by normal plutonium analysis, can infer from americium/plutonium results.	E	E	E	E	E
13982-10-0	Pu-242	N/A	Constituent with atomic mass number greater than or equal to 242 that represents << 1% of the actinide activity (based on ORIGEN2 modeling of Hanford reactor production).	E	E	E	E	E
14981-79-4	Pr-143	N/A	Short-lived radionuclide (half-life <3 years).	E	E	E	E	E
14119-05-2	Pr-144	N/A	Short-lived radionuclide (half-life <3 years).	E	E	E	E	E
14380-75-7	Pm-147	N/A	Short-lived radionuclide (half-life <3 years).	E	E	E	E	E
13981-14-1	Pa-233	N/A	Even though Pa233 was detected during spectral gamma logging performed at boreholes in the Z Plant complex area, as referenced by Price et al. (1979), it is a daughter product and can be calculated from Np-237.	E	E	E	E	E
13233-32-4	Ra-224	N/A	Not expected to be a significant contributor to dose.	E	E	E	E	E
13982-63-3	Ra-226	N/A	GEA will report if detectable quantities are present.	E	E	E	E	E
15262-20-1	Ra-228	N/A	Not expected to be a significant contributor to dose.	E	E	E	E	E
14234-34-5	Rh-106	N/A	Short-lived radionuclide (half-life <3 years).	E	E	E	E	E
13968-53-1	Ru-103	N/A	Short-lived radionuclide (half-life <3 years).	E	E	E	E	E
13967-48-1	Ru-106	N/A	Short-lived radionuclide (half-life <3 years).	E	E	E	E	E
15715-94-3	Sm-151	N/A	Less than 1% of Cs-137 activity. Insignificant contribution to dose.	E	E	E	E	E
15758-45-9	Se-79	N/A	Constituent generated at less than 5E-5 times the Cs-137 activity.	E	E	E	E	E
14158-27-1	Sr-89	N/A	Short-lived radionuclide (half-life <3 years).	E	E	E	E	E

Table B-5. Table 200-MW-1 Operable Unit COPC Exclusions and Justifications. (19 Pages)

CAS#	COPCs	Analyzed as Ions (as applicable)	Rationale for Exclusion	A-4	T-33	T-13	U-3	E-4
10098-97-2	Sr-90	N/A	See final COC tables.	I	I	I	I	I
14133-76-7	Tc-99	N/A	See final COC tables.	I	I	I	I	I
14269-71-7	Te-129m	N/A	Short-lived radionuclide (half-life <3 years).	E	E	E	E	E
14269-71-7	Te-129	N/A	Short-lived radionuclide (half-life <3 years).	E	E	E	E	E
14274-82-9	Th-228	N/A	Not expected to be a significant contributor to dose.	E	E	E	E	E
7440-29-1	Th-232	N/A	Not expected to be a significant contributor to dose.	E	E	E	E	E
13966-06-8	Sn-113	N/A	Short-lived radionuclide (half-life <3 years).	E	E	E	E	E
14683-07-9	Sn-123m	N/A	Short-lived radionuclide (half-life <3 years).	E	E	E	E	E
14683-07-9	Sn-123	N/A	Short-lived radionuclide (half-life <3 years).	E	E	E	E	E
14683-08-0	Sn-125	N/A	Short-lived radionuclide (half-life <3 years).	E	E	E	E	E
15832-50-5	Sn-126	N/A	Constituent generated at less than 5E-5 times the Cs-137 activity. (GEA will be reported if detected.)	E	E	E	E	E
10028-17-8	Tritium	N/A	Constituent associated with fuel reprocessing process condensate streams.	I	E	E	I	E
14158-29-3	U-232	N/A	<2 x 10-3 times the U-238 activity.	E	E	E	E	E
13968-55-3	U-233	N/A	Measurement cannot resolve U-233 + U-234 isotopes, reported as U-234 or U-233/234.	E	E	E	E	E
13966-29-5	U-234	N/A	See final COC tables.	I	I	I	I	I
15117-96-1	U-235	N/A	See final COC tables.	I	I	I	I	I
13982-70-2	U-236	N/A	Measurement cannot resolve U-235 + U-236 isotopes, reported as U-235.	E	E	E	E	E
U-238	U-238	N/A	See final COC tables.	I	I	I	I	I
10098-91-6	Y-90	N/A	Short-lived descendent daughter of Sr-90 (COC).	E	E	E	E	E
14234-24-3	Y-91	N/A	Short-lived radionuclide (half-life <3 years).	E	E	E	E	E
15751-77-6	Zr-93	N/A	Constituent generated at less than 5E-5 times the Cs-137 activity.	E	E	E	E	E

Table B-5. Table 200-MW-1 Operable Unit COPC Exclusions and Justifications. (19 Pages)

CAS#	COPCs	Analyzed as Ions (as applicable)	Rationale for Exclusion	A-4	T-33	T-13	U-3	E-4
13967-71-0	Zr-95	N/A	Short-lived radionuclide (half-life <3 years).	E	E	E	E	E
Inorganic Chemical COPCs								
7784-18-1	Aluminum fluoride	Al (via ICP), F (via anions)	This compound is unlikely to be present in toxic concentrations.	E	E	E	E	E
13473-90-0	Aluminum nitrate	Al (via ICP), NO_3 (via anions)	This compound is unlikely to be present in toxic concentrations.	E	E	E	E	E
13473-90-0	Aluminum nitrate nonahydrate (ANN)	Al (via ICP), NO_3 (via anions)	This compound is unlikely to be present in toxic concentrations.	E	E	E	E	E
13473-90-0	Aluminum nitrate (mono basic)	Al (via ICP), NO_3 (via anions)	This compound is unlikely to be present in toxic concentrations.	E	E	E	E	E
1327-36-2	Aluminum silicate	Al and Si (via ICP)	This compound is unlikely to be present in toxic concentrations.	E	E	E	E	E
10043-01-3	Aluminum sulfate	Al (via ICP), SO_4 (via anions)	This compound is unlikely to be present in toxic concentrations.	E	E	E	E	E
16774-21-3	Ammonium cerium nitrate	NH_4, NO_3 (via anions)	Cerium only excluded as it is not likely present in detectable quantities.	E	E	E	E	E
12125-01-8 6484-52-2	Ammonium fluoride/ ammonium nitrate (AFAN)	NH_4, F and NO_3 (via anions)	This compound is unlikely to be present in toxic concentrations.	E	E	E	E	E
12125-01-8	Ammonium fluoride	NH_4, F (via anions)	This compound is unlikely to be present in toxic concentrations.	E	E	E	E	E
16919-19-0	Ammonium fluosilicate	NH_4, F (via anions), Si (via ICP)	This compound is unlikely to be present in toxic concentrations.	E	E	E	E	E
1336-21-6	Ammonium hydroxide	NH_4, OH (via pH)	This compound is unlikely to be present in toxic concentrations.	E	E	E	E	E
N/A	Ammonium iron fluoride	NH_4, F (via anions), Fe (via ICP)	This compound is unlikely to be present in toxic concentrations.	E	E	E	E	E
10045-89-3	Ammonium ferrous sulfate	NH_4, SO_4 (via anions), Fe (via ICP)	This compound is unlikely to be present in toxic concentrations.	E	E	E	E	E

Table B-5. Table 200-MW-1 Operable Unit COPC Exclusions and Justifications. (19 Pages)

CAS#	COPCs	Analyzed as Ions (as applicable)	Rationale for Exclusion	A-4	T-33	T-13	U-3	E-4
10169-00-3	Ammonium lanthanum nitrate	NH_4, NO_3 (via anions)	This compound is unlikely to be present in toxic concentrations.	E	E	E	E	E
6009-70-7	Ammonium oxalate	NH_4	Oxalate exclusion in organic section as oxalic acid.	E	E	E	E	E
N/A	Ammonium sulfate anion resins	NH_4, SO_4 (via anions)	Bulk material is a nonsoluble solid analysis for any leached ammonium or sulfate ions.	E	E	E	E	E
7440-36-0	Antimony	Sb (via ICP)	This element is unlikely to be present in toxic concentrations.	E	E	E	E	E
7440-38-2	Arsenic salts	As (via ICP)	This compound is unlikely to be present in toxic concentrations.	E	E	E	E	E
10022-31-8	Barium nitrate	Ba (via ICP), NO_3 (via anions)	This compound is unlikely to be present in toxic concentrations.	E	E	E	E	E
7440-41-7	Beryllium	Be (via ICP)	This element is unlikely to be present in toxic concentrations.	E	E	E	E	E
N/A	Bismuth orthophos-phate	Bi (via ICP), PO_4 (via anions)	This compound is unlikely to be present in toxic concentrations.	E	E	E	E	E
1304-85-4	Bismuth subnitrate/ oxynitrate	Bi (via ICP), NO_3 (via anions)	This compound is unlikely to be present in toxic concentrations.	E	E	E	E	E
7410-42-8	Borate(s)	B (via ICP)	CAS# is for element.	E	E	E	E	E
1113-50-1	Boric acid	B (via ICP), acid (via pH)	Acids screened for potential effects on pH.	E	E	E	E	E
10325-94-7	Cadmium nitrate	Cd (via ICP), NO_3 (via anions)	See final COC tables.	I	I	I	I	I
471-34-1	Calcium carbonate (lime)	Ca (via ICP)	Carbonate anion not likely present in toxic quantities. Screened for potential effect on pH.	E	E	E	E	E
7789-75-5	Calcium fluoride	Ca (via ICP), F (via anions)	This compound is unlikely to be present in toxic concentrations.	E	E	E	E	E
10031-31-9	Calcium iodide (hexa-hydrate)	Ca (via ICP)	Iodides not likely present in toxic quantities.	E	E	E	E	E
13780-06-8	Calcium nitrate	Ca (via ICP), NO_3 (via anions)	This compound is unlikely to be present in toxic concentrations.	E	E	E	E	E

Table B-5. Table 200-MW-1 Operable Unit COPC Exclusions and Justifications. (19 Pages)

CAS#	COPCs	Analyzed as Ions (as applicable)	Rationale for Exclusion	A-4	T-33	T-13	U-3	E-4
11115-74-5	Chromic acid	Cr (via ICP), CrVI	See final COC tables.	I	I	I	I	I
13825-86-0	Chromous sulfate	Cr (via ICP), CrVI, SO_4 (via anions)	See final COC tables.	I	I	I	I	I
2/8/7789	Chromium nitrate	Cr (via ICP), CrVI, NO_3 (via anions)	See final COC tables.	I	I	I	I	I
	Citric fluoride	F (via anions)	Excluded as citric acid in organic section.	E	E	E	E	E
3251-23-8	Cupric nitrate	Cu (via ICP), NO_3 (via anions)	Compound unlikely to be present in toxic or high concentrations in vehicle/heavy equipment decontamination waste streams.	I	E	E	I	I
7758-98-7	Cupric sulfate	Cu (via ICP), SO_4 (via anions)	Compound unlikely to be present in toxic or high concentrations in vehicle/heavy equipment decontamination waste streams.	I	E	E	I	I
7558-79-4	Disodium phosphate	Na (via ICP), PO_4 (via anions)	See final COC tables.	I	I	I	I	I
10138-04-2	Ferric ammonium sulfate	NH_4, SO_4 (via anions), Fe (via ICP)	Compound is not likely present in toxic concentrations.	E	E	E	E	E
18624-44-7	Ferric hydroxide	Fe (via ICP) OH via pH	Compound is not likely present in toxic concentrations.	E	E	E	E	E
10421-48-4	Ferric nitrate	Fe (via ICP), NO_3 (via anions)	Compound is not likely present in toxic concentrations.	E	E	E	E	E
10045-89-3	Ferrous ammonium sulfate	NH_4, SO_4 (via anions), Fe (via ICP)	Compound is not likely present in toxic or high concentrations.	E	E	E	E	E
N/A	Ferro/ferric cyanide	Fe (via ICP), cyanide	Compound is not likely present in toxic or high concentrations in vehicle/heavy equipment decontamination or secondary condensate streams.	I	E	E	I	E
N/A	Ferrous sulfamate	Fe (via ICP), SO_4 (via anions)	Sulfamate degraded to sulfate.	E	E	E	E	E
10028-22-5	Ferrous sulfate	SO_4 (via anions)	Compound is not likely to be present in toxic or high concentration.	E	E	E	E	E
N/A	Ferrous sulfide	Fe (via ICP),	Compound is not likely to be present in toxic or high concentration.	E	E	E	E	E

Table B-5. Table 200-MW-1 Operable Unit COPC Exclusions and Justifications. (19 Pages)

CAS#	COPCs	Analyzed as Ions (as applicable)	Rationale for Exclusion	A-4	T-33	T-13	U-3	E-4
7440-57-5	Gold	N/A	Used in minor quantities relative to bulk production chemicals; not likely to be present in toxic of high concentrations.	E	E	E	E	E
12024-21-4	Gallium oxide	N/A	Minimal use in Hanford 200 Areas, not likely to be present in toxic or high concentration. "Oxide" moiety does not contribute to any toxicity issues.	E	E	E	E	E
10035-10-6	Hydrobromic acid	Br (via anions), acid (via pH)	Acids screened for potential effects on pH.	E	E	E	E	E
7647-01-0	Hydrochloric acid	Cl (via anions), acid (via pH)	Acids screened for potential effects on pH.	E	E	E	E	E
7664-39-3	Hydrofluoric acid	F (via anions), acid (via pH)	Acids screened for potential effects on pH.	E	E	E	E	E
N/A	Hydrogen sulfide	N/A	Compound is a gas and not likely to be present in toxic or high concentration.	E	E	E	E	E
10034-85-2	Hydroiodic acid	Acid (via pH)	Iodides not likely present in toxic quantities.	E	E	E	E	E
7722-84-1	Hydrogen peroxide	N/A	Degraded to water and oxygen.	E	E	E	E	E
7439-91-0	Lanthanum	N/A	Compound is not likely to be present in toxic or high concentration.	E	E	E	E	E
13709-38-1	Lanthanum fluoride	F (via anions)	Compound is not likely to be present in toxic or high concentration.	E	E	E	E	E
N/A	Lanthanum hydroxide	OH (via pH)	Compound is not likely to be present in toxic or high concentration.	E	E	E	E	E
10099-56-9	Lanthanum nitrate	NO_3 (via anions)	Compound is not likely to be present in toxic or high concentration.	E	E	E	E	E
7439-92-1	Lead	Pb (via ICP)	See final COC tables.	I	I	I	I	I
10099-74-8	Lead nitrate	Pb (via I CP), NO_3 (via anions)	See final COC tables.	I	I	I	I	I
1314-41-6	Lead oxide	Pb (via ICP)	Compound is not likely to be present in toxic or high concentration.	E	E	E	E	E
7447-41-8	Lithium chloride	Cl (via anions)	Compound is not likely to be present in toxic or high concentration.	E	E	E	E	E
10377060-3	Magnesium nitrate	Mg (via ICP), NO_3 (via anions)	Compound is not likely to be present in toxic or high concentration.	E	E	E	E	E

Table B-5. Table 200-MW-1 Operable Unit COPC Exclusions and Justifications. (19 Pages)

CAS#	COPCs	Analyzed as Ions (as applicable)	Rationale for Exclusion	A-4	T-33	T-13	U-3	E-4
1309-42-8	Magnesium oxide	Mg (via ICP)	Compound is not likely to be present in toxic or high concentration.	E	E	E	E	E
14987-04-3	Magnesium silicate (Mistron)	Mg and Si (via ICP)	Compound is not likely to be present in toxic or high concentration.	E	E	E	E	E
7697-37-2	Manganese nitrate	Mn (via ICP), NO_3 (via anions)	Compound is not likely to be present in toxic or high concentration.	E	E	E	E	E
1313-13-9	Manganese oxide	Mn (via ICP)	Compound is not likely to be present in toxic or high concentration.	E	E	E	E	E
10045-94-0	Mercuric nitrate	Hg, NO_3 (via anions)	Compound is not likely to be present in toxic or high concentration in vehicle heavy equipment decontamination.	I	E	E	I	I
592-85-8	Mercuric thiocyanate	Hg, cyanide	Thiocyanate analyzed as total cyanide. This compound is unlikely to be present in toxic concentrations.	E	E	E	E	E
7439-97-6	Mercury	Hg	See final COC tables.	I	I	I	I	I
7439-98-7	Molybdenum	N/A	Compound is not likely to be present in toxic or high concentration.	E	E	E	E	E
14216-75-2	Nickel nitrate	Ni (via ICP), NO_3 (via anions)	Compound is not likely to be present in toxic or high concentration.	E	E	E	E	E
7786-81-4	Nickel sulfate	Ni (via ICP), SO_4 (via anions)	Compound is not likely to be present in toxic or high concentration.	E	E	E	E	E
7782077-6	Nitrous acid	NO_2 (via anions), acid (via pH)	Nitrites have likely degraded to nitrates.	E	E	E	E	E
7697-37-2	Nitric acid	NO_3 (via anions), acid (via pH)	Compound is not likely to be present in toxic or high concentration in vehicle heavy equipment decontamination.	I	E	E	I	I
10450-60-9	Periodic acid	Acid (via pH)	Iodides not likely present in toxic quantities.	E	E	E	E	E
7664-38-2	Phosphoric acid	PO_4 (via anions), acid (via pH)	See final COC tables.	I	I	I	I	I
1314-56-3	Phosphorous pentoxide	PO_4 (via anions), acid (via pH)	Phosphorous pentoxide degrades to phosphoric acid.	E	E	E	E	E

Table B-5. Table 200-MW-1 Operable Unit COPC Exclusions and Justifications. (19 Pages)

CAS#	COPCs	Analyzed as Ions (as applicable)	Rationale for Exclusion	A-4	T-33	T-13	U-3	E-4
12067-99-1	Phospho-tungstic acid (PTA)	PO_4 (via anions), acid (via pH)	Will not likely to be present in toxic or high concentration.	E	E	E	E	E
584-08-7	Potassium carbonate	K (via ICP), CO_3 (via pH)	Carbonate anion not likely present in toxic quantities.	E	E	E	E	E
7447-40-7	Potassium chloride	K (via ICP), Cl (via anions)	This compound is unlikely to be present in toxic concentrations.	E	E	E	E	E
7778-50-9	Potassium dichromate	K and Cr (via ICP), CrVI	This compound is unlikely to be present in toxic concentrations.	E	E	E	E	E
7789-29-9	Potassium fluoride	K (via ICP), F (via anions)	This compound is unlikely to be present in toxic or high concentrations.	E	E	E	E	E
1310-58-3	Potassium hydroxide	K (via ICP), OH (via pH)	This compound is unlikely to be present in toxic or high concentrations.	E	E	E	E	E
7557-79-1	Potassium nitrate	K (via ICP), NO_3 (via anions)	This compound is unlikely to be present in toxic concentrations.	E	E	E	E	E
582-52-8	Potassium oxalate	K (via ICP)	Oxalate exclusion in organic section as oxalic acid.	E	E	E	E	E
7722-64-7	Potassium permanga-nate	K and MN (via ICP)	This compound is unlikely to be present in toxic or high concentrations.	E	E	E	E	E
7782-49-2	Selenium	Se (via ICP)	This element is unlikely to be present in toxic concentrations.	E	E	E	E	E
7631-86-9	Silicon dioxide	Si (via ICP)	Oxide moiety does not contribute to any toxicity issues.	E	E	E	E	E
7738-96-2	Silver iodide	Ag (via ICP)	This compound is likely to be present in ventilation related streams only.	I	E	E	E	E
7761-88-8	Silver nitrate	Ag (via ICP), NO_3 (via anions)	This compound is likely to be present in ventilation related streams only.	I	E	E	E	E
1303-42-7	Sodium aluminate	Na and Al (via ICP)	This compound is likely to be present in toxic concentrations.	E	E	E	E	E
144-55-8	Sodium bicarbonate	Na (via ICP), CO_3 (via pH)	Carbonate anion not likely present in toxic quantities. Screened for potential effect on pH.	E	E	E	E	E
7789-38-0	Sodium bromate	Na (via ICP), Br (via anions)	Compound is not likely to be present in toxic or high concentration	E	E	E	E	E
497-19-8	Sodium carbonate	Na (via ICP), CO_3 (via pH)	Carbonate anion not likely present in toxic quantities. Screened for potential effect on pH.	E	E	E	E	E

Table B-5. Table 200-MW-1 Operable Unit COPC Exclusions and Justifications. (19 Pages)

CAS#	COPCs	Analyzed as Ions (as applicable)	Rationale for Exclusion	A-4	T-33	T-13	U-3	E-4
7647-14-5	Sodium chloride	Na (via ICP), Cl (via anions)	Compound is not likely to be present in toxic or high concentration	E	E	E	E	E
10588-01-9	Sodium dichromate	Na and Cr (via ICP), CrVI	Compound is not likely to be present in toxic or high concentration.	E	E	E	E	E
7681-49-4	Sodium fluoride	Na (via ICP), F (via anions)	Compound is not likely to be present in toxic or high concentration.	E	E	E	E	E
10124-56-8	Sodium hexameta-phosphate (calgon)	Na (via ICP), PO4 (via anions)	Compound is not likely to be present in toxic or high concentration.	E	E	E	E	E
7681-31-8	Sodium hydrogen sulfate	Na (via ICP), SO_4 (via anions)	Compound is not likely to be present in toxic or high concentration.	E	E	E	E	E
1310-73-2	Sodium hydroxide	Na (via ICP), OH (via pH)	Compound is not likely to be present in toxic or high concentration.	E	E	E	E	E
12232-99-4	Sodium meta-bismuthate	Na and Bi (visa ICP)	CAS# is for sodium bismuthate. This compound is likely to be present in toxic concentrations.	E	E	E	E	E
7631-99-4	Sodium nitrate	Na (via ICP), NO_3 (via anions)	This compound is not likely to be present in toxic concentrations.	I	E	E	E	E
7632-00-0	Sodium nitrite	Na (via ICP), NO_2 (via anions)	Nitrites degraded to nitrates.	E	E	E	E	E
62-76-0	Sodium oxalate	Na (via ICP)	Oxalate exclusion in organic section as oxalic acid.	E	E	E	E	E
7775-27-1	Sodium persulfate	Na (via ICP), SO_4 (via anions)	Compound is not likely to be present in toxic or high concentration.	E	E	E	E	E
6834-92-0	Sodium silicate	Na and Si (via ICP), pH	Sodium silicate may raise pH.	E	E	E	E	E
7757-82-6	Sodium sulfate	Na (via ICP), SO_4 (via anions)	This compound is not likely to be present in toxic concentrations.	E	E	E	E	E
N/A	Sodium sulfite	N/A	See final COC tables. Sulfite degrades to SO_4.	I	I	I	I	I
7772-98-7	Sodium thiosulfate	Na (via ICP), SO_4 (via anions)	This compound is not likely to be present in toxic concentrations.	E	E	E	E	E

Table B-5. Table 200-MW-1 Operable Unit COPC Exclusions and Justifications. (19 Pages)

CAS#	COPCs	Analyzed as Ions (as applicable)	Rationale for Exclusion	A-4	T-33	T-13	U-3	E-4
7601-54-9	Sodium phosphate	Na (via ICP), PO_4 (via anions)	See final COC tables.	I	I	I	I	I
7722-88-5	Sodium pyrophos-phate	Na (via ICP), PO_4 (via anions)	This compound is not likely to be present in toxic concentrations.	E	E	E	E	E
5329-14-6	Sulfamic acid	SO_4 (via anions)	Has degraded to sulfates.	E	E	E	E	E
7664-93-9	Sulfuric acid	SO_4 (via anions), acid (via pH)	See final COC tables.	I	I	I	I	I
7440-25-7	Tantalum	N/A	This compound is not likely to be present in toxic or high concentrations.	E	E	E	E	E
7440-31-5	Tin	N/A	This compound is not likely to be present in toxic or high concentrations.	E	E	E	E	E
7550-4500	Titanium chloride	Cl (via anions), acid (via pH)	TiCl3 degrades on contact with water to HCl and TiO2. Ti not likely to be present in toxic or high concentration.	E	E	E	E	E
7779-88-6	Zinc nitrate	Zn (via ICP), NO_3 (via anions)	This compound is not likely to be present in toxic concentrations.	E	E	E	E	E
7779-90-0	Zinc phosphate	Zn (via ICP), PO_4 (via anions)	This compound is not likely to be present in toxic concentrations.	E	E	E	E	E
7440-67-7	Zirconium	N/A	Zr not likely to be present in toxic or high concentration.	E	E	E	E	E
N/A	Zirconium carbonate gel	CO_3 (via pH)	Zr not likely to be present in toxic or high concentration. Carbonate anion not likely present in toxic quantities. Screened for potential effect on pH.	E	E	E	E	E
13746-89-9	Zirconyl nitrate	NO_3 (via anions)	Zr not likely to be present in toxic or high concentration.	E	E	E	E	E
N/A	Zirconyl phosphate	PO_4 (via anions)	Zr not likely to be present in toxic or high concentration.	E	E	E	E	E
Organic Chemical COPCs								
75-34-3	1,1-dichloro-ethane (DCA)	N/A	See final COC tables.	I	I	I	I	I
107-06-2	1,2-dichloro-ethane (DCA)	N/A	See final COC tables.	I	I	I	I	I

Table B-5. Table 200-MW-1 Operable Unit COPC Exclusions and Justifications. (19 Pages)

CAS#	COPCs	Analyzed as Ions (as applicable)	Rationale for Exclusion	A-4	T-33	T-13	U-3	E-4
71-55-6	1,1,1-thrichloro-ethane (TCA)	N/A	See final COC tables.	I	I	I	I	I
64-19-7	Acetic acid	N/A	Very soluble, likely to have migrated or vaporized if exposed; reasonably biodegradable. Available as food-grade material. Minimal potential for presence in toxic level quantities.	E	E	E	E	E
67-64-1	Acetone	N/A	See final COC tables.	I	I	I	I	I
528-21-2	Alizarin yellow		Laboratory indicator. Typically used in drop quantities as <1% solutions. No analytical technology or toxicity issues identified.	E	E	E	E	E
71-43-2	Benzene	N/A	Compound is not likely to be presented in toxic or high concentrations in secondary condensate waste streams.	I	I	I	I	E
115-40-2	Bromocresol purple	N/A	Laboratory indicator. Typically used in drop quantities as <1% solutions. No analytical technology or toxicity issues identified.	E	E	E	E	E
580-13-2 90-11-9	Bromo-naphthalene	N/A	Use in microscopic examinations. Used in minimal quantities and most probable disposal/release as part of solid wastes.	E	E	E	E	E
71-36-3	n-butyl alcohol	N/A	See final COC tables.	I	I	I	I	I
78-93-3	Methyl ethyl ketone	N/A	See final COC tables.	I	I	I	I	I
100-51-6	Benzyl alcohol	N/A	Very soluble, likely to have migrated or vaporized if exposed; reasonably biodegradable. Available as food-grade material. Minimal potential for presence in toxic level quantities.	E	E	E	E	E
56-23-5	Carbon tetrachloride	N/A	Compound unlikely to be present in toxic or high concentration but will be reported if detected by EPA Method 8260.	E	E	E	E	E
77-92-9	Citric acid	Present as citric anion	Very soluble. Available as food-grade material. Minimal potential for presence in toxic level quantities. No direct standard analytical technique available. Has dissolved to a complexing agent that could have affected the mobility of certain COCs. Unexpected mobility of COCs will indicate the presence of complexents.	E	E	E	E	E

Table B-5. Table 200-MW-1 Operable Unit COPC Exclusions and Justifications. (19 Pages)

CAS#	COPCs	Analyzed as Ions (as applicable)	Rationale for Exclusion	A-4	T-33	T-13	U-3	E-4
156-59-2	Cis-1,2-ditranschloro-ethylene	N/A	See final COC tables.	I	I	I	I	I
108-90-7	Chloro-benzene	N/A	Compound unlikely to be present in toxic or high concentration but will be reported if detected by EPA Method 8260.	E	E	E	E	E
67-66-3	Chloroform	N/A	Compound unlikely to be present in toxic or high concentration but will be reported if detected by EPA Method 8260.	E	E	E	E	E
298-07-7	Di(2-ethylhexyl) phosphoric acid	N/A	No direct standard analytical technique available. Has dissolved to a complexing agent that could have affected the mobility of certain COCs. Unexpected mobility of COCs will indicate the presence of complexents.	E	E	E	E	E
78-46-6	Dibutyl butyl phosphonate (DBBP)	N/A	DBBP was widely used as a solvent during the PRF americium recovery operations. No direct standard analytical procedure available. Will degrade to phosphate and detected in those analytical measurements.	E	E	E	E	E
107-66-4	Dibutyl phosphate	N/A	No direct standard analytical technique available. This compound is a degradation product of TBP and is unlikely to be present in toxic or high concentrations.	E	E	E	E	E
112-40-3	Dodecane	Hydrocarbon measured as part of TPH analysis	Hydrocarbon measured as part of TPH analysis.	E	E	E	E	E
60-00-4	Ethylene-diamine tetra acetic acid (EDTA)	N/A	No direct standard analytical technique available. Available as a food-grade material. Has dissolved to a complexing agent that could have affected the mobility of certain COCs. Unexpected mobility of COCs will indicate the presence of complexents.	E	E	E	E	E
64-17-5	Ethanol	N/A	Very soluble, likely to have migrated or vaporized if exposed; reasonably biodegradable. Available as food-grade material. Minimal potential for presence in toxic level quantities.	E	E	E	E	E
60-29-7	Ethyl ether	N/A	Very soluble, likely to have migrated or vaporized if exposed; reasonably biodegradable. Minimal potential for presence in toxic level quantities.	E	E	E	E	E

Table B-5. Table 200-MW-1 Operable Unit COPC Exclusions and Justifications. (19 Pages)

CAS#	COPCs	Analyzed as Ions (as applicable)	Rationale for Exclusion	A-4	T-33	T-13	U-3	E-4
107-21-1	Ethylene glycol	N/A	Very soluble, likely to have migrated or vaporized if exposed; reasonably biodegradable. Minimal potential for presence in toxic level quantities.	E	E	E	E	E
100-41-4	Ethyl-benzene	N/A	See final COC tables.	I	I	I	I	I
50-00-0	Formalde-hyde	N/A	Very soluble, likely to have migrated or vaporized if exposed; reasonably biodegradable. Minimal potential for presence in toxic level quantities.	E	E	E	E	E
N/A	Glycerol	N/A	Very soluble, likely to have migrated or vaporized if exposed; reasonably biodegradable. Available as food-grade material. Minimal potential for presence in toxic level quantities.	E	E	E	E	E
527-07-1	(Sodium) gluconate	N/A	Available as food-grade material. Minimal potential for presence in toxic level quantities. No direct standard analytical technique available. Has dissolved to a complexing agent that could have affected the mobility of certain COCs. Unexpected mobility of COCs will indicate the presence of complexents.	E	E	E	E	E
108-10-1	Hexone (methyl isobutyl ketone [MIBK])	N/A	See final COC tables.	I	I	I	I	I
N/A	Hydraulic fluids (greases)	Hydrocarbon measured as part of oil and grease analysis	Hydrocarbon measured as part of oil and grease analysis.	I	I	I	I	I
302-01-2	Hydrazine	N/A	Extremely reactive, very likely to have degraded and not be present within waste stream.	E	E	E	E	E
7803-49-8	Hyro-droxylamine (HN)	N/A	Hydroxylamine rapidly degrades to nitrogen, ammonia and water. Used in the PRF process.	E	E	E	E	E
11/1/5470	Hydroxyla-mine hydro-chloride	Cl (via anions), acid (via pH)	Hydroxylamine rapidly degrades to nitrogen, ammonia and water. Used in the PRF process.	E	E	E	E	E
79-14-1	Hydroxy-acetic acid (glycolic acid)	N/A	No direct standard analytical technique available. Has dissolved to a complexing agent that could have affected the mobility of certain COCs. Unexpected mobility of COCs will indicate the presence of complexents.	E	E	E	E	E

Table B-5. Table 200-MW-1 Operable Unit COPC Exclusions and Justifications. (19 Pages)

CAS#	COPCs	Analyzed as Ions (as applicable)	Rationale for Exclusion	A-4	T-33	T-13	U-3	E-4
148-24-3 59-31-4	Hydroxy-quinoline	N/A	No direct standard analytical technique available. Has dissolved to a complexing agent that could have affected the mobility of certain COCs. Unexpected mobility of COCs will indicate the presence of complexents.	E	E	E	E	E
67-63-0	Isopropyl alcohol	N/A	Very soluble, likely to have migrated or vaporized if exposed; reasonably biodegradable. Available as food-grade material. Minimal potential for presence in toxic level quantities.	E	E	E	E	E
N/A	Mandelic acid	N/A	No direct standard analytical technique available. Has dissolved to a complexing agent that could have affected the mobility of certain COCs. Unexpected mobility of COCs will indicate the presence of complexents.	E	E	E	E	E
67-56-1	Methanol	N/A	Extremely soluble, and very likely to have degraded and not be present in waste stream.	E	E	E	E	E
N/A	Methyl lactic acid	N/A	No direct standard analytical technique available. Has dissolved to a complexing agent that could have affected the mobility of certain COCs. Unexpected mobility of COCs will indicate the presence of complexents.	E	E	E	E	E
75-09-2	Methylene chloride	N/A	Associated with B plant complex decontamination operations and as a listed waste with code F002.	I	I	I	I	I
N/A	Molybdate-citrate reagent	Present as citric anion	Mo not likely to be present in toxic or high concentration. No direct standard analytical technique available. Has dissolved to a complexing agent that could have affected the mobility of certain COCs. Unexpected mobility of COCs will indicate the presence of complexents.	E	E	E	E	E
670-03-7	Mono-2-ethylhexyl phosphoric acid	N/A	No direct standard analytical technique available. Has dissolved to a complexing agent that could have affected the mobility of certain COCs. Unexpected mobility of COCs will indicate the presence of complexents.	E	E	E	E	E
1623-15-0	Monobutyl phosphate	N/A	No direct standard analytical technique available. This compound is a degradation product of TBP and is unlikely to be present in toxic or high concentrations.	E	E	E	E	E
8030-30-6	Naphtha	N/A	Hydrocarbon measured as part of TPH analysis and associated with equipment decontamination.	E	E	E	E	E

Table B-5. Table 200-MW-1 Operable Unit COPC Exclusions and Justifications. (19 Pages)

CAS#	COPCs	Analyzed as Ions (as applicable)	Rationale for Exclusion	A-4	T-33	T-13	U-3	E-4
91-59-8	Napthyla-mine	Analyzed as two isomers	Compound unlikely to be present in toxic or high concentrations but would be reported if detected by EPA Method 8270.	E	E	E	E	E
104-51-8	n-butyl benzene	N/A	Compound is unlikely to be present in decontamination or secondary cooling water waste streams.	I	E	E	I	E
8008-20-6	Normal paraffin hydro-carbons (kerosene, Shell solvent, etc)	N/A	Hydrocarbon measured as part of TPH analysis. CAS# for kerosene.	I	I	I	I	I
144-62-7	Oxalic acid	Acid (via pH)	No direct standard analytical technique available. Has dissolved to a complexing agent that could have affected the mobility of certain COCs. Unexpected mobility of COCs will indicate the presence of complexents.	E	E	E	E	E
108-95-2	Phenol	N/A	Compound unlikely to be present in toxic or high concentrations but would be reported if detected by EPA Method 8270.	E	E	E	E	E
140-01-2	Pentasodium diethylene triamine penta acetate (DTPA)	N/A	No direct standard analytical technique available. Has dissolved to a complexing agent that could have affected the mobility of certain COCs. This compound is unlikely to be present in toxic or high concentrations.	E	E	E	E	E
1336-36-3	PCBs	N/A	See final COC tables.	I	I	I	I	I
140-22-7	S-diphenyl-arbazide	N/A	Laboratory indicator. Typically used in drop quantities as <1% solutions. No analytical technology or toxicity issues identified.	E	E	E	E	E
527-07-1	Sodium gluconate	Na (via ICP)	Gluconate exclusion in organic section.	E	E	E	E	E
7790-74-5	Sulfonic acid (chloro)	Cl and SO_4 (via anions)	Will have degraded to chloride and sulfate anions	E	E	E	E	E
87-69-4	Tartaric acid	N/A	Very soluble. Available and used as food-grade material. Minimal potential for presence in toxic level quantities. No direct standard analytical technique available. Has dissolved to a complexing agent that could have affected the mobility of certain COCs. Unexpected mobility of COCs will indicate the presence of complexents.	E	E	E	E	E

Table B-5. Table 200-MW-1 Operable Unit COPC Exclusions and Justifications. (19 Pages)

CAS#	COPCs	Analyzed as Ions (as applicable)	Rationale for Exclusion	A-4	T-33	T-13	U-3	E-4
558-13-4	Tetrabromo-thane	N/A	Use in microscopic examinations. Used in minimal quantities and most probable disposal/release as part of solid wastes.	E	E	E	E	E
109-99-9	Tetrahydro-uran	N/A	No direct standard analytical technique available. Has dissolved to a complexing agent that could have affected the mobility of certain COCs. This compound is unlikely to be present in toxic or high concentration.	E	E	E	E	E
127-18-4	Tetrachloro-thylene (PCE)	N/A	See final COC tables.	I	I	I	I	E
146-66-8	Tetraphenyl boron	B (via ICP)	Will have degraded into inorganic boron compound and aromatic organics analyzed by EPA Method 8260.	E	E	E	E	E
326-91-0	Thenoyl-rifluoro-acetone	N/A	No direct standard analytical technique available. Has dissolved to a complexing agent that could have affected the mobility of certain COCs. This compound is unlikely to be present in toxic or high concentrations.	E	E	E	E	E
125020-2	Thymol-hthalein	N/A	Laboratory indicator. Typically used in drop quantities as <1% solutions. No analytical technology or toxicity issues identified.	E	E	E	E	E
25549-16-0	Tri-iso-octylamine	N/A	No direct standard analytical technique available. Has dissolved to a complexing agent that could have affected the mobility of certain COCs. Unexpected mobility of COCs will indicate the presence of complexents.	E	E	E	E	E
102-87-4	Tri-n-dodecylamine	N/A	No direct standard analytical technique available. Has dissolved to a complexing agent that could have affected the mobility of certain COCs. Unexpected mobility of COCs will indicate the presence of complexents.	E	E	E	E	E
1116-76-3	Tri-n-octylamine	N/A	No direct standard analytical technique available. Has dissolved to a complexing agent that could have affected the mobility of certain COCs. Unexpected mobility of COCs will indicate the presence of complexents.	E	E	E	E	E
126-73-8	Tributyl phosphate (TBP)	N/A	Not likely to be present in toxic or high concentrations in vehicle/heavy equipment waste streams.	I	E	E	I	I
79-01-6	Trichloro-ethylene (TCE)	N/A	Not likely to be present in toxic of high concentrations in secondary condensate streams but if detected would be reported by EPA Method 8260.	I	I	I	I	E

Table B-5. Table 200-MW-1 Operable Unit COPC Exclusions and Justifications. (19 Pages)

CAS#	COPCs	Analyzed as Ions (as applicable)	Rationale for Exclusion	A-4	T-33	T-13	U-3	E-4
77-86-1	Tris (hydroxy-methyl) amino methane	N/A	Very soluble. Available and used as pharmaceutical grade material. Minimal potential for presence in toxic level quantities. No direct standard analytical technique available.	E	E	E	E	E
10041-84-9	Trisodium nitrilo triacetate (NTA)	N/A	No direct standard analytical technique available. Has dissolved to a complexing agent that could have affected the mobility of certain COCs. Unexpected mobility of COCs will indicate the presence of complexents.	E	E	E	E	E
57-13-6	Urea	N/A	This compound will degrade to nitrogen, nitrate, and ammonia. No standard analytical method in place for its analysis.	E	E	E	E	E
150-39-0	Trisodium hydroxyethyl ethylene – diamine triacetate (HEDTA)	N/A	No direct standard analytical technique available. Has dissolved to a complexing agent that could have affected the mobility of certain COCs. Unexpected mobility of COCs will indicate the presence of complexents.	E	E	E	E	E
108-88-3	Toluene	N/A	See final COC tables.	I	I	I	I	I
1330-20-7	Xylene	N/A	See final COC tables.	I	I	I	I	I

CAS = Chemical Abstract Services
EPA = U.S. Environmental Protection Agency
GEA = gamma energy analysis
ICP = inductively coupled plasma
N/A = not applicable
PRF = Plutonium Reclamation Facility

Table B-6. 200-MW-1 Operable Unit Final COC List Process Facility Ventilation Stack and Sand Filter Sources. (2 Pages)

CAS #	Final COCs	Rationale for Inclusion
Radiological Constituents		
14596-10-2	Americium-241	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
10045-97-3	Cesium-137	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
10198-40-0	Cobalt-60	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
14683-23-9	Europium-152	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
15585-10-1	Europium-154	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
14391-16-3	Europium-155	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
15046-84-1	Iodine-129	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
13981-16-3	Plutonium-238	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
15117-48-3	Plutonium-239	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
14119-33-6	Plutonium-240	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
10098-97-2	Strontium-90	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
14133-76-7	Technetium-99	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
10028-17-8	Tritium	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
13966-29-5	Uranium-233/234	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
15117-96-1	Uranium-235/236	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
13982-70-2	Uranium-238	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
Nonradiological Constituents – Metals		
7440-43-9	Cadmium	Analytical results from sediment samples collected in 200 Areas (Rohay 1994).
7440-47-3	Chromium	Due to sodium/potassium dichromate added during first- and second-cycle decontamination and concentration operations of bismuth-phosphate process (GE 1944 [Section C], WHC 1990a).
7440-47-3	Chromium (VI)	Due to sodium/potassium dichromate added during first- and second-cycle decontamination and concentration operations of bismuth-phosphate process (GE 1944 [Section C], WHC 1990a).
7440-50-8	Copper	Associated with ventilation and cooling systems.
7439-92-1	Lead	Metal used in lead-dipped cladding and cladding waste stream (1952 to 1956) (GE 1944 [Section A]).
7429-90-5	Silver	Associated with ventilation system silver reactors (Agnew et al. 1997).
7439-97-6	Mercury	Several uses in bismuth-phosphate campaign including addition to cladding and metal waste streams to prevent gaseous generations and miscellaneous laboratory uses (Agnew et al. 1997).
Nonradiological Constituents – General Inorganics		
57-12-5	Cyanide	Extensive use (1954 to 1958) as nickel ferro/ferric cyanide during scavenging and recovery processes. Listed as a result of tank farm integration (Agnew et al. 1997, Borsheim and Simpson 1991, GE 1951b).
16984-48-8	Fluoride	Several compounds contained fluoride. The most widely used included lanthanum-fluoride (which was used during the concentration operations of the bismuth-phosphate process) and ammonium silica fluoride (which was used as a cleaning and decontamination compound based on ability to dissolve metals and fission products) (GE 1944 [Section C], 1951a; HEW 1945).
N02-N03-N	Nitrate/nitrite	Several compounds contained nitrates/nitrites. The most widely used included sodium nitrite, a salting agent during the cladding removal; nitric acid, used throughout the bismuth-phosphate process and Uranium Reclamation Process (URP); and bismuth subnitrate, which was used to create the bismuth-phosphate/plutonium solid during the first and second decontamination cycles (GE 1944 [Section C], 1951a; HEW 1945).
14265-44-2	Phosphate	Several compounds contained phosphate. The most widely used included phosphoric acid, which was used throughout bismuth-phosphate process (GE 1944 [Section C], HEW 1945).

Table B-6. 200-MW-1 Operable Unit Final COC List Process Facility Ventilation Stack and Sand Filter Sources. (2 Pages)

CAS #	Final COCs	Rationale for Inclusion
14808-79-8	Sulfate	Several compounds contained sulfate. The most widely used included sulfuric acid, which was used in dissolving the fuel rods during the bismuth-phosphate process (GE 1944 [Section C], 1951a; HEW 1945). Other sulfate complexes were used as carriers for various metals.
Volatile Organics		
75-34-3	1,1-dichloroethane (DCA)	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
107-06-2	1,2-dichloroethane (DCA)	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
71-55-6	1,1,1-trichloroethane (TCA)	Listed waste associated with B Plant operations-F001 (WHC 1996).
67-19-7	Acetone	Listed waste associated with PUREX Plant operations-F003 (WHC 1996).
71-43-2	Benzene	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
156-59-2	cis-1,2-dichloroethylene	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
100-41-4	Ethylbenzene	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
108-10-1	Methyl isobutyl ketone	Listed waste associated with B Plant operations-F002 (WHC 1996).
156-60-5	trans-1,2-dichloroethylene	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
78-93-3	Methyl ethyl ketone	Listed waste associated with B Plant operations-F005 (WHC 1996).
75-09-2	Methylene chloride	Listed waste associated with B Plant operations-F002 (WHC 1996).
71-63-3	n-butyl alcohol	Listed waste associated with PUREX Plant operations-F003 (WHC 1996).
104-51-8	n-butyl benzene	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
127-18-4	Tetrachloroethylene (PCE)	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
79-01-6	Trichloroethylene (TCE)	TCE is a degradation product of carbon tetrachloride. Analytical results and measurements have illustrated that this contaminant is prevalent throughout the vadose zone and has impacted groundwater (Rohay 1994).
108-88-3	Toluene	Listed waste associated with PUREX Plant operations-F005 (WHC 1996).
1330-20-7	Xylene	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
Semi-Volatile Organics		
8008-20-6	Normal paraffins[a]	Extensive use (1953 to 1957) in solvent extraction operation as the dilutant for TBP in URPs (GE 1951a).
1336-36-3	Polychlorinated biphenyls (PCBs)	Various types of normal paraffins were used as milling, cutting, and washing solutions during the production of plutonium buttons/rods. These solutions usually contained PCBs (discussions/publications with David A. Dodd, Plutonium Finishing Plant chemist [Mandis 2001]). Analytical results from sediment samples collected within tank 241-Z-361 (FH 2000).
126-73-8	Tributyl phosphate and derivatives (mono, bi)	Extensive use in the extraction of plutonium and uranium in the PUREX process and of uranium in the uranium recovery process (GE 1951b, 1955).

[a]Analyzed as kerosene by nonhalogenated volatile organic analytes via 8015 Method; total petroleum hydrocarbons, diesel to oil ranges; or total petroleum hydrocarbons, gasoline range.
CAS = Chemical Abstract Services

Table B-7. 200-MW-1 Operable Unit Final COC List Vehicle/Heavy Equipment Facility Decontamination Sources. (2 Pages)

CAS #	Final COCs	Rationale for Inclusion
Radiological Constituents		
14596-10-2	Americium-241	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
10045-97-3	Cesium-137	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
10198-40-0	Cobalt-60	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
14683-23-9	Europium-152	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
15585-10-1	Europium-154	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
14391-16-3	Europium-155	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
13981-16-3	Plutonium-238	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
15117-48-3	Plutonium-239	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
14119-33-6	Plutonium-240	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
10098-97-2	Strontium-90	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
14133-76-7	Technetium-99	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
13966-29-5	Uranium-233/234	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
15117-96-1	Uranium-235/236	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
13982-70-2	Uranium-238	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
Nonradiological Constituents – Metals		
7439-92-1	Lead	Metal used in lead-dipped cladding and cladding waste stream (1952 to 1956) (GE 1944 [Section A]).
7440-43-9	Cadmium	Expected to be present from contaminants/engine wear in oil/grease and pigments in paint.
7440-47-3	Chromium	Expected to be present from contaminants/engine wear in oil/grease and pigments in paint.
Nonradiological Constituents – General Inorganics		
14265-44-2	Phosphate	Several compounds contained phosphate. The most widely used included phosphoric acid, which was used throughout bismuth-phosphate process (GE 1944 [Section C], HEW 1945).
14808-79-8	Sulfate	Several compounds contained sulfate. The most widely used included sulfuric acid, which was used in dissolving the fuel rods during the bismuth-phosphate process (GE 1944 [Section C], 1951a; HEW 1945). Other sulfate complexes were used as carriers for various metals.
Volatile Organics		
75-34-3	1,1-dichloroethane (DCA)	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
107-06-2	1,2-dichloroethane (DCA)	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
71-55-6	1,1,1-trichloroethane (TCA)	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
67-19-7	Acetone	Listed waste associated with T Plant operations-F003 (WHC 1996).
71-43-2	Benzene	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
156-59-2	cis-1,2-dichloroethylene	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
100-41-4	Ethylbenzene	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
75-09-2	Methylene chloride	Listed waste associated with T Plant operations-F002

Table B-7. 200-MW-1 Operable Unit Final COC List Vehicle/Heavy Equipment Facility Decontamination Sources. (2 Pages)

CAS #	Final COCs	Rationale for Inclusion
71-63-3	n-butyl alcohol	Associated with T Plant heavy equipment decontamination operations-F003 (WHC 1990a).
104-51-8	n-butyl benzene	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
127-18-4	Tetrachloroethylene (PCE)	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
156-60-5	trans-1,2-dichloroethylene	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
79-01-6	Trichloroethylene (TCE)	TCE is a degradation product of carbon tetrachloride. Analytical results and measurements have illustrated that this contaminant is prevalent throughout the vadose zone and has impacted groundwater (Rohay 1994).
108-88-3	Toluene	Listed waste associated with PUREX Plant operations-F005 (WHC 1996).
1330-20-7	Xylene	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
Semi-Volatile Organics		
8008-20-6	Normal paraffins[a]	Expected from vehicle oil and grease removed during decontamination.
1336-36-3	Polychlorinated biphenyls (PCBs)	Expected from vehicle oil and grease removed during decontamination.

[a]Analyzed as kerosene by nonhalogenated volatile organic analytes via 8015 Method; total petroleum hydrocarbons, diesel to oil ranges; or total petroleum hydrocarbons, gasoline range.

Table B-8. 200-MW-1 Operable Unit Final COC List Vehicle/Heavy Equipment Field Decontamination Source. (2 Pages)

CAS #	Final COCs	Rationale for Inclusion
Radiological Constituents		
14596-10-2	Americium-241	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
10045-97-3	Cesium-137	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
10198-40-0	Cobalt-60	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
14683-23-9	Europium-152	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
15585-10-1	Europium-154	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
14391-16-3	Europium-155	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
13981-16-3	Plutonium-238	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
15117-48-3	Plutonium-239	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
14119-33-6	Plutonium-240	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
10098-97-2	Strontium-90	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
14133-76-7	Technetium-99	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
13966-29-5	Uranium-233/234	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
15117-96-1	Uranium-235/236	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
13982-70-2	Uranium-238	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
Nonradiological Constituents – Metals		
7439-92-1	Lead	Expected to be present from contaminants/engine wear in oil/grease and pigments in paint.
7440-43-9	Cadmium	Expected to be present from contaminants/engine wear in oil/grease and pigments in paint.
7440-47-3	Chromium	Expected to be present from contaminants/engine wear in oil/grease and pigments in paint.
Nonradiological Constituents – General Inorganics		
14265-44-2	Phosphate	Several compounds contained phosphate. The most widely used included phosphoric acid, which was used throughout bismuth-phosphate process (GE 1944 [Section C], HEW 1945).
14808-79-8	Sulfate	Several compounds contained sulfate. The most widely used included sulfuric acid, which was used in dissolving the fuel rods during the bismuth-phosphate process (GE 1944 [Section C], 1951a; HEW 1945). Other sulfate complexes were used as carriers for various metals.
Volatile Organics		
75-34-3	1,1-dichloroethane (DCA)	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
107-06-2	1,2-dichloroethane (DCA)	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
71-55-6	1,1,1-trichloroethane (TCA)	Listed waste associated with B Plant operations-F001 (WHC 1996).
67-19-7	Acetone	Listed waste associated with PUREX Plant operations-F003 (WHC 1996).
71-43-2	Benzene	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
156-59-2	cis-1,2-dichloroethylene	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
108-10-1	Methyl isobutyl ketone	Listed waste associated with B Plant operations-F002 (WHC 1996).
78-93-3	Methyl ethyl ketone	Listed waste associated with B Plant operations-F005 (WHC 1996).
75-09-2	Methylene chloride	Listed waste associated with B Plant operations-F002.

Table B-8. 200-MW-1 Operable Unit Final COC List Vehicle/Heavy Equipment Field Decontamination Source. (2 Pages)

CAS #	Final COCs	Rationale for Inclusion
71-63-3	n-butyl alcohol	Listed waste associated with PUREX Plant operations-F003 (WHC 1996).
127-18-4	Tetrachloroethylene (PCE)	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
156-60-5	trans-1,2-dichloroethylene	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
79-01-6	Trichloroethylene (TCE)	TCE is a degradation product of carbon tetrachloride. Analytical results and measurements have illustrated that this contaminant is prevalent throughout the vadose zone and has impacted groundwater (Rohay 1994).
108-88-3	Toluene	Listed waste associated with PUREX Plant operations-F005 (WHC 1996).
1330-20-7	Xylene	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
Semi-Volatile Organics		
8008-20-6	Normal paraffins (greases and oils)	Expected from vehicle oil and grease removed during decontamination.
1336-36-3	Polychlorinated biphenyls (PCBs)	Expected from vehicle oil and grease removed during decontamination.

Table B-9. 200-MW-1 Operable Unit Final COC List Low-Level Radioactive Process or Steam Condensate Source. (2 Pages)

CAS #	Final COCs	Rationale for Inclusion
Radiological Constituents		
14596-10-2	Americium-241	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997)..
10045-97-3	Cesium-137	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
10198-40-0	Cobalt-60	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
14683-23-9	Europium-152	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
15585-10-1	Europium-154	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
14391-16-3	Europium-155	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
13981-16-3	Plutonium-238	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
15117-48-3	Plutonium-239	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
14119-33-6	Plutonium-240	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
10098-97-2	Strontium-90	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
14133-76-7	Technetium-99	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
10028-17-8	Tritium	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
13966-29-5	Uranium-234	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
15117-96-1	Uranium-235	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
13982-70-2	Uranium-238	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
Nonradiological Constituents – Metals		
7440-43-9	Cadmium	Analytical results from sediment samples collected in 200 Areas (Rohay 1994).
7440-47-3	Chromium	Due to sodium/potassium dichromate added during first- and second-cycle decontamination and concentration operations of bismuth-phosphate process (GE 1944 [Section C], WHC 1990a).
7440-47-3	Chromium (VI)	Due to sodium/potassium dichromate added during first- and second-cycle decontamination and concentration operations of bismuth-phosphate process (GE 1944 [Section C], WHC 1990a).
7440-50-8	Copper	Associated with ventilation and cooling systems.
7439-92-1	Lead	Metal used in lead-dipped cladding and cladding waste stream (1952 to 1956) (GE 1944 [Section A]).
7439-97-6	Mercury	Several uses in bismuth-phosphate campaign including addition to cladding and metal waste streams to prevent gaseous generations and miscellaneous laboratory uses (Agnew et al. 1997).
Nonradiological Constituents – General Inorganics		
57-12-5	Cyanide	Extensive use (1954 to 1958) as nickel ferro/ferric cyanide during scavenging and recovery processes. Listed as a result of tank farm integration (Agnew et al. 1997, Borsheim and Simpson 1991, GE 1951a).
16984-48-8	Fluoride	Several compounds contained fluoride. The most widely used included lanthanum-fluoride (which was used during the concentration operations of the bismuth-phosphate process) and ammonium silica fluoride (which was used as a cleaning and decontamination compound based on ability to dissolve metals and fission products) (GE 1944 [Section C], 1951a; HEW 1945).
N02+N03-N	Nitrate/nitrite	Several compounds contained nitrates/nitrites. The most widely used included sodium nitrite, a salting agent during the cladding removal; nitric acid, used throughout the bismuth-phosphate process and URP; and bismuth subnitrate, which was used to create the bismuth-phosphate/plutonium solid during the first and second decontamination cycles (GE 1944 [Section C], 1951a; HEW 1945).

Table B-9. 200-MW-1 Operable Unit Final COC List Low-Level Radioactive Process or Steam Condensate Source. (2 Pages)

CAS #	Final COCs	Rationale for Inclusion
14265-44-2	Phosphate	Several compounds contained phosphate. The most widely used included phosphoric acid, which was used throughout bismuth-phosphate process (GE 1944 [Section C], HEW 1945).
14808-79-8	Sulfate	Several compounds contained sulfate. The most widely used included sulfuric acid, which was used in dissolving the fuel rods during the bismuth-phosphate process (GE 1944 [Section C], 1951a; HEW 1945). Other sulfate complexes were used as carriers for various metals.
Volatile Organics		
75-34-3	1,1-dichloroethane (DCA)	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
107-06-2	1,2-dichloroethane (DCA)	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
71-55-6	1,1,1-trichloroethane (TCA)	Listed waste associated with B Plant operations-F001 (WHC 1996).
67-19-7	Acetone	Listed waste associated with PUREX Plant operations-F003 (WHC 1996).
71-43-2	Benzene	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
156-59-2	cis-1,2-dichloroethylene	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
100-41-4	Ethylbenzene	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
108-10-1	Methyl isobutyl ketone	Listed waste associated with B Plant operations-F002 (WHC 1996).
78-93-3	Methyl ethyl ketone	Listed waste associated with B Plant operations-F005 (WHC 1996).
75-09-2	Methylene chloride	Listed waste associated with B Plant operations-F002.
71-63-3	n-butyl alcohol	Listed waste associated with PUREX Plant operations-F003 (WHC 1996).
104-51-8	n-butyl benzene	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
127-18-4	Tetrachloroethylene (PCE)	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
156-60-5	trans-1,2-dichloroethylene	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
79-01-6	Trichloroethylene (TCE)	TCE is a degradation product of carbon tetrachloride. Analytical results and measurements have illustrated that this contaminant is prevalent throughout the vadose zone and has impacted groundwater (Rohay 1994).
108-88-3	Toluene	Listed waste associated with PUREX Plant operations-F005 (WHC 1996).
1330-20-7	Xylene	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
Semi-Volatile Organics		
8008-20-6	Normal paraffins[a]	Extensive use (1953 to 1957) in solvent extraction operation as the dilutant for TBP in URPs (GE 1951a).
1336-36-3	Polychlorinated biphenyls (PCBs)	Various types of normal paraffins were used as milling, cutting, and washing solutions during the production of plutonium buttons/rods. These solutions usually contained PCBs (discussions/publications with David A. Dodd, PFP chemist [Mandis 2001]). Analytical results from sediment samples collected within the 241-Z-361 tank (FH 2000).
126-73-8	Tributyl phosphate and derivatives (mono, bi)	Extensive use in the extraction of plutonium and uranium in the PUREX process and of uranium in the uranium recovery process (GE 1951b, 1955).

[a]Analyzed as kerosene by nonhalogenated volatile organic analytes via 8015 Method; total petroleum hydrocarbons, diesel to oil ranges; or total petroleum hydrocarbons, gasoline range.

Table B-10. 200-MW-1 Operable Unit Final COC List Nonradiological Process Steam Condensate with Radiological Cross Contamination. (2 Pages)

CAS #	Final COCs	Rationale for Inclusion
Radiological Constituents		
14596-10-2	Americium-241	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
10045-97-3	Cesium-137	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
10198-40-0	Cobalt-60	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
14683-23-9	Europium-152	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
15585-10-1	Europium-154	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
14391-16-3	Europium-155	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
13981-16-3	Plutonium-238	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
15117-48-3	Plutonium-239	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
14119-33-6	Plutonium-240	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
10098-97-2	Strontium-90	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
14133-76-7	Technetium-99	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
13966-29-5	Uranium-233/234	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
15117-96-1	Uranium-235/236	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
13982-70-2	Uranium-238	Known constituent produced by various Hanford Site operations (Kupfer et al. 1997).
Nonradiological Constituents – Metals		
7440-50-8	Copper	Associated with ventilation and cooling systems.
7439-92-1	Lead	Metal used in lead-dipped cladding and cladding waste stream (1952 to 1956) (GE 1944 [Section A]).
Nonradiological Constituents – General Inorganics		
N02+N03-N	Nitrate/nitrite	Several compounds contained nitrates/nitrites. The most widely used included sodium nitrite, a salting agent during the cladding removal; nitric acid, used throughout the bismuth-phosphate process and URP; and bismuth subnitrate, which was used to create the bismuth-phosphate/plutonium solid during the first and second decontamination cycles (GE 1944 [Section C], 1951a; HEW 1945).
14265-44-2	Phosphate	Several compounds contained phosphate. The most widely used included phosphoric acid, which was used throughout bismuth-phosphate process (GE 1944 [Section C], HEW 1945).
14808-79-8	Sulfate	Several compounds contained sulfate. The most widely used included sulfuric acid, which was used in dissolving the fuel rods during the bismuth-phosphate process (GE 1944 [Section C], 1951a; HEW 1945). Other sulfate complexes were used as carriers for various metals.
Volatile Organics		
71-55-6	1,1,1-trichloroethane (TCA)	Listed waste associated with B Plant operations-F001 (WHC 1996).
67-19-7	Acetone	Listed waste associated with PUREX Plant operations-F003 (WHC 1996).
156-59-2	cis-1,2-dichloroethylene	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (Rohay 1994).
108-10-1	Methyl isobutyl ketone	Listed waste associated with B Plant operations-F002 (WHC 1996).
78-93-3	Methyl ethyl ketone	Listed waste associated with B Plant operations-F005 (WHC 1996).
75-09-2	Methylene chloride	Listed waste associated with B Plant operations-F002.

Table B-10. 200-MW-1 Operable Unit Final COC List Nonradiological Process Steam Condensate with Radiological Cross Contamination. (2 Pages)

CAS #	Final COCs	Rationale for Inclusion
71-63-3	n-butyl alcohol	Listed waste associated with PUREX Plant operations-F003 (WHC 1996).
108-88-3	Toluene	Listed waste associated with PUREX Plant operations-F005 (WHC 1996).
Semi-Volatile Organics		
8008-20-6	Normal paraffins[a]	Extensive use (1953 to 1957) in solvent extraction operation as the dilutant for TBP in URPS (GE 1951a).
1336-36-3	Polychlorinated biphenyls (PCBs)	Various types of normal paraffins were used as milling, cutting, and washing solutions during the production of plutonium buttons/rods. These solutions usually contained PCBs (discussions/publications with David A. Dodd, PFP chemist [Mandis 2001]). Analytical results from sediment samples collected within the 241-Z-361 tank (FH 2000).
126-73-8	Tributyl phosphate and derivatives (mono, bi)	Extensive use in the extraction of plutonium and uranium in the PUREX process and of uranium in the uranium recovery process (GE 1951b, 1955).

[a]Analyzed as kerosene by nonhalogenated volatile organic analytes via 8015 Method; total petroleum hydrocarbons, diesel to oil ranges; or total petroleum hydrocarbons, gasoline range.

DISTRIBUTION

U.S. Department of Energy
Richland Operations Office

B. L. Foley (10 copies)	A6-38

ERC Team

K. A. Anselm, CHI	H9-02
L. A. Dietz, BHI	H0-20
L. M. Dittmer, BHI	H0-02
B. H. Ford, BHI	H0-21
M. J. Galgoul, CHI (8 copies)	H9-01
C. W. Hedel, CHI	H9-03
M. L. Mandis, CHI	H9-01
K. M. Singleton, CH2M HILL	H9-02
C. D. Wittreich, CHI (2 copies)	H9-03

Fluor Hanford

R. T. Wilde, DFSH	H8-68

Document and Information Services (3)	H0-09
DOE-RL Public Reading Room	H2-53
Hanford Technical Library	P8-55