CHPRC ADMINISTRATIVE DOCUMENT PROCESSING AND APPROVAL

DOCUMENT TITLE:	**OWNING ORGANIZATION/FACILITY:**
Data Quality Assessment Report for the 200-BP-5 Groundwater Operable Unit	S&GRP

Document Number: SGW-44071 **Revision/Change Number:** 2

DOCUMENT TYPE *(Check Applicable)* [ ] Plan [X] Report [ ] Study [ ] Description Document [ ] Other

DOCUMENT ACTION *(Check One)* [] New [X] Revision [ ] Cancellation

RESPONSIBLE CONTACTS

Name	Phone Number
Author: C. Haas	392-3790
Manager: C. Narquis	373-3693

DOCUMENT CONTROL

VSK 01/28/11

Is the document intended to be controlled within the Hanford Document Control System (HDCS)?	[X] Yes ~~[X]~~ No
Does document contain scientific and technical information intended for public use?	[X] Yes [ ] No
Does document contain controlled-use information *("yes" requires information clearance review in accordance with PRC-PRO-IRM-184)*	[ ] Yes [X] No

DOCUMENT REVISION SUMMARY

NOTE: Provide a brief description or summary of the changes for the document listed.

Document revised to include depth discrete sample data.

REVIEWERS **Others**

Name *(print)*	Organization
S. Huggins	EQA
G. Thomas	RCRA Monitoring/Reporting
V. Rohay	Remedy Selection
R. Oldham	Environmental
C. Wittreich	Remediation Integration

APPROVAL SIGNATURES

Author:	Chris R. Haas	1-27-11
Name: (Print)	CR Haas	Date
Responsible Manager:	C.T. Narquis	01-27-11
Name: (print)	C.T. NARQUIS	Date
Other:	ST Smith	2/2/11
Name: (print)	ST SMITH MGR EQA	Date

RELEASE / ISSUE
MAR 07 2011
DATE:
STA: 14
HANFORD RELEASE
ID: 16

S

Date Received for Clearance Process (MM/DD/YYYY): 01/27/2011

INFORMATION CLEARANCE FORM

A. Information Category

- ☐ Abstract
- ☐ Journal Article
- ☐ Summary
- ☐ Internet
- ☐ Visual Aid
- ☐ Software
- ☐ Full Paper
- ☒ Report
- ☐ Other _____

B. Document Number: SGW-44071, Rev. 2

C. Title: Data Quality Assessment Report for the 200-BP-5 Groundwater Operable Unit

D. Internet Address:

E. Required Information (MANDATORY)

1. Is document potentially Classified? ◉ No ○ Yes
   C. Wittreich
   Manager Required (Print and Sign)
   If Yes _____
   ADC Required (Print and Sign) ◉ No ○ Yes Classified
2. Official Use Only ◉ No ○ Yes Exemption No. ____
3. Export Controlled Information ◉ No ○ Yes OUO Exemption No. 3
4. UCNI ◉ No ○ Yes
5. Applied Technology ◉ No ○ Yes
6. Other (Specify) _____

7. Does Information Contain the Following:
   a. New or Novel (Patentable) Subject Matter? ◉ No ○ Yes
      If "Yes", OUO Exemption No. 3
      If "Yes", Disclosure No.: _____
   b. Commercial Proprietary Information Received in Confidence, Such as Proprietary and/or Inventions?
      ◉ No ○ Yes If "Yes", OUO Exemption No. 4
   c. Corporate Privileged Information? ◉ No ○ Yes
      If "Yes", OUO Exemption No. 4
   d. Government Privileged Information? ◉ No ○ Yes
      If "Yes", Exemption No. 5
   e. Copyrights? ◉ No ○ Yes If "Yes", Attach Permission.
   f. Trademarks? ◉ No ○ Yes If "Yes", Identify in Document.
8. Is Information requiring submission to OSTI? ◉ No ○ Yes
9. Release Level? ◉ Public ○ Limited

F. Complete for a Journal Article

1. Title of Journal

G. Complete for a Presentation

1. Title for Conference or Meeting _____
2. Group Sponsoring _____
3. Date of Conference _____
4. City/State _____
5. Will Information be Published in Proceedings? ○ No ○ Yes
6. Will Material be Handed Out? ○ No ○ Yes

H. Information Owner/Author/Requestor
V. Rohay V J Rohay 01/28/11
(Print and Sign)

Responsible Manager
C. Wittreich
(Print and Sign)

Approval by Direct Report to President (Speech/Articles Only) _____
(Print and Sign)

I. Reviewers	Yes	Print	Signature	Public Y/N (If N, complete J)
General Counsel	☐			Y / N
Office of External Affairs	☐			Y / N
DOE-RL	☐			Y / N
Other	☒	OUO Reviewer		(Y) / N
Other	☒	J. Aardal/S.E. Adams		(Y) / N

J. Comments

If Additional Comments, Please Attach Separate Sheet

Information Clearance Approval

APPROVED FOR RELEASE OFFICIAL DOCUMENT SA 02/07/2011

SGW-44071
Revision 2

Data Quality Assessment Report for the 200-BP-5 Groundwater Operable Unit

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

CH2MHILL
Plateau Remediation Company

P.O. Box 1600
Richland, Washington 99352

SGW-44071
Revision 2

Data Quality Assessment Report for the 200-BP-5 Groundwater Operable Unit

Date Published
March 2011

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

P.O. Box 1600
Richland, Washington

Release Approval — Date 03/07/2011

Approved for Public Release:
Further Dissemination Unlimited

TRADEMARK DISCLAIMER

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

This report has been reproduced from the best available copy.

Printed in the United States of America

Executive Summary

The scope of this report is to summarize data quality assessment (DQA) activities performed to evaluate the results of 13,405 groundwater samples collected from wells in the 200-BP-5 Groundwater Operable Unit (OU) over a period from November 2004, through December 2010. Included in the scope of this report is an assessment of the results of depth discrete sampling performed in 28 wells between November 2006 and May 2010.

The objective of this DQA is to determine whether the data can support the baseline risk assessment (BRA) and selection of remedial alternatives for the 200-BP-5 Groundwater OU. The requirements for the sampling program are found in DOE/RL-2007-18,[1] hereinafter referred to as the Remedial Investigation (RI)/Feasibility Study (FS) Work Plan. Over the assessment period, samples were also collected in accordance with the following documentation:

- DOE/RL-99-07[2]
- DOE/RL-99-44[3]
- DOE/RL-2001-49[4]
- DOE/RL-2006-55[5]

Depth discrete samples were also collected in accordance with the following documentation:

---

[1] DOE/RL-2007-18, 2008, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-5 Groundwater Operable Unit*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=0901220536.

[2] DOE/RL-99-07, 2000, *200-CW-1 Operable Unit RI/FS Work Plan and 216-B-3 RCRA TSD Unit Sampling Plan*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=D8434692.

[3] DOE/RL-99-44, 2000, *200-CS-1 Operable Unit RI/FS Work Plan and RCRA TSD Unit Sampling Plan*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D8434677.

[4] DOE/RL-2001-49, 2004, *Groundwater Sampling and Analysis Plan for the 200-BP-5 Operable Unit*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D7379978.

[5] DOE/RL-2006-55, 2010, *Sampling and Analysis Plan for FY 2006 200-BP-5 Groundwater Operable Unit Remedial Investigation/Feasibility Study*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

- DOE/RL-2008-41[6]
- PNNL-19129[7]
- SGW-44067[8]

The DQA process follows general DQA guidelines established by the U.S. Environmental Protection Agency in EPA/240/B-06/003.[9]

The assessment is based on three levels of evaluation: verification, validation, and data usability. Data verification is the process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual requirements. Data validation is an analyte- and sample-specific process that extends the evaluation of data beyond method, procedural, or contractual compliance (i.e., data verification) to determine the analytical quality of a specific data set. Finally, the usability assessment is a determination of the adequacy of the data to support a particular environmental decision and is based upon the verification and validation results.

The 200-BP-5 Groundwater OU data set included close to 100,000 analytical results, from samples of 163 wells for 339 individual constituents over a period from November 2004 to May 2010. In addition, more than 500,000 individual quality control (QC) results were generated in support of the chemical analyses.

The conclusion of the assessment is that the 200-BP-5 Groundwater OU data are the correct type, quality, and quantity for direct regulatory use (e.g., in the BRA) as part of the RI/FS process. Detection limits, precision, accuracy, and data completeness were analyzed to determine if any analytical data should be rejected as a result of quality assurance (QA) or QC deficiencies. Other than those results that were noted as unusable, the analytical data were found to be acceptable for the intended use.

---

[6] DOE/RL-2008-41, 2008, *Sampling and Analysis Plan for the Liquid Effluent Retention Facility (LERF) Replacement RCRA Wells*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at:

[7] PNNL-19129, 2010, *Discrete Sampling Test Plan for the 200–BP-5 Operable Unit*, Pacific Northwest National Laboratory, Richland, Washington. Available at: http://www.osti.gov/bridge/product.biblio.jsp?osti_id=973414.

[8] SGW-44067, 2009, *Sampling and Analysis Plan for Waste Management Area C Assessment Groundwater Monitoring Well Installation*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington.

[9] EPA/240/B-06/003, 2006, *Data Quality Assessment: Statistical Methods for Practitioners*, EPA QA/G-9S, Office of Environmental Information, U.S. Environmental Protection Agency, Washington, D.C. Available at: http://www.epa.gov/quality/qs-docs/g9s-final.pdf.

Comparison of the 200-BP-5 Groundwater OU data set with the overall Hanford Site groundwater data set, as described in the annual Hanford Site groundwater reports, showed that the 200-BP-5 Groundwater OU data is at least as good, in terms of accuracy, precision, and blank contamination, as the overall site groundwater data set. Both field and laboratory performance parameters are equal to or better than those for the Hanford Site groundwater data as a whole. The overall project completeness is estimated to be greater than 99 percent. Completeness is a measure of valid data obtained from the laboratory compared to the amount of data expected to be obtained, based on the analyses requested in the sampling and analysis plan(s), under correct normal conditions.

The following limitations or data weaknesses were observed in the data assessed in the main body of this document:

1. Twenty-three general chemistry sample results were rejected by the independent third party data validator. Users of this data (particularly cyanide and nitrite) should be cognizant of potential impacts with their data.

2. Thorium-234 is listed as a contaminant of potential concern in Appendix A of the 200-BP-5 RI/FS Work Plan; however, no indications exist that this constituent was included in the analyses for radionuclides and, as such, no laboratory results were available for evaluation in this DQA report.

3. While the overall field QC performance was very good, specific observed deficiencies should be taken into account by any data user. Data users should evaluate the well-specific and constituent-specific field QC to validate the use of the individual data points. The following field QC weaknesses were noted:

    - Constituents and properties with high percentages of unacceptable field duplicate results include nitrogen in nitrite, calcium, copper, magnesium, silver, sodium, and potassium-40.

    - Constituents and properties with high percentages of unacceptable field split results include calcium, cyanide, fluoride, gross beta, magnesium, potassium, and sodium.

    - Constituents and properties with high percentages of positive field blank results include chloride, nitrogen in nitrate, specific conductance, total organic halides, calcium, magnesium, sodium, americium-241, methylene chloride, and oil and grease.

- Although the laboratory QC performance overall was excellent, some isolated data batches exhibited problems. The appropriate qualifiers have been added to the Hanford Environmental Information System (HEIS) database. Data users relying on single data results should ensure that they understand the qualifiers identified in HEIS and confirm that laboratory batch data associated with the specific result are also good.
- Approximately 45 percent of the reported values for the 200-BP-5 Groundwater OU constituents are below the laboratory reporting limits (nondetects). Data for 53 constituents are all nondetected values, with reporting limits greater than the applicable regulatory action limit. These constituents are listed on Table 5-2 in Chapter 5 of this document. None of these are RI/FS constituents, but they were reported as method-based analytes. Data users must look carefully at data detection limits relative to action limits when using these data. An additional 34 constituents displayed a large percentage of detection limits that exceeded regulatory action limits. These data must be considered carefully when using the data set for regulatory decision making, particularly when using the data to demonstrate achievement of a remediation goal. These constituents are listed on Table 5-3 in Chapter 5 of this document. Data users must look carefully at data detection limits relative to action limits when using these data.

4. Analytical results associated with sample B1V569 from Well 299-E33-205 were not considered representative due to the addition of drilling fluid prior to sample collection and completion of limited purging. As such, the data associated with these samples are not considered useable for regulatory decision making.

The following limitations or data weaknesses were observed in the data assessed in Appendix B of this document:

1. Although the laboratory and field QA data were excellent overall, some isolated data batches exhibited problems. The appropriate qualifiers have been added in the HEIS database. Data users that rely on single data results should ensure that they understand the qualifiers identified in HEIS and confirm that laboratory batch data associated with the specific result are also good.

2. Data for 16 constituents had 100 percent nondetected values and 100 percent of the reporting limits greater than the applicable regulatory action limit (Table B3-2). None of these are 200-BP-5 Groundwater OU RI/FS constituents, but they were reported as method-based analytes. Data users must look carefully at data detection limits relative to action limits when using these data.

3. An additional 31 constituents displayed a large percentage (25 percent or more) of detection limits that exceeded regulatory action limits (Table B3-3). These data must be considered carefully when using the data set for regulatory decision making, particularly when using the data to demonstrate achievement of a remediation goal. Data users must look carefully at data detection limits relative to action limits when using these data.

4. Analytical results associated with samples B1TTV1, B1TTV2, B1TTV3, B1TTV4, and B1TVL1 from Well 299-E33-340 were not considered representative due to the addition of drilling fluid prior to sample collection and completion of limited purging. As such, the data associated with these samples are not considered useable for regulatory decision making.

Contents

Appendices

Figure

Tables

Terms

AEA	alpha energy analysis
ARAR	applicable or relevant and appropriate requirement
BRA	baseline risk assessment
CAS	Chemical Abstracts Service
CCC	criterion continuous concentration
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CHPRC	CH2M HILL Plateau Remediation Company
COPC	contaminant of potential concern
DOE	U.S. Department of Energy
DQA	data quality assessment
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
FS	feasibility study
FY	fiscal year
GEA	gamma energy analysis
HASQARD	*Hanford Analytical Services Quality Assurance Requirements Document*
HEIS	Hanford Environmental Information System
IDL	instrument detection limit
LCS	laboratory control sample
MCL	maximum contaminant level
MDA	minimum detectable activity
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
N/A	not applicable
OU	operable unit
PCB	polychlorinated biphenyl
QA	quality assurance

QC	quality control
RCRA	*Resource Conservation and Recovery Act of 1976*
RDR	request for data review
RI	remedial investigation
RPD	relative percent difference
S&GRP	Soil and Groundwater Remediation Project
SAP	sampling and analysis plan
SST	single-shell tank
SVOC	semivolatile organic compound
TPH	total petroleum hydrocarbon
TSD	treatment, storage, and/or disposal
VOC	volatile organic compound
WMA	waste management area

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	25.40	millimeters	millimeters	0.0394	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 (statute)	1.609	kilometers	kilometers	0.621	miles (statute)
Area			**Area**		
sq. inches	6.452	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.0929	sq. meters	sq. meters	10.764	sq. feet
sq. yards	0.836	sq. meters	sq. meters	1.196	sq. yards
sq. miles	2.591	sq. kilometers	sq. kilometers	0.386	sq. miles
acres	0.405	hectares	hectares	2.471	acres
Mass (weight)			**Mass (weight)**		
ounces (avoir)	28.349	grams	Grams	0.0353	ounces (avoir)
pounds	0.453	kilograms	kilograms	2.205	pounds (avoir)
tons (short)	0.907	ton (metric)	ton (metric)	1.102	tons (short)
Volume			**Volume**		
teaspoons	5	milliliters	milliliters	0.034	ounces (U.S., liquid)
tablespoons	15	milliliters	liters	2.113	pints
ounces (U.S., liquid)	29.573	milliliters	liters	1.057	quarts (U.S., liquid)
cups	0.24	liters	liters	0.264	gallons (U.S., liquid)
pints	0.473	liters	cubic meters	35.315	cubic feet
quarts (U.S., liquid)	0.946	liters	cubic meters	1.308	cubic yards
gallons (U.S., liquid)	3.785	liters			
cubic feet	0.0283	cubic meters			
cubic yards	0.764	cubic meters			
Temperature			**Temperature**		
Fahrenheit	(°F-32)*5/9	Centigrade	Centigrade	(°C*9/5)+32	Fahrenheit
Radioactivity			**Radioactivity**		
picocurie	37	millibecquerel	millibecquerel	0.027	picocurie

1 Introduction

This data quality assessment (DQA) report assesses laboratory data for groundwater samples obtained from 163 wells in the 200-BP-5 Groundwater Operable Unit (OU) for the period from November 2004 through November 2009. Also assessed in this report were laboratory data from 28 wells from which depth discrete samples were collected. These samples were collected between November 2006 and May 2010. An assessment of 9 wells is presented in the main body of this document; an assessment of the remaining 19 wells is presented in Appendix B of this document. Table 1-1 identifies all 163 wells and highlights the 9 wells assessed in the main body of this document from which depth discrete samples were collected.

Table 1-1. List of Selected Groundwater Wells in the 200-BP-5 Groundwater Operable Unit

199-K-31	299-E32-10	299-E33-344	699-50-28B
299-E24-8	299-E32-2	299-E33-345	699-50-53B
299-E24-25	299-E-28-30	299-E29-54	699-50-56
299-E26-10	299-E32-3	299-E33-35	699-50-59
299-E26-11	299-E32-4	299-E33-36	699-52-19
299-E26-77	299-E32-5	299-E33-37	699-52-46A
299-E26-79	299-E32-6	299-E33-38	699-52-55
299-E26-8	299-E32-7	299-E33-39	699-52-55B
299-E27-10	299-E32-8	299-E33-4	699-53-47A
299-E27-11	299-E32-9	299-E33-40	699-53-47B
299-E27-12	299-E33-12	299-E33-41	699-53-48A
299-E27-13	299-E33-13	299-E33-42	699-53-55A
299-E27-14	299-E33-14	299-E33-43	699-53-55B
299-E27-15	299-E33-15	299-E33-44	699-53-55C
299-E27-155	299-E33-16	299-E33-47	699-54-34
299-E27-16	299-E33-17	299-E33-48	699-54-45A
299-E27-17	299-E33-18	299-E33-49	699-54-45B
299-E27-18	299-E33-1A	299-E33-5	699-54-48
299-E27-19	299-E33-2	299-E33-50	699-54-49
299-E27-21	299-E33-20	299-E33-7	699-55-50C
299-E27-22	299-E33-205	299-E33-9	699-55-57

Table 1-1. List of Selected Groundwater Wells in the 200-BP-5 Groundwater Operable Unit

299-E27-23	299-E33-21	299-E34-10	699-55-60A
299-E27-4	299-E33-25	299-E34-12	699-56-43
299-E27-7	299-E33-26	299-E34-2	699-56-53
299-E27-8	299-E33-28	299-E34-5	699-57-59
299-E27-9	299-E33-29	299-E34-7	699-59-58
299-E28-13	299-E33-3	299-E34-8	699-60-60
299-E28-17	299-E33-30	299-E34-9	699-61-62
299-E28-18	299-E33-31	699-42-40A	699-61-66
299-E28-2	299-E33-32	699-42-40C	699-62-43F
299-E28-21	299-E33-33	699-42-42B	699-63-55
299-E28-23	299-E33-334	699-43-44	699-64-62
299-E28-24	299-E33-335	699-43-45	699-65-50
299-E28-25	299-E33-337	699-44-39B	699-65-72
299-E28-26	299-E33-338	699-45-42	699-66-58
299-E28-27	299-E33-339	699-47-60	699-66-64
299-E28-28	299-E33-34	699-48-50B	699-67-51
299-E28-5	299-E33-340	699-49-55A	699-70-68
299-E28-6	299-E33-341	699-49-55B	699-72-73
299-E28-7	299-E33-342	699-49-57A	699-73-61
299-E28-8	299-E33-343	699-49-57B	

Note: Shading denotes the 9 wells from which depth discrete samples were collected. These samples are assessed in the main text of this document. An additional 19 wells had depth discrete samples collected. The data associated with these wells are assessed in Appendix B of this document.

1.1 Background

In 1989, the Hanford Site was listed on the 40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," Appendix B, "National Priorities List," pursuant to the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA). To address groundwater issues in the 200 East Area, 200-BP-5 Groundwater OU and 200-PO-1 Groundwater OU areas were established. The 200-BP-5 Groundwater OU extends from the 200 East Area to the Columbia River to the north, and to the east flank of Gable Mountain to the east (Figure 1-1). The 200-BP-5 Groundwater OU

includes the groundwater beneath the northern part of the 200 East Area. Collectively, the 200-BP-5 and 200-PO-1 Groundwater OUs contain all of the groundwater beneath the 200 East Area of the Hanford Site. The boundaries of the 200-BP-5 Groundwater OU encompass an area of approximately 84.5 km^2 (32.6 mi^2), underlying mostly undeveloped land, with clusters of industrial buildings and associated structures. The buildings and structures primarily are located within the fence line of the 200 East Area. The OU underlies 72 CERCLA liquid effluent waste sites and the following 5 facilities, which have groundwater monitoring requirements under the *Resource Conservation and Recovery Act of 1976* (RCRA) and the *Atomic Energy Act of 1954*:

- Waste Management Area (WMA) B/BX/BY Tank Farms
- 216-B-63 Trench
- Low-Level WMA-1 and -2
- Liquid Effluent Retention Facility
- WMA C Tank Farm

Localized occurrences of contaminated soils in the vadose zone most likely are the primary sources of contamination that currently may be entering the groundwater. In the past, contamination has migrated to the groundwater through percolation or infiltration via the vadose zone (as evidenced by high levels of groundwater contamination) or was injected directly via injection wells. The Columbia River and West Lake are the only surface water bodies that could be impacted from contaminated groundwater in the 200-BP-5 Groundwater OU.

The major sources of contaminated soils overlying the 200-BP-5 Groundwater OU include past intentional liquid discharges to cribs, ponds, and ditches; injection wells; accidental spills and releases; and leaking single-shell tanks (SSTs) and ancillary equipment.

The primary sources known or strongly suspected of contributing to groundwater contamination in the 200-BP-5 Groundwater OU are the BY Cribs, SSTs and ancillary equipment, spills within WMA B/BX/BY and WMA C Tank Farms, the 216-B-5 Reverse Well, and the 216-B-8 Crib. In addition to these sources, vadose zone contamination, that is likely to pose a significant threat to groundwater quality, is suspected below the 216-B-12 and 216-C-1 Cribs and the 216-B-6 Reverse Well (DOE/RL-2007-18, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-5 Groundwater Operable Unit*). The most widely distributed groundwater contaminants in the 200-BP-5 Groundwater OU are tritium, nitrate, technetium-99, and iodine-129. Contaminants mostly confined to localized areas in the OU are strontium-90, cesium-137, plutonium-239/240, uranium, sulfate, and cyanide.

Groundwater sampling within the 200-BP-5 Groundwater OU is performed in accordance with DOE/RL-2001-49. The RCRA treatment, storage, and/or disposal (TSD) monitoring is performed in accordance with facility-specific RCRA monitoring plans (DOE/RL-99-07, *200-CW-1 Operable Unit RI/FS Work Plan and 216-B-3 RCRA TSD Unit Sampling Plan*, and DOE/RL-99-44, *200-CS-1 Operable Unit RI/FS Work Plan and RCRA TSD Unit Sampling Plan*). The analytical data for all groundwater monitoring samples and their associated field quality control (QC) samples are maintained in the Hanford Environmental Information System (HEIS) database; the data are summarized in annual groundwater monitoring reports. The most recent of these reports is DOE/RL-2010-11, *Hanford Site Groundwater Monitoring and Performance Report for 2009: Volumes 1 & 2*. These reports are hereafter referred to as the annual groundwater reports.

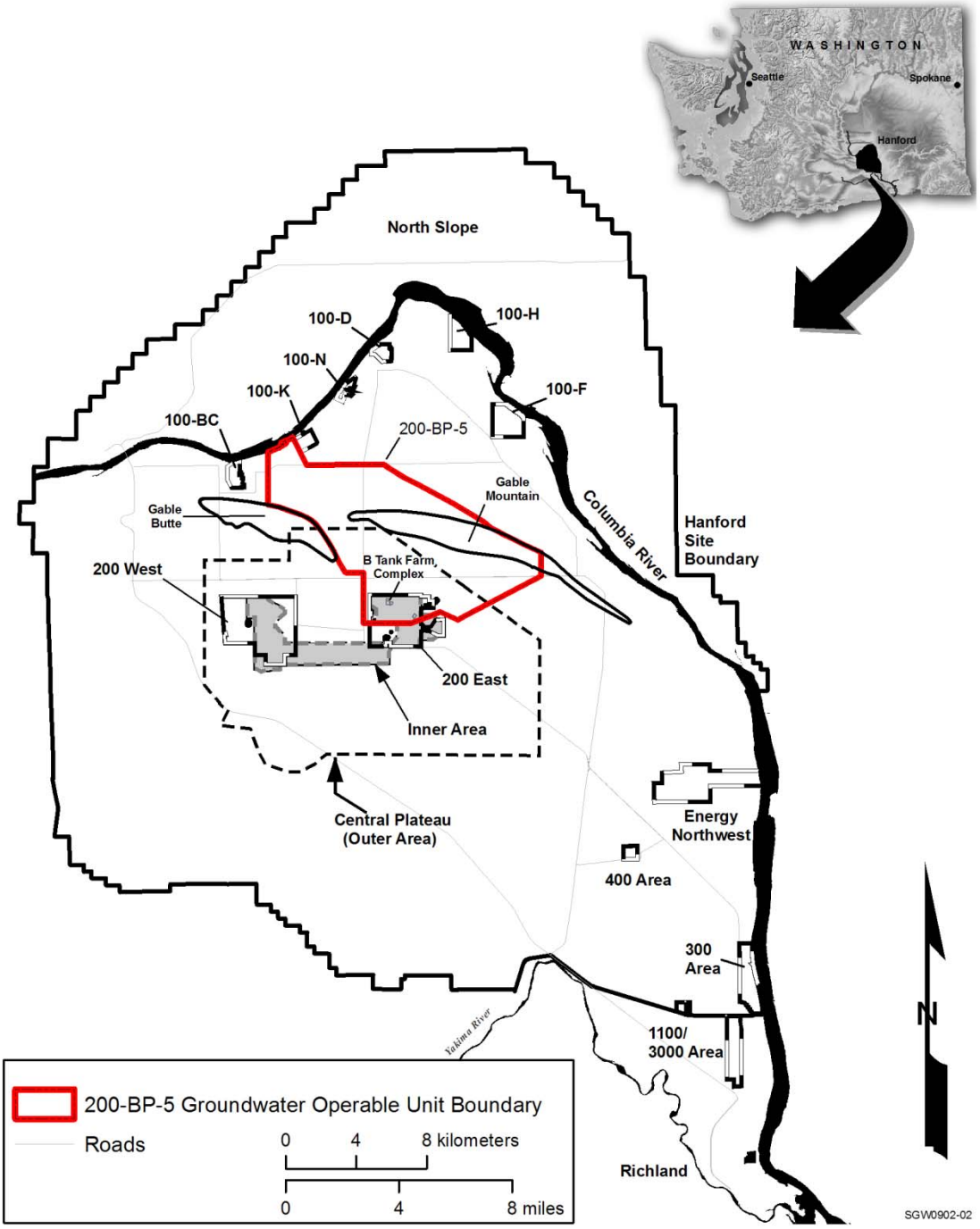

Figure 1-1. Location of the 200-BP-5 Groundwater Operable Unit at the Hanford Site

1.2 Monitoring Wells Selection

A total of 163 wells were selected for inclusion in this DQA. These wells, which represent a subset of the total number of wells in the 200-BP-5 Groundwater OU, were selected because they have data results from the November 2004 to May 2010 timeframe. A list of the 163 wells is presented in Table 1-1.

The wells selected for sampling include those from the monitoring well network of the 200-BP-5 Groundwater OU, as originally established in the sampling and analysis plans (SAPs) DOE/RL-2001-49, *Groundwater Sampling and Analysis Plan for the 200-BP-5 Operable Unit*, and DOE/RL-2006-55, *Sampling and Analysis Plan for FY 2006 200-BP-5 Groundwater Operable Unit Remedial Investigation/ Feasibility Study*. Subsequently, DOE/RL-2007-18, Appendix A, specified some changes to sampling frequency and target analytes to support the remedial investigation (RI) process. Finally, some sampling activities were also specified by two RCRA well monitoring plans (DOE/RL-99-07 and DOE/RL-99-44).

1.3 Target Analytes

A data quality objectives (DQOs) process was conducted in 2007 to support the RI for the 200-BP-5 Groundwater OU (WMP-28945, *Data Quality Objectives Summary Report in Support of the 200-BP-5 Groundwater Operable Unit Remedial Investigation/Feasibility Study Process*). This DQO process resulted in a comprehensive list of contaminants of potential concern (COPCs), which was revised to a final list of 26 COPCs as shown in Table 1-2.

Table 1-2. 200-BP-5 Groundwater Operable Unit Contaminants of Potential Concern

Radionuclides	Metals	Inorganics
Americium-241	Aluminum	Chloride
Cobalt-60	Antimony	Nitrite
Carbon-14	Arsenic	**Volatile Organics**
Neptunium-237	Cadmium	Chloroform
Plutonium-238	Chromium	Methylene Chloride
Thorium-232	Chromium(VI)	**Semivolatile Organics**
Thorium-234	Iron	Bis(2-ethylhexyl)phthalate
Uranium Isotopes*	Sodium	Pentachlorophenol
	Thallium	

Source: DOE/RL-2007-18, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-5 Groundwater Operable Unit*, Table A1-3.

* Isotopes include uranium-233, uranium-234, uranium-235, and uranium-238.

In addition to target COPC analytes for RI/feasibility study (FS) characterization (Table 1-2) or TSD process monitoring, additional constituents have been reported through method-based analysis. Method-based analysis avoids identification of individual COPCs and instead specifies the suites of analytical methods that will yield results for the COPCs needed. The data set used for this DQA includes a total of 339 individual analytical parameters.

1.4 Action Levels

Action levels are derived from readily available sources of chemical-specific applicable or relevant and appropriate requirements (ARARs).

The following sources identify the chemical-specific ARARs obtained from federal regulations:

- Maximum contaminant levels (MCLs), secondary MCLs, and non-zero MCL goals established under the *Safe Drinking Water Act of 1974*

- Ambient water quality criteria established under Section 304 or Section 303 of the *Clean Water Act of 1977*

The following sources identify chemical-specific ARARs obtained from Washington State regulations:

- WAC 173-340-720, "Model Toxics Control Act—Cleanup," "Ground Water Cleanup Standards"
- WAC 173-340-730, "Surface Water Cleanup Standards"
- WAC 246-290-310, "Group A Public Water Supplies," "Maximum Contaminant Levels (MCLs) and Maximum Residual Disinfectant Levels (MRDLs)"
- WAC 173-201A, "Water Quality Standards for Surface Waters of the State of Washington"

All sources of action levels (chemical-specific ARARs) for each of the 339 analytes reported will be identified in a COPC selection calculation brief, to be developed.

The action level selected for the DQA process represents the lowest of the chemical-specific ARARs that are protective of human and aquatic receptors and available at the time of the assessment. These action levels, along with their basis, appear in the Table 1-3.

Table 1-3. List of Target Constituents and Action Levels for the 200-BP-5 Groundwater Operable Unit

Analyte Name	Analyte Class	Action Level	Units	Action Level Basis
1,2,3,4,6,7,8-Heptachlorodibenzodioxin	Dioxin/Furan	6.73E-05	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
1,2,3,4,6,7,8-Heptachlorodibenzofuran	Dioxin/Furan	6.73E-05	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Heptachlorodibenzofurans	Dioxin/Furan	--	--	--
Heptachlorodibenzo-*p*-dioxins	Dioxin/Furan	--	--	--
Hexachlorodibenzo-*p*-dioxin	Dioxin/Furan	--	--	--
Octachlorodibenzofuran	Dioxin/Furan	2.16E-04	µg/L	WAC 173-340-730(3)(b)(iii)(A) and (B)
Octachlorodibenzo-*p*-dioxin	Dioxin/Furan	1.27E-04	µg/L	WAC 173-340-730(3)(b)(iii)(A) and (B)
Pentachlorodibenzo-*p*-dioxins	Dioxin/Furan	--	--	--
2-(2-methyl-4-chlorophenoxy)propionic Acid	Herbicides	16	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
2,4,5-T (2,4,5-Trichlorophenoxyacetic Acid)	Herbicides	160	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
2,4,5-TP (2-(2,4,5-Trichlorophenoxy) propionic Acid) Silvex	Herbicides	10	µg/L	Human Health for the Consumption of Water + Organism
2,4-D (2,4-Dichlorophenoxyacetic Acid)	Herbicides	70	µg/L	40 CFR 141.61

Table 1-3. List of Target Constituents and Action Levels for the 200-BP-5 Groundwater Operable Unit

Analyte Name	Analyte Class	Action Level	Units	Action Level Basis
2,4-DB (4-(2,4-Dichlorophenoxy) butanoic Acid)	Herbicides	128	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
2-Methyl-4-chlorophenoxyacetic Acid	Herbicides	8.0	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Dalapon	Herbicides	200	µg/L	40 CFR 141.61
Dicamba	Herbicides	480	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Dichloroprop	Herbicides	--	--	--
Aluminum	Metals	50	µg/L	40 CFR 143.3
Antimony	Metals	5.6	µg/L	Human Health for the Consumption of Water + Organism
Arsenic	Metals	0.018	µg/L	Human Health for the Consumption of Water + Organism
Barium	Metals	1,000	µg/L	Human Health for the Consumption of Water + Organism
Beryllium	Metals	4.0	µg/L	WAC 246-290-310
Boron	Metals	3,200	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Cadmium	Metals	0.25	µg/L	Freshwater CCC
Calcium	Metals	--	--	--
Chromium	Metals	65	µg/L	Freshwater CCC
Cobalt	Metals	2.6	µg/L	WAC 173-340-730(3)(b)(iii)(A) and (B)
Copper	Metals	9.0	µg/L	Freshwater CCC
Hexavalent Chromium	Metals	10	µg/L	WAC 173-201A
Iron	Metals	300	µg/L	Human Health for the Consumption of Water + Organism
Lead	Metals	2.1	µg/L	WAC 173-201A
Lithium	Metals	32	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)

Table 1-3. List of Target Constituents and Action Levels for the 200-BP-5 Groundwater Operable Unit

Analyte Name	Analyte Class	Action Level	Units	Action Level Basis
Magnesium	Metals	--	--	--
Manganese	Metals	50	µg/L	Human Health for the Consumption of Water + Organism/WAC 246-290-310
Mercury	Metals	0.012	µg/L	WAC 173-201A
Nickel	Metals	52	µg/L	Freshwater CCC
Phosphorus	Metals	--	--	--
Potassium	Metals	--	--	--
Selenium	Metals	5.0	µg/L	Freshwater CCC/ WAC 173-201A
Silicon	Metals	--	--	--
Silver	Metals	2.6	µg/L	WAC 173-201A
Sodium	Metals	--	--	--
Strontium	Metals	9,600	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Sulfur	Metals	--	--	--
Thallium	Metals	0.24	µg/L	Human Health for the Consumption of Water + Organism
Uranium	Metals	30	µg/L	40 CFR 141.62
Vanadium	Metals	80	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Zinc	Metals	91	µg/L	WAC 173-201A
Oil and Grease	Oil/Grease	--	--	--
Aroclor 1016	PCB	6.40E-05	µg/L	Human Health for the Consumption of Water + Organism
Aroclor 1221	PCB	6.40E-05	µg/L	Human Health for the Consumption of Water + Organism
Aroclor 1232	PCB	6.40E-05	µg/L	Human Health for the Consumption of Water + Organism

Table 1-3. List of Target Constituents and Action Levels for the 200-BP-5 Groundwater Operable Unit

Analyte Name	Analyte Class	Action Level	Units	Action Level Basis
Aroclor 1242	PCB	6.40E-05	µg/L	Human Health for the Consumption of Water + Organism
Aroclor 1248	PCB	6.40E-05	µg/L	Human Health for the Consumption of Water + Organism
Aroclor 1254	PCB	6.40E-05	µg/L	Human Health for the Consumption of Water + Organism
Aroclor 1260	PCB	6.40E-05	µg/L	Human Health for the Consumption of Water + Organism
4,4'-DDD (Dichlorodiphenyldichloroethane)	Pesticides	3.10E-04	µg/L	Human Health for the Consumption of Water + Organism
4,4'-DDE (Dichlorodiphenyldichloroethylene)	Pesticides	2.20E-04	µg/L	Human Health for the Consumption of Water + Organism
4,4'-DDT (Dichlorodiphenyltrichloroethane)	Pesticides	2.20E-04	µg/L	Human Health for the Consumption of Water + Organism
Aldrin	Pesticides	4.90E-05	µg/L	Human Health for the Consumption of Water + Organism
Alpha-BHC	Pesticides	0.0026	µg/L	Human Health for the Consumption of Water + Organism
beta-1,2,3,4,5,6-Hexachlorocyclohexane (beta-BHC)	Pesticides	0.0091	µg/L	Human Health for the Consumption of Water + Organism
Chlordane	Pesticides	8.00E-04	µg/L	Human Health for the Consumption of Water + Organism
Delta-BHC	Pesticides	--	--	--
Dieldrin	Pesticides	5.20E-05	µg/L	Human Health for the Consumption of Water + Organism
Dinoseb(2-secButyl-4,6-dinitrophenol)	Pesticides	7.0	µg/L	40 CFR 141.61

Table 1-3. List of Target Constituents and Action Levels for the 200-BP-5 Groundwater Operable Unit

Analyte Name	Analyte Class	Action Level	Units	Action Level Basis
Disulfoton	Pesticides	0.48	µg/L	WAC 173-340-730(3)(b)(iii)(A) and (B)
Endosulfan I	Pesticides	0.056	µg/L	Freshwater CCC
Endosulfan II	Pesticides	0.056	µg/L	Freshwater CCC
Endosulfan Sulfate	Pesticides	62	µg/L	Human Health for the Consumption of Water + Organism
Endrin	Pesticides	0.0023	µg/L	WAC 173-201A
Endrin Aldehyde	Pesticides	0.29	µg/L	Human Health for the Consumption of Water + Organism
Gamma-BHC (Lindane)	Pesticides	0.045	µg/L	WAC 173-340-730(3)(b)(iii)(A) and (B)
Heptachlor	Pesticides	7.90E-05	µg/L	Human Health for the Consumption of Water + Organism
Heptachlor Epoxide	Pesticides	3.90E-05	µg/L	Human Health for the Consumption of Water + Organism
Methoxychlor	Pesticides	0.030	µg/L	Freshwater CCC
Methyl Parathion	Pesticides	4.0	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Phorate	Pesticides	3.2	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Toxaphene	Pesticides	2.00E-04	µg/L	Freshwater CCC/ WAC 173-201A
Americium-241	Radiochemistry	15	pCi/L	40 CFR 141.66
Antimony-125	Radiochemistry	300	pCi/L	40 CFR 141.66
Beryllium-7	Radiochemistry	--	--	--
Carbon-14	Radiochemistry	2,000	pCi/L	40 CFR 141.66
Cesium-134	Radiochemistry	80	pCi/L	40 CFR 141.66
Cesium-137	Radiochemistry	200	pCi/L	40 CFR 141.66
Cobalt-60	Radiochemistry	100	pCi/L	40 CFR 141.66
Europium-152	Radiochemistry	200	pCi/L	40 CFR 141.66

Table 1-3. List of Target Constituents and Action Levels for the 200-BP-5 Groundwater Operable Unit

Analyte Name	Analyte Class	Action Level	Units	Action Level Basis
Europium-154	Radiochemistry	60	pCi/L	40 CFR 141.66
Europium-155	Radiochemistry	600	pCi/L	40 CFR 141.66
Gross Alpha	Radiochemistry	15	pCi/L	40 CFR 141.66
Gross Beta	Radiochemistry	--	--	--
Iodine-129	Radiochemistry	1.0	pCi/L	40 CFR 141.66
Neptunium-237	Radiochemistry	15	pCi/L	40 CFR 141.66
Nickel-63	Radiochemistry	50	pCi/L	40 CFR 141.66
Plutonium-238	Radiochemistry	15	pCi/L	40 CFR 141.66
Plutonium-239/240	Radiochemistry	15	pCi/L	40 CFR 141.66
Potassium-40	Radiochemistry	--	--	--
Protactinium-231	Radiochemistry	15	pCi/L	40 CFR 141.66
Ruthenium-106	Radiochemistry	30	pCi/L	40 CFR 141.66
Selenium-79	Radiochemistry	--	--	--
Strontium-90	Radiochemistry	8.0	pCi/L	40 CFR 141.66
Technetium-99	Radiochemistry	900	pCi/L	40 CFR 141.66
Thorium-228	Radiochemistry	15	pCi/L	40 CFR 141.66
Thorium-230	Radiochemistry	15	pCi/L	40 CFR 141.66
Thorium-232	Radiochemistry	15	pCi/L	40 CFR 141.66
Tritium	Radiochemistry	20,000	pCi/L	40 CFR 141.66
Uranium-233/234	Radiochemistry	--	--	--
Uranium-234	Radiochemistry	--	--	--
Uranium-235	Radiochemistry	--	--	--
Uranium-238	Radiochemistry	--	--	--
1,2,4,5-Tetrachlorobenzene	SVOC	0.28	µg/L	WAC 173-340-730(3)(b)(iii)(A) and (B)
1,2,4-Trichlorobenzene	SVOC	1.5	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
1,2-Propanediol	SVOC	160,000	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)

Table 1-3. List of Target Constituents and Action Levels for the 200-BP-5 Groundwater Operable Unit

Analyte Name	Analyte Class	Action Level	Units	Action Level Basis
1,3-Isobenzofurandione	SVOC	32,000	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
1,4-Dichlorobenzene	SVOC	8.1	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
1,4-Naphthoquinone	SVOC	--	--	--
11-Bromoundecanoic Acid	SVOC	--	--	--
1-Heptanol	SVOC	--	--	--
1-Hexanol	SVOC	--	--	--
1-Methyl-2-pyrrolidinone	SVOC	--	--	--
1-Naphthylamine	SVOC	--	--	--
1-Penten-3-ol, 2-methyl	SVOC	--	--	--
2,3,4,6-Tetrachlorophenol	SVOC	480	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
2,4,5-Trichlorophenol	SVOC	486	µg/L	WAC 173-340-730(3)(b)(iii)(A) and (B)
2,4,6-Trichlorophenol	SVOC	1.4	µg/L	Human Health for the Consumption of Water + Organism
2,4-Dichlorophenol	SVOC	24	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
2,4-Dimethylphenol	SVOC	160	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
2,4-Dinitrophenol	SVOC	32	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
2,4-Dinitrotoluene	SVOC	0.11	µg/L	Human Health for the Consumption of Water + Organism
2,6-Dichlorophenol	SVOC	--	--	--
2,6-Dinitrotoluene	SVOC	16	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
2-Acetylaminofluorene	SVOC	0.023	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)

Table 1-3. List of Target Constituents and Action Levels for the 200-BP-5 Groundwater Operable Unit

Analyte Name	Analyte Class	Action Level	Units	Action Level Basis
2-Butoxyethanol	SVOC	4,000	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
2-Chloronaphthalene	SVOC	640	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
2-Chlorophenol	SVOC	40	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
2-Ethyl-1-hexanol	SVOC	--	--	--
2-Ethylhexanoic Acid	SVOC	--	--	--
2-Fluoro-5-nitropyrimidine	SVOC	--	--	--
2-Methylnaphthalene	SVOC	32	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
2-Methylphenol (cresol, *o*-)	SVOC	400	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
2-Naphthylamine	SVOC	0.049	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
2-Nitroaniline	SVOC	160	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
2-Nitrophenol	SVOC	--	--	--
3,3'-Dichlorobenzidine	SVOC	0.021	µg/L	Human Health for the Consumption of Water + Organism
3,3'-Dimethylbenzidine	SVOC	0.0080	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
3+4 Methylphenol (cresol, *m*+*p*)	SVOC	--	--	--
3-Chloro-3-methyl-1-butene	SVOC	--	--	--
3-Methylcholanthrene	SVOC	3.68E-05	µg/L	WAC 173-340-730(3)(b)(iii)(A) and (B)
3-Nitroaniline	SVOC	4.2	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
4,6-Dinitro-2-methylphenol	SVOC	1.6	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
4-Aminobiphenyl	SVOC	0.0042	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
4-Bromophenylphenyl Ether	SVOC	--	--	--

Table 1-3. List of Target Constituents and Action Levels for the 200-BP-5 Groundwater Operable Unit

Analyte Name	Analyte Class	Action Level	Units	Action Level Basis
4-Chloro-3-methylphenol	SVOC	1,600	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
4-Chloroaniline	SVOC	0.22	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
4-Chlorophenylphenyl Ether	SVOC	--	--	--
4-Fluoroaniline	SVOC	--	--	--
4-Hexen-3-ol	SVOC	--	--	--
4-Methylphenol (cresol, *p*-)	SVOC	40	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
4-Nitroaniline	SVOC	4.4	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
4-Nitrophenol	SVOC	128	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
4-Nitroquinoline-1-oxide	SVOC	--	--	--
5-Nitro-*o*-toluidine	SVOC	2.7	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
7,12-Dimethylbenz[a]anthracene	SVOC	8.31E-06	µg/L	WAC 173-340-730(3)(b)(iii)(A) and (B)
Acenaphthene	SVOC	643	µg/L	WAC 173-340-730(3)(b)(iii)(A) and (B)
Acenaphthylene	SVOC	--	--	--
Acetophenone	SVOC	800	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
alpha,alpha-Dimethylphenethylamine	SVOC	--	--	--
Aniline	SVOC	7.7	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Anthracene	SVOC	4,800	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Aramite	SVOC	0.37	µg/L	WAC 173-340-730(3)(b)(iii)(A) and (B)
Azobenzene	SVOC	0.80	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Benzo(a)anthracene	SVOC	0.0038	µg/L	Human Health for the Consumption of Water + Organism

Table 1-3. List of Target Constituents and Action Levels for the 200-BP-5 Groundwater Operable Unit

Analyte Name	Analyte Class	Action Level	Units	Action Level Basis
Benzo(a)pyrene	SVOC	0.0038	µg/L	Human Health for the Consumption of Water + Organism
Benzo(b)fluoranthene	SVOC	0.0038	µg/L	Human Health for the Consumption of Water + Organism
Benzo(ghi)perylene	SVOC	--	--	--
Benzo(k)fluoranthene	SVOC	0.0038	µg/L	Human Health for the Consumption of Water + Organism
Benzoic Acid	SVOC	64,000	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Benzothiazole	SVOC	--	--	--
Benzyl Alcohol	SVOC	800	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Bis(2-chloro-1-methylethyl)ether	SVOC	0.63	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Bis(2-Chloroethoxy)methane	SVOC	48	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Bis(2-chloroethyl)ether	SVOC	0.030	µg/L	Human Health for the Consumption of Water + Organism
Bis(2-ethylhexyl)phthalate	SVOC	1.2	µg/L	Human Health for the Consumption of Water + Organism
Bisphenol A	SVOC	800	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Butylbenzylphthalate	SVOC	8.2	µg/L	WAC 173-340-730(3)(b)(iii)(A) and (B)
Carbazole	SVOC	1.9	µg/L	WAC 173-340-730(3)(b)(iii)(A) and (B)
Chlorobenzilate	SVOC	0.12	µg/L	WAC 173-340-730(3)(b)(iii)(A) and (B)
Chrysene	SVOC	0.0038	µg/L	Human Health for the Consumption of Water + Organism

Table 1-3. List of Target Constituents and Action Levels for the 200-BP-5 Groundwater Operable Unit

Analyte Name	Analyte Class	Action Level	Units	Action Level Basis
Diallate	SVOC	0.25	µg/L	WAC 173-340-730(3)(b)(iii)(A) and (B)
Dibenz[a,h]anthracene	SVOC	0.0038	µg/L	Human Health for the Consumption of Water + Organism
Dibenzofuran	SVOC	1.7	µg/L	WAC 173-340-730(3)(b)(iii)(A) and (B)
Diethylphthalate	SVOC	12,800	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Dimethoate	SVOC	3.2	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Dimethyl Phthalate	SVOC	270,000	µg/L	Human Health for the Consumption of Water + Organism
Di-n-butylphthalate	SVOC	1,600	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Di-n-octylphthalate	SVOC	--	--	--
Ethylmethanesulfonate	SVOC	--	--	--
Famphur	SVOC	--	--	--
Fluoranthene	SVOC	90	µg/L	WAC 173-340-730(3)(b)(iii)(A) and (B)
Fluorene	SVOC	640	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Hexachlorobenzene	SVOC	2.80E-04	µg/L	Human Health for the Consumption of Water + Organism
Hexachlorobutadiene	SVOC	0.44	µg/L	Human Health for the Consumption of Water + Organism
Hexachlorocyclopentadiene	SVOC	40	µg/L	Human Health for the Consumption of Water + Organism
Hexachloroethane	SVOC	1.4	µg/L	Human Health for the Consumption of Water + Organism
Hexachlorophene	SVOC	4.8	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)

Table 1-3. List of Target Constituents and Action Levels for the 200-BP-5 Groundwater Operable Unit

Analyte Name	Analyte Class	Action Level	Units	Action Level Basis
Hexachloropropene	SVOC	--	--	--
Indeno(1,2,3-cd)pyrene	SVOC	0.0038	µg/L	Human Health for the Consumption of Water + Organism
Isodrin	SVOC	--	--	--
Isosafrole	SVOC	--	--	--
Kepone	SVOC	4.18E-04	µg/L	WAC 173-340-730(3)(b)(iii)(A) and (B)
m-Dinitrobenzene	SVOC	1.6	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Methapyrilene	SVOC	--	--	--
Methyl Methanesulfonate	SVOC	0.88	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Naphthalene	SVOC	160	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Nitrobenzene	SVOC	16	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Nitrosopyrrolidine	SVOC	0.016	µg/L	Human Health for the Consumption of Water + Organism
n-Nitrosodiethylamine	SVOC	2.92E-04	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
n-Nitrosodimethylamine	SVOC	6.90E-04	µg/L	Human Health for the Consumption of Water + Organism
n-Nitrosodi-n-butylamine	SVOC	0.0063	µg/L	Human Health for the Consumption of Water + Organism
n-Nitrosodi-n-dipropylamine	SVOC	0.0050	µg/L	Human Health for the Consumption of Water + Organism
n-Nitrosodiphenylamine	SVOC	3.3	µg/L	Human Health for the Consumption of Water + Organism
n-Nitrosomethylethylamine	SVOC	0.0040	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)

Table 1-3. List of Target Constituents and Action Levels for the 200-BP-5 Groundwater Operable Unit

Analyte Name	Analyte Class	Action Level	Units	Action Level Basis
n-Nitrosomorpholine	SVOC	0.013	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
n-Nitrosopiperidine	SVOC	0.0093	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
O,*O*,*O*-Triethylphosphorothioate	SVOC	--	--	--
O,*O*-Diethyl *O*-2-pyrazinyl phosphorothioate	SVOC	--	--	--
o-Toluidine	SVOC	--	--	--
Parathion	SVOC	0.013	µg/L	Freshwater CCC/ WAC 173-201A
p-Dimethylaminoazobenzene	SVOC	0.019	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Pentachlorobenzene	SVOC	1.4	µg/L	Human Health for the Consumption of Water + Organism
Pentachloronitrobenzene	SVOC	0.046	µg/L	WAC 173-340-730(3)(b)(iii)(A) and (B)
Pentachlorophenol	SVOC	0.27	µg/L	Human Health for the Consumption of Water + Organism
Phenacetin	SVOC	40	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Phenanthrene	SVOC	--	--	--
Phenol	SVOC	2,400	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
p-Phenylenediamine	SVOC	3,040	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Pronamide	SVOC	1,200	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Pyrene	SVOC	480	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Ricinoleic Acid	SVOC	--	--	--
Safrol	SVOC	0.34	µg/L	WAC 173-340-730(3)(b)(iii)(A) and (B)
Sebacic Acid	SVOC	--	--	--

Table 1-3. List of Target Constituents and Action Levels for the 200-BP-5 Groundwater Operable Unit

Analyte Name	Analyte Class	Action Level	Units	Action Level Basis
sym-Trinitrobenzene	SVOC	480	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Tetradecanoic Acid	SVOC	--	--	--
Tetraethyl Dithiopyrophosphate (Sulfotepp)	SVOC	6.5	µg/L	WAC 173-340-730(3)(b)(iii)(A) and (B)
Total Cresols	SVOC	1,600	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Total Petroleum Hydrocarbons – Kerosene Range	SVOC	500	µg/L	WAC 173-340-900, Table 720-1
Tributyl Phosphate	SVOC	9.5	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Tris-2-chloroethylphosphate	SVOC	4.4	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Total Petroleum Hydrocarbons – Diesel Range	TPH	500	µg/L	WAC 173-340-900, Table 720-1
Total Petroleum Hydrocarbons – Gasoline Range	TPH	1,000	µg/L	WAC 173-340-900, Table 720-1
1,1,1,2-Tetrachloroethane	VOC	1.7	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
1,1,1-Trichloroethane	VOC	200	µg/L	40 CFR 141.61
1,1,2,2-Tetrachloroethane	VOC	0.17	µg/L	Human Health for the Consumption of Water + Organism
1,1,2-Trichloroethane	VOC	0.59	µg/L	Human Health for the Consumption of Water + Organism
1,1-Dichloroethane	VOC	1,600	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
1,1-Dichloroethene	VOC	7.0	µg/L	40 CFR 141.61
1,2,3-Trichloropropane	VOC	0.0015	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
1,2-Dibromo-3-chloropropane	VOC	0.055	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
1,2-Dibromoethane	VOC	0.022	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)

Table 1-3. List of Target Constituents and Action Levels for the 200-BP-5 Groundwater Operable Unit

Analyte Name	Analyte Class	Action Level	Units	Action Level Basis
1,2-Dichlorobenzene	VOC	420	µg/L	Human Health for the Consumption of Water + Organism
1,2-Dichloroethane	VOC	0.38	µg/L	Human Health for the Consumption of Water + Organism
1,2-Dichloroethene (Total)	VOC	72	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
1,2-Dichloropropane	VOC	0.50	µg/L	Human Health for the Consumption of Water + Organism
1,3-Dichlorobenzene	VOC	320	µg/L	Human Health for the Consumption of Water + Organism
1,4-Dioxane	VOC	4.0	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
1-Butanol	VOC	800	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
2-Butanone	VOC	4,800	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
2-Hexanone	VOC	80	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
2-Pentanone, 4-Methyl	VOC	640	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
2-Picoline	VOC	--	--	--
Acetone	VOC	7,200	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Acetonitrile	VOC	--	--	--
Acrolein	VOC	3.0	µg/L	Freshwater CCC
Allyl Chloride	VOC	2.1	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Benzene	VOC	0.80	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Bromodichloromethane	VOC	0.55	µg/L	Human Health for the Consumption of Water + Organism

Table 1-3. List of Target Constituents and Action Levels for the 200-BP-5 Groundwater Operable Unit

Analyte Name	Analyte Class	Action Level	Units	Action Level Basis
Bromoform	VOC	4.3	µg/L	Human Health for the Consumption of Water + Organism
Bromomethane	VOC	11	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Carbon Disulfide	VOC	800	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Carbon Tetrachloride	VOC	0.23	µg/L	Human Health for the Consumption of Water + Organism
Chlorobenzene	VOC	100	µg/L	40 CFR 141.61
Chloroethane	VOC	--	--	--
Chloroform	VOC	1.4	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Chloromethane	VOC	--	--	--
Chloroprene	VOC	160	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
cis-1,2-Dichloroethylene	VOC	70	µg/L	40 CFR 141.61
cis-1,3-Dichloropropene	VOC	0.34	µg/L	Human Health for the Consumption of Water + Organism
Dibromochloromethane	VOC	0.40	µg/L	Human Health for the Consumption of Water + Organism
Dibromomethane	VOC	80	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Dichlorodifluoromethane	VOC	1,600	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Diethyl Ether	VOC	1,600	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Ethyl Cyanide	VOC	--	--	--
Ethyl Methacrylate	VOC	720	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Ethylbenzene	VOC	4.0	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)

Table 1-3. List of Target Constituents and Action Levels for the 200-BP-5 Groundwater Operable Unit

Analyte Name	Analyte Class	Action Level	Units	Action Level Basis
Ethylene Glycol	VOC	16,000	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Hexane	VOC	480	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Iodomethane	VOC	--	--	--
Isobutyl Alcohol	VOC	2,400	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Isophorone	VOC	35	µg/L	Human Health for the Consumption of Water + Organism
Methacrylonitrile	VOC	0.80	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Methyl Methacrylate	VOC	11,200	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Methylene Chloride	VOC	4.6	µg/L	Human Health for the Consumption of Water + Organism
n-Butylbenzene	VOC	--	--	--
Pentachloroethane	VOC	0.97	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Pyridine	VOC	8.0	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Styrene	VOC	100	µg/L	40 CFR 141.61
Tetrachloroethene	VOC	0.081	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Tetrahydrofuran	VOC	--	--	--
Toluene	VOC	640	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
trans-1,2-Dichloroethylene	VOC	100	µg/L	40 CFR 141.61
trans-1,3-Dichloropropene	VOC	0.34	µg/L	Human Health for the Consumption of Water + Organism
trans-1,4-Dichloro-2-butene	VOC	--	--	--
Trichloroethene	VOC	0.49	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)

Table 1-3. List of Target Constituents and Action Levels for the 200-BP-5 Groundwater Operable Unit

Analyte Name	Analyte Class	Action Level	Units	Action Level Basis
Trichloromonofluoromethane	VOC	2,400	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Vinyl Acetate	VOC	8,000	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Vinyl Chloride	VOC	0.025	µg/L	Human Health for the Consumption of Water + Organism
Xylenes (Total)	VOC	1,600	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Alkalinity	Physical Properties	--	--	--
Ammonia	Wet Chemistry	--	--	--
Bromide	Wet Chemistry	--	--	--
Coliform Bacteria	Biological	--	--	--
Dissolved Oxygen	Physical Properties	--	--	--
Oxidation-Reduction Potential	Physical Properties	--	--	--
pH Measurement	Physical Properties	--	--	--
Specific Conductance	Physical Properties	--	--	--
Temperature	Physical Properties	--	--	--
Total Dissolved Solids	Physical Properties	--	--	--
Total Organic Carbon	General Organics	--	--	--
Total Organic Halides	General Organics	--	--	--
Turbidity	Physical Properties	--	--	--
Ammonium Ion	Wet Chemistry	--	--	--
Chloride	Wet Chemistry	230,000	µg/L	Freshwater CCC/ WAC 173-201A

Table 1-3. List of Target Constituents and Action Levels for the 200-BP-5 Groundwater Operable Unit

Analyte Name	Analyte Class	Action Level	Units	Action Level Basis
Cyanide	Wet Chemistry	5.2	µg/L	Freshwater CCC/ WAC 173-201A
Fluoride	Wet Chemistry	480	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Nitrate	Wet Chemistry	25,600	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Nitrite	Wet Chemistry	1,600	µg/L	WAC 173-340-720(4)(b)(iii)(A) and (B)
Nitrogen in Nitrite and Nitrate	Wet Chemistry	10,000	µg/L	40 CFR 141.62
Phosphate	Wet Chemistry	--	--	--
Sulfate	Wet Chemistry	250,000	µg/L	WAC 246-290-310

Sources:

40 CFR 141.61, "National Primary Drinking Water Regulations," "Maximum Contaminant Levels for Organic Contaminants."

40 CFR 141.62, "Maximum Contaminant Levels for Inorganic Contaminants."

40 CFR 141.66, "Maximum Contaminant Levels for Radionuclides."

40 CFR 143.3, "National Secondary Drinking Water Regulations," "Secondary Maximum Contaminant Levels."

WAC 173-201A, "Water Quality Standards for Surface Waters of the State of Washington."

WAC 173-340-720, "Model Toxics Control Act—Cleanup," "Ground Water Cleanup Standards."

WAC 173-340-730, "Surface Water Cleanup Standards."

WAC 173-340-900, "Tables."

WAC 246-290-310, "Group A Public Water Supplies," "Maximum Contaminant Levels (MCLs) and Maximum Residual Disinfectant Levels (MRDLs)."

Note: Shading denotes those analytes that were identified as COPCs in DOE/RL-2007-18, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-5 Groundwater Operable Unit*, Appendix A.

1.5 Sample Results

Table 1-4 provides a listing of sample results generated. The data are presented by well number and by analyte class and represent the full data set of nearly 100,000 results. The analytes classes shown include the following:

- Biological (e.g., coliform bacteria)
- General organics (e.g., total organic halides)
- Dioxins/furans (e.g., heptachlorodibenzofuran)
- Herbicides (e.g., dalapon and dicamba)
- Metals (e.g., arsenic and barium)
- Pesticides/polychlorinated biphenyls (e.g., aroclors)
- Physical properties (e.g., pH and specific conductance)

- Radiochemistry (e.g., plutonium-238 and technetium-99)
- Semivolatile organics (e.g., pentachlorophenol)
- Volatile organics (e.g., chloroform, methylene chloride)
- Wet chemistry (e.g., ammonia, chloride, and fluoride)

Table 1-4. Sample Results by Well and Analyte Class

Well	Biological	General Organics	Herbicides	Metals	Pesticides and Polychlorinated Biphenyls	Physical Properties	Radiochemistry	Semivolatile Organics	Volatile Organics	Wet Chemistry	Total By Well
199-K-31	--	--	--	306	--	37	75	--	39	50	**507**
299-E24-8	--	--	--	1	--	5	14	--	--	6	**26**
299-E26-10	--	40	--	165	--	84	53	106	182	54	**684**
299-E26-11	--	40	--	130	--	95	48	106	182	45	**646**
299-E26-77	--	20	--	48	--	44	26	31	26	21	**216**
299-E26-79	--	22	--	50	--	46	26	31	26	26	**227**
299-E26-8	--	--	--	72	--	15	12	--	--	21	**120**
299-E27-10	4	97	--	361	49	150	47	348	116	89	**1,261**
299-E27-11	--	80	--	334	42	168	53	85	--	89	**851**
299-E27-12	--	88	--	612	--	228	281	85	--	156	**1,450**
299-E27-13	--	86	--	539	--	244	254	85	--	142	**1,350**
299-E27-14	4	88	--	630	--	236	304	85	--	174	**1,521**
299-E27-15	--	85	--	539	--	244	254	85	--	160	**1,367**
299-E27-155	--	--	--	542	--	42	334	532	378	125	**1,953**
299-E27-16	--	84	--	109	--	164	19	68	--	41	**485**
299-E27-17	--	80	--	301	42	167	51	85	--	86	**812**
299-E27-18	--	72	--	148	--	140	22	85	--	43	**510**
299-E27-19	--	87	--	109	--	176	17	68	--	41	**498**

Table 1-4. Sample Results by Well and Analyte Class

Well	Biological	General Organics	Herbicides	Metals	Pesticides and Polychlorinated Biphenyls	Physical Properties	Radiochemistry	Semivolatile Organics	Volatile Organics	Wet Chemistry	Total By Well
299-E27-21	--	80	--	502	--	226	242	85	--	137	**1,272**
299-E27-22	4	80	--	575	--	232	267	85	--	153	**1,396**
299-E27-23	--	80	--	559	--	226	267	85	--	149	**1,366**
299-E27-4	--	80	--	557	--	224	254	85	--	142	**1,342**
299-E27-7	4	88	--	658	--	234	302	102	--	184	**1,572**
299-E27-8	--	80	--	380	56	155	61	102	--	97	**931**
299-E27-9	--	88	--	316	42	175	58	85	--	81	**845**
299-E28-13	--	--	--	74	--	13	11	--	--	19	**117**
299-E28-17	--	--	--	94	--	20	71	---	--	29	**214**
299-E28-18	--	--	--	46	--	24	29	--	--	35	**134**
299-E28-2	--	--	--	145	--	29	105	--	--	41	**320**
299-E28-21	--	--	--	39	--	20	2	--	--	7	**68**
299-E28-23	--	--	--	9	--	23	171	--	--	15	**218**
299-E28-24	--	--	--	5	--	25	98	--	--	10	**138**
299-E28-25	--	--	--	10	--	24	102	--	--	29	**165**
299-E28-26	--	84	--	280	--	162	37	85	--	91	**739**
299-E28-27	--	80	--	255	--	164	123	85	--	88	**795**
299-E28-28	--	80	--	313	--	162	41	85	--	91	**772**

Table 1-4. Sample Results by Well and Analyte Class

Well	Biological	General Organics	Herbicides	Metals	Pesticides and Polychlorinated Biphenyls	Physical Properties	Radiochemistry	Semivolatile Organics	Volatile Organics	Wet Chemistry	Total By Well
299-E28-5	--	--	--	134	--	27	89	--	--	33	**283**
299-E28-6	--	--	--	97	--	22	80	--	--	26	**225**
299-E28-7	--	--	--	1	--	4	11	--	--	5	**21**
299-E28-8	--	--	--	574	--	80	168	--	--	152	**974**
299-E32-10	--	95	--	378	--	176	126	119	--	115	**1,009**
299-E32-2	--	80	--	276	--	157	48	85	--	88	**734**
299-E32-3	--	79	--	276	--	157	50	85	--	92	**739**
299-E32-4	--	92	--	297	--	192	57	85	--	105	**828**
299-E32-5	--	96	--	349	--	233	59	85	--	120	**942**
299-E32-6	--	96	--	277	--	182	49	85	--	95	**784**
299-E32-7	--	80	--	316	--	163	78	102	--	110	**849**
299-E32-8	--	80	--	276	--	165	49	85	--	92	**747**
299-E32-9	--	79	--	276	--	163	52	85	--	89	**744**
299-E33-12	--	--	--	56	--	14	31	--	--	16	**117**
299-E33-13	--	--	--	443	--	69	221	--	--	125	**858**
299-E33-14	--	--	--	442	--	72	215	--	--	119	**848**
299-E33-15	--	--	--	460	--	60	236	--	--	121	**877**
299-E33-16	--	--	--	683	--	80	345	--	--	184	**1,292**

Table 1-4. Sample Results by Well and Analyte Class

Well	Biological	General Organics	Herbicides	Metals	Pesticides and Polychlorinated Biphenyls	Physical Properties	Radiochemistry	Semivolatile Organics	Volatile Organics	Wet Chemistry	Total By Well
299-E33-17	--	--	--	350	--	48	120	--	--	86	**604**
299-E33-18	--	--	--	555	--	76	225	--	--	150	**1,006**
299-E33-1A	--	4	--	477	--	84	254	--	--	127	**946**
299-E33-2	--	4	--	459	--	82	248	--	--	116	**909**
299-E33-20	--	1	--	386	--	64	156	--	--	113	**720**
299-E33-205	--	6	--	193	--	13	110	249	165	65	**801**
299-E33-21	--	--	--	294	--	40	38	--	--	71	**443**
299-E33-25	--	--	--	37	--	4	14	--	--	8	**63**
299-E33-26	--	--	--	481	--	74	237	--	--	138	**930**
299-E33-28	--	88	--	276	--	156	38	85	--	90	**733**
299-E33-29	--	88	--	275	--	173	39	85	--	92	**752**
299-E33-3	--	4	--	498	--	88	251	--	--	129	**970**
299-E33-30	--	79	--	275	--	161	39	85	--	93	**732**
299-E33-31	--	8	--	517	--	97	280	--	--	145	**1,047**
299-E33-32	--	8	--	535	--	103	262	--	--	148	**1,056**
299-E33-33	--	76	--	226	--	160	53	51	--	80	**646**
299-E33-334	--	8	--	499	--	98	74	--	--	146	**825**
299-E33-335	--	8	--	572	--	101	88	--	--	160	**929**

Table 1-4. Sample Results by Well and Analyte Class

Well	Biological	General Organics	Herbicides	Metals	Pesticides and Polychlorinated Biphenyls	Physical Properties	Radiochemistry	Semivolatile Organics	Volatile Organics	Wet Chemistry	Total By Well
299-E33-337	--	8	--	535	--	96	106	--	--	147	**892**
299-E33-338	--	8	--	516	--	98	72	--	--	143	**837**
299-E33-339	--	8	--	553	--	102	98	--	--	150	**911**
299-E33-34	--	96	--	374	--	194	131	119	--	116	**1,030**
299-E33-340	--	--	--	263	--	16	165	347	252	60	**1,103**
299-E33-341	--	4	--	403	--	24	208	277	258	67	**1,241**
299-E33-342	--	2	--	271	--	25	138	167	167	46	**816**
299-E33-343	--	2	--	338	--	36	162	184	193	70	**985**
299-E33-344	--	--	--	311	--	26	121	96	167	50	**771**
299-E33-345	--	--	--	345	--	34	168	148	182	60	**937**
299-E33-35	--	80	--	294	--	153	72	85	--	105	**789**
299-E33-36	--	84	--	220	--	166	36	85	--	63	**654**
299-E33-37	--	84	--	183	--	167	33	68	--	70	**605**
299-E33-38	--	8	--	660	--	104	341	--	--	173	**1,286**
299-E33-39	--	8	--	517	--	99	117	--	--	151	**892**
299-E33-4	--	--	--	202	--	32	128	--	--	64	**426**
299-E33-40	--	--	--	167	--	24	74	--	--	40	**305**
299-E33-41	--	8	--	535	--	95	269	--	--	147	**1,054**

Table 1-4. Sample Results by Well and Analyte Class

Well	Biological	General Organics	Herbicides	Metals	Pesticides and Polychlorinated Biphenyls	Physical Properties	Radiochemistry	Semivolatile Organics	Volatile Organics	Wet Chemistry	Total By Well
299-E33-42	--	8	--	498	--	97	255	--	--	136	**994**
299-E33-43	--	8	--	571	--	95	131	--	--	141	**946**
299-E33-44	--	8	--	537	--	112	279	--	--	163	**1,099**
299-E33-47	--	8	--	573	--	91	81	--	--	159	**912**
299-E33-48	--	8	--	627	--	102	95	--	--	160	**992**
299-E33-49	--	8	--	590	--	112	75	--	--	153	**938**
299-E33-5	--	--	--	148	--	16	56	--	--	29	**249**
299-E33-50	--	--	--	308	--	32	199	357	295	61	**1,252**
299-E33-7	--	--	--	666	--	86	326	--	--	173	**1,251**
299-E33-9	--	4	--	238	--	53	128	--	--	72	**495**
299-E34-10	--	95	--	319	49	194	59	102	--	92	**910**
299-E34-12	--	80	--	298	42	174	41	85	--	88	**808**
299-E34-2	--	80	--	318	49	180	45	102	--	95	**869**
299-E34-5	--	2	--	21	7	4	6	--	--	6	**46**
299-E34-7	25	19	10	21	26	36	6	140	55	12	**350**
299-E34-8	--	64	--	184	--	128	24	51	--	50	**501**
299-E34-9	--	81	--	357	49	138	65	102	--	91	**883**
699-42-40A	--	--	--	57	--	5	9	--	--	10	**81**

Table 1-4. Sample Results by Well and Analyte Class

Well	Biological	General Organics	Herbicides	Metals	Pesticides and Polychlorinated Biphenyls	Physical Properties	Radiochemistry	Semivolatile Organics	Volatile Organics	Wet Chemistry	Total By Well
699-42-40C	--	--	--	97	19	13	20	17	59	20	**245**
699-42-42B	--	80	--	243	--	166	23	85	--	44	**641**
699-43-44	--	83	--	188	--	163	19	85	--	34	**572**
699-43-45	--	112	--	446	--	231	38	170	--	93	**1,090**
699-44-39B	--	80	--	245	--	169	25	85	--	53	**657**
699-45-42	--	--	--		--	10	4	--	--	12	**26**
699-47-60	--	--	--	182	--	35	31	--	78	45	**371**
699-48-50B	--	--	--	285	--	28	185	229	196	57	**980**
699-49-55A	--	--	--	2	--	12	91	--	--	30	**135**
699-49-55B	--	--	--	56	--	10	29	--	--	16	**111**
699-49-57A	--	--	--	121	--	36	111	--	--	64	**332**
699-49-57B	--	--	--	57	--	25	70	--	--	38	**190**
699-50-28B	--	--	--	--	--	4	2	--	--	5	**11**
699-50-53B	--	--	--	72	--	15	15	--	--	21	**123**
699-50-56	--	--	--	272	--	36	169	145	137	60	**819**
699-50-59	--	--	--	219	--	42	132	--	--	65	**458**
699-52-19	--	--	--	--	--	4	1	--	--	5	**10**
699-52-46A	--	--	--	18	--	5	4	--	--	7	**34**

Table 1-4. Sample Results by Well and Analyte Class

Well	Biological	General Organics	Herbicides	Metals	Pesticides and Polychlorinated Biphenyls	Physical Properties	Radiochemistry	Semivolatile Organics	Volatile Organics	Wet Chemistry	Total By Well
699-52-55	--	--	--	25	--	4	21	21	26	7	**104**
699-52-55B	--	8	--	334	--	24	177	368	252	69	**1,232**
699-53-47A	--	--	--	72	--	25	24	--	--	37	**158**
699-53-47B	--	--	--	--	--	8	3	--	--	10	**21**
699-53-48A	--	--	--	129	--	25	25	--	--	32	**211**
699-53-55A	--	--	--	37	--	24	63	--	--	35	**159**
699-53-55B	--	---	--	36	--	24	76	--	--	42	**178**
699-53-55C	--	--	--	38	--	25	67	--	--	37	**167**
699-54-34	--	--	--	18	--	4	3	--	--	7	**32**
699-54-45A	--	--	--	--	--	8	2	--	--	11	**21**
699-54-45B	--	--	--	--	--	4		--	--	5	**9**
699-54-48	--	--	--	--	--	4	1	--	--	--	**5**
699-54-49	--	--	--	72	--	25	22	--	--	42	**161**
699-55-50C	--	--	--	36	--	20	20	--	--	26	**102**
699-55-57	--	--	--	37	--	25	81	--	--	43	**186**
699-55-60A	--	--	--	111	--	33	73	--	78	41	**336**
699-56-43	--	--	--	90	--	15	11	--	--	26	**142**
699-56-53	--	--	--	18	--	5	3	--	--	7	**33**

Table 1-4. Sample Results by Well and Analyte Class

Well	Biological	General Organics	Herbicides	Metals	Pesticides and Polychlorinated Biphenyls	Physical Properties	Radiochemistry	Semivolatile Organics	Volatile Organics	Wet Chemistry	Total By Well
699-57-59	--	8	--	130	--	25	87	--	--	40	**290**
699-59-58	--	10	--	149	--	25	106	--	--	47	**337**
699-60-60	--	10	--	148	--	25	106	--	--	47	**336**
699-61-62	--	8	--	130	--	25	87	--	--	40	**290**
699-61-66	--	8	--	130	--	25	86	--	--	40	**289**
699-62-43F	--	--	--	145	--	20	5	--	--	30	**200**
699-63-55	--	--	--	73	--	20	5	--	--	18	**116**
699-64-62	--	8	--	167	--	25	101	--	--	47	**348**
699-65-50	--	--	--	--	--	4	1	--	--	--	**5**
699-65-72	--	--	--	54	--	12	3	--	--	12	**81**
699-66-58	--	--	--	--	--	4	2	--	--	--	**6**
699-66-64	--	--	--	--	--	4	2	--	--	--	**6**
699-67-51	--	--	--	54	--	8	2	--	--	12	**76**
699-70-68	--	--	--	110	--	24	37	--	--	40	**211**
699-72-73	--	--	--	341	--	25	19	--	39	50	**474**
699-73-61	--	--	--	142	--	17	30	--	39	17	**245**
Total	**41**	**4,236**	**10**	**40,676**	**472**	**12,801**	**15,260**	**7,860**	**3,587**	**11,410**	**96,353**

2 Purpose

The 200-BP-5 Groundwater OU DQA addresses a subset of the total data collected to support the 200-BP-5 Groundwater OU RI/FS process, addresses data collected in support of other activities (e.g., risk assessment) that will be used for the RI/FS process, and serves the following purposes:

- Ensures that the data are of sufficient pedigree to provide an appropriate description of 200-BP-5 Groundwater OU conditions
- Specifically assesses the usability of the data set for 200-BP-5 Groundwater OU RI/FS-related activities, including risk assessment and remedial alternative evaluation

3 Scope

The DQA completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the 200-BP-5 Groundwater OU RI/FS DQO process.

The DQA process involves the scientific evaluation of data to determine if the data are of the right type, quality, and quantity to support the intended use. This DQA was performed in accordance with CH2M HILL Plateau Remediation Company (CHPRC) Soil and Groundwater Remediation Project (S&GRP) procedure GRP-EE-01-1.22, *Data Quality Assessment*. The DQA methodology consists of the following steps:

1. **Data Verification** is the process of evaluating the completeness, correctness, conformance and compliance of a specific data set against the requirements developed through the systematic planning process. It includes confirmation that the specified sampling and analytical requirements have been completed. This includes verification that the number, type, and location of all samples identified in the SAP have been collected and that all required measurements and analyses were performed.

2. **Data Validation** is an analyte- and sample-specific process that extends the evaluation of data beyond method, procedural, or contractual compliance (i.e., data verification) to determine the analytical quality of a specific data set. Data validation includes a determination, where possible, of the reasons for any failure to meet method, procedural, or contractual requirements, and an evaluation of the impact of such failure on the overall data set. It includes confirmation that the particular requirements for a specific intended use are fulfilled. This requires understanding of the applicable DQOs associated with the data collection. If no DQO summary report is available, then, typically, all specific requirements are identified in the SAP. This includes review of sampling and laboratory reports to confirm that the appropriate methods, procedures, and contract requirements have been met. Typically, a specified percentage of the project data is subjected to a third party independent validation. The scope of this validation task is specified through the subcontract scope of work. If no independent validation report exists, then the necessary validation components must be included in the scope of the DQA and included in the DQA final report.

3. **Data Usability** is an assessment to determine the adequacy of the data to support a particular environmental decision and is based upon the verification and validation results. The assessment relates to the adequacy of data to support a specific and defined data need. The usability step involves assessing whether the process execution and the resulting data meet project quality objectives.

The DQA procedure is not intended to be a definitive analysis of a project or problem. Instead, it provides an initial assessment of the reasonableness of the data that have been generated through a systematic quality assurance (QA) and QC review process. This DQA focuses on the chemical and radionuclide contaminant monitoring data collected by groundwater sampling at the 200-BP-5 Groundwater OU between November 2004 and November 2009, as well depth discrete sample data collected between November 2006 and May 2010. The monitoring data have been examined to determine if they meet the analytical quality criteria outlined in DOE/RL-2007-18 and to determine if the data are adequate to support decision making.

The five-step DQA process is described in the U.S. Environmental Protection Agency (EPA) guidance document, EPA/240/B-06/002, *Data Quality Assessment: A Reviewer's Guide*, EPA QA/G-9R. Table 3-1 presents a crosswalk between the major sections in this DQA report, the CHPRC S&GRP DQA procedure, and the EPA guidance document. This table shows how the elements of the DQA are consistent with the CHPRC procedure and the EPA guidance.

A total of 163 200-BP-5 Groundwater OU wells were included in this DQA. A list of the 163 wells is included as Table 1-1. Five years of monitoring data, from November 2004 through November 2009, represent the DQA data domain. In addition, depth discrete data are included in this DQA from samples collected between November 2006 and May 2010. The overall data set includes data for 339 unique constituents and other analytical parameters, and nearly 100,000 individual results.

Table 3-1. Data Quality Assessment Crosswalk

DQA Report Section	GRP-EE-01-1.22 Section	EPA/240/B-06/002
4.0, Data Verification	2.2.1, Data Verification	Step 2, Conduct Preliminary Data Review
4.1, Project Objectives	2.2.3, Data Usability	Step 1, Review DQOs and Sampling Design
4.1.3, Analytical Requirements	2.2.3, Data Usability	Step 1, Review DQOs and Sampling Design
4.2, Sample Design	2.2.3, Data Usability	Step 1, Review DQOs and Sampling Design
5.0, Data Validation	2.2.2, Data Validation	Step 2, Conduct Preliminary Data Review
6.0, Data Usability	2.2.3, Data Usability	Step 3, Select Statistical Test Step 4, Verify the Assumptions Step 5, Draw Conclusions from the Data

Sources:

EPA/240/B-06/002, *Data Quality Assessment: A Reviewer's Guide*, EPA QA/G-9R.

GRP-EE-01-1.22, *Data Quality Assessment.*

4 Data Verification

This section describes data verification activities, including identification of project objectives and requirements and evaluating the complete implementation of the identified sampling design.

4.1 Data Quality Objectives

The primary objectives of the DQO process for the 200-BP-5 Groundwater OU were to determine the environmental measurements necessary to refine the conceptual site model describing the groundwater contamination sources, nature and extent of groundwater contamination, and potential exposure scenarios; support the future baseline risk assessment (BRA); and support evaluation of remedial alternatives. The primary question to be resolved was whether the data from the groundwater wells are of sufficient quality to be used in the RI/FS decision making process. Within this larger question are the additional concerns for QC demonstrations, sufficiency of the data, quantity and circumstances of outliers, and data trends. The data set that addresses this question consists of the analytical data for those analytes identified as COPCs in the RI/FS Work Plan (DOE/RL-2007-18, Appendix A) from 163 groundwater wells, as described earlier. The COPCs are provided in Table 1-2. To ensure that these objectives would be met, the DQO process was used to evaluate data needs and develop the sampling design to collect the needed data (WMP-28945). Analytical parameters and associated QC criteria were specified as part of the DQO process. The DQO results were used to develop the SAPs for the 200-BP-5 Groundwater OU RI, which were approved by EPA, the Washington State Department of Ecology, and the U.S. Department of Energy (DOE), Richland Operations Office.

Although the DQA is based on EPA guidelines, actual decision tests for this project are specific to the 200-BP-5 Groundwater OU RI/FS requirements as described in DOE/RL-2007-18. This section of the DQA summarizes the DQOs and the resulting sample design.

4.1.1 Statement of Problem

The DQO process is used to determine whether additional data may be needed to support implementation of the CERCLA RI/FS process for the 200-BP-5 Groundwater OU. If additional data are necessary, the DQO process will identify the sampling requirements, the analyses to be performed, the detection limit requirements, and other analytical performance requirements (e.g., precision and accuracy) for the data to be collected (WMP-28945).

4.1.2 Decision Rules

A key output of the DQO process is a set of decision rules. The decision rules define how the data will be applied to guide and justify key project decisions. This process identifies the analytes identified as COPCs in the RI/FS Work Plan (DOE/RL-2007-18, Appendix A) and the associated action levels, the decisions to be made in the project, the principal questions that must be answered to make those decisions, and the data and analytical requirements needed to answer the questions. Decision rules are generally “IF…THEN” statements, indicating what action will be taken when a prescribed condition is met. Decision rules incorporate the parameters of interest (e.g., COPCs), the scale of the decision (e.g., geographic area), the action level (e.g., COPC concentration), and the consequences that could result from the decision. The decision rules developed in the DQO process for the 200-BP-5 Groundwater OU are given in WMP-28945.

4.1.3 Field Quality Control

Table 4-1 summarizes the applicable field QC requirements found in the RI/FS Work Plan SAP (DOE/RL-2007-18, Appendix A). The number of field QC samples collected was consistent with and, in most cases, exceeds the number required to be collected as described in the RI/FS Work Plan SAP

(DOE/RL-2007-18, Appendix A). The number of field duplicates exceeds the 5 percent frequency, and the number of blanks exceeds the blanks frequency. Further discussion on field QC is provided in Section 5.1.4.

Table 4-1. Field Quality Control Requirements

Sample Type	Frequency	Purpose
Duplicate	5 percent (1 sample in 20)	To check the precision of the laboratory analyses and field sampling.
Equipment Rinsate	One per 10 well trips	To check the effectiveness of the decontamination process. Not applicable when dedicated or disposable equipment is used.
Field Transfer Blank	One per day well trips when volatile organics are samples	To check for contamination during transport.

Source: DOE/RL-2007-18, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-5 Groundwater Operable Unit*.

4.1.4 Uncertainty Limits

Allowable tolerances for analytical and sampling uncertainty were developed during the RI/FS DQO process. Tables 4-2 and 4-3 present the precision and accuracy criteria developed in WMP-28945.

4.2 Implementation of the Sample Design

The 200-BP-5 Groundwater OU data being assessed by this DQA have been collected in accordance with the following documentation:

- DOE/RL-2007-18
- DOE/RL-99-07
- DOE/RL-99-44
- DOE/RL-2001-49
- DOE/RL-2006-55

Because the data were originally collected in accordance with various documents for various purposes, it is not necessary to evaluate the sampling implementation against the requirements of these documents. Rather, the adequacy of the data set in terms of comprehensiveness must be evaluated by the individual data user, based on the unique requirements of the application (e.g., the BRA).

4.2.1 Comparability

In addition to the documents listed in the previous section, data were collected and analyzed in accordance with DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Documents* (HASQARD), and the testing specified and used methods based on the SW-846, *Test Methods for Evaluation Solid Waste: Physical/Chemical Methods, Third Edition; Final Update IV-B*, along with current radiochemical methods. All of these methods have been specified for Hanford Site work for more than 10 years. Therefore, the data should be compatible and comparable over time.

Table 4-2. Groundwater Radiological Analytical Performance Requirements

COPC	CAS Number	Background	Preliminary Groundwater Action Level[a] (pCi/L)	Name/Analytical Technology	Target Required Quantitation Limits Groundwater (pCi/L)	Precision[b] Water (%)	Accuracy[b] Water (%)
Radionuclides							
Americium-241	14596-10-2	N/A	15	Isotopic Americium – AEA	1	≤30	70-130
Cobalt-60	10198-40-0	N/A	100	GEA	25	≤30	70-130
Carbon-14	14762-75-5	N/A	2,000	C-14 – Liquid Scintillation	200	≤30	70-130
Neptunium-237	13994-20-2	N/A	15	Np-237 – AEA	1	≤30	70-130
Plutonium-238	13981-16-3	N/A	15	Isotopic Plutonium – AEA	1	≤30	70-130
Thorium-232	Th-232	N/A	15	Thorium Isotopic – AEA	1	≤30	70-130
Thorium-234	Th-234	N/A	401	Thorium Isotopic – AEA	1	≤30	70-130
Uranium-233/234	U-233/234	N/A	20	Isotopic Uranium – AEA	1	≤30	70-130
Uranium-235	15117-96-1	N/A	20	Isotopic Uranium – AEA	1	≤30	70-130
Uranium-238	U-238	N/A	20	Isotopic Uranium – AEA	1	≤30	70-130

a. The most conservative value from 40 CFR 141, "National Primary Drinking Water Regulations;" 40 CFR 143, "National Secondary Drinking Water Standards;" and WAC 173-340-720(4),"Model Toxics Control Act—Cleanup," "Ground Water Cleanup Standards."

b. Precision and accuracy criteria listed in this table are typically for soil samples; however, the appropriate criteria for water samples were utilized by the laboratories.

Table 4-3. Groundwater Chemical Analytical Performance Requirements

COPC	CAS Number	Preliminary Action Level			Name/Analytical Technology[c]	Target Required Quantitation Limits Water – Low Conc. (µg/L)	Precision[d] Water (Percent)	Accuracy[d] Water (Percent)
		Target Level[a] (µg/L)	Analytical Detection Limits (µg/L)	Background[b] (µg/L)				
Metals								
Aluminum	7429-90-5	50 to 200	50	11.7	EPA Method 6020 EPA Method 200.8	50	≤30[e]	70-130[e]
Antimony	7440-36-0	6	6	69.8	EPA Method 6010 EPA Method 6020 EPA Method 200.8	6	≤30[e]	70-130[e]
Arsenic	7440-38-2	11.8	10	11.8	EPA Method 6020 EPA Method 200.8	10	≤30[e]	70-130[e]
Cadmium	7440-43-9	5	2	1.29	EPA Method 6010 EPA Method 6020 EPA Method 200.8	2	≤30[e]	70-130[e]
Chromium (Total)	7440-47-3	100	2	3.17	EPA Method 6010 EPA Method 6020 EPA Method 200.8	2	≤30[e]	70-130[e]
Chromium (Hexavalent)	18540-29-9	48	10	N/A	Chromium (Hexavalent) – EPA Method 7196	10	≤30[e]	70-130[e]
Iron	7439-89-6	1,104	50	1,104	EPA Method 6010	50	≤30[e]	70-130[e]
Sodium	7440-23-5	250,000	5,000	32,919	EPA Method 6010	5,000	≤30[e]	70-130[e]

Table 4-3. Groundwater Chemical Analytical Performance Requirements

COPC	CAS Number	Preliminary Action Level			Name/Analytical Technology[c]	Target Required Quantitation Limits Water – Low Conc. (µg/L)	Precision[d] Water (Percent)	Accuracy[d] Water (Percent)
		Target Level[a] (µg/L)	Analytical Detection Limits (µg/L)	Background[b] (µg/L)				
Thallium	7440-28-0	1.87	5	1.87	EPA Method 6010 EPA Method 6020 EPA Method 200.8	5	≤30[e]	70-130[e]
Inorganics								
Chloride	16887-00-6	250,000	200	28,500	EPA Method 300.0	200	≤30[e]	70-130[e]
Nitrite	14797-65-0	1	250	130	EPA Method 300.0	250	≤30[e]	70-130[e]
Volatile Organics								
Chloroform	67-66-3	7.17	5	N/A	EPA Method 8260	5	≤30[f]	50-150[f]
Methylene Chloride	75-09-2	5	5	N/A	EPA Method 8260	5	≤30[f]	50-150[f]
Semivolatile Organics								
Bis(2-ethylhexyl)phthalate	117-81-7	6.25	10	N/A	EPA Method 8270	10	≤30[f]	50-150[f]
Pentachlorophenol	108-95-2	0.729	10	N/A	EPA Method 8270	10	≤30[f]	50-150[f]

Table 4-3. Groundwater Chemical Analytical Performance Requirements

COPC	CAS Number	Preliminary Action Level			Name/Analytical Technology[c]	Target Required Quantitation Limits	Precision[d]	Accuracy[d]
		Target Level[a] (µg/L)	Analytical Detection Limits (µg/L)	Background[b] (µg/L)		Water – Low Conc. (µg/L)	Water (Percent)	Water (Percent)

a. The most conservative value from 40 CFR 141, "National Primary Drinking Water Regulations;" 40 CFR 143, "National Secondary Drinking Water Standards;" and WAC 173-340-720(4),"Model Toxics Control Act—Cleanup," "Ground Water Cleanup Standards."

b. Groundwater background concentration provided by DOE/RL-92-23, *Hanford Site Groundwater Background*, or DOE/RL-96-61, *Hanford Site Background: Part 3, Groundwater Background*.

c. For EPA Method 200.8, see EPA/600/R-94/111, *Methods for Determination of Metals in Environmental Samples, Supplement I*. For EPA Methods 300.0, 335, and 353, see EPA/600/4-79/020, *Methods of Chemical Analysis of Water and Wastes*. For four-digit EPA methods, see SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update IV-B*.

d. Precision and accuracy criteria listed in this table are typically for soil samples; however, the appropriate criteria for water samples were utilized by the laboratories.

e. Precision and accuracy requirements are identified and defined in the referenced EPA procedures. Accuracy criteria are for associated batch matrix spike percentage recoveries. Evaluations based on statistical control of laboratory control sample also are performed. Precision criteria is based on batch laboratory replicate matrix spike sample analyses or replicate sample analyses.

f. Accuracy criteria are the minimum for associated batch laboratory control sample percentage recoveries. Laboratories must meet statistically based control if more stringent. Additional analyte-specific evaluations also performed for matrix spike and surrogates as appropriate to the method. Precision criteria as based on laboratory replicate matrix spike sample analyses.

5 Data Validation

This section describes data validation activities, including formal validation, data set review, development and evaluation of data trend charts, evaluation of field and laboratory QC data, and evaluation of annual groundwater monitoring reports.

5.1 Review Data Quality

The CHPRC S&GRP generated nearly 100,000 distinct analytical results from the 163 target 200-BP-5 Groundwater OU wells. As required by the RI/FS Work Plan SAP (DOE/RL-2007-18, Appendix A), the analytical data were evaluated in accordance with EPA/240/B-06/003, *Data Quality Assessment: Statistical Methods for Practitioners*, to ensure that specific QA objectives of the project were achieved. This evaluation consisted of the following activities:

- Formal validation of a minimum of 5 percent of a randomly selected segment of the data
- Supplemental evaluation of the following data:
  - Detection limits against regulatory action levels
  - Data trend charts to identify trends, outliers, and anomalies
  - Annual groundwater monitoring reports
- Evaluation of the field QC sample data
- Evaluation of the laboratory QC data

The results of these activities are summarized in the following sections.

5.2 Formal Data Validation

A third party independent data validation was performed by Analytical Quality Associates, Inc., of Albuquerque, New Mexico. Three SAPs were used to identify the quantity and the level of data validation to be completed for 200-BP-5 Groundwater OU analytical data (DOE/RL-2001-49; DOE/RL-2006-55; and DOE/RL-2007-18, Appendix A).

Based on a per-method survey of the analytical results, at least 5 percent of the characterization data by method was selected for samples analyzed and validated to Level C, per HNF-20433, *Data Validation Procedure for Chemical Analyses* and HNF-20434, *Data Validation Procedure for Radiochemical Analyses*.

5.2.1 Validation Results

The majority of the data did not require qualification. However, qualifiers were applied to some percentage of the analytical results, based on lack of traceability to standards, holding time exceedences, blank contamination, lack of QC data, QC data out-of-tolerance, or method blank contamination. Qualified results included results from volatile organics, semivolatile organics, inorganics, radiochemical, general chemistry, herbicides and pesticides, and dioxins and furans analyte classes.

Nearly all of the qualifiers were either “J,” indicating that the result should be considered an estimate rather than absolute quantitative value, or “UJ” indicating that the sample was not detected but the absolute detection limit should be considered an estimate.

The validation did result in some data rejections:

- Four general chemistry samples (cyanide) were rejected because of a very low matrix spike (MS) recovery. A "UR" flag was applied to these samples.
- Four general chemistry samples (cyanide) were rejected because the analysis was beyond two times the holding time and a lack of MS data. A "UR" flag was applied to these samples.
- Six general chemistry samples (nitrogen in nitrite) were rejected because the analysis was beyond two times the holding time. A "UR" flag was applied to these samples.
- Seven general chemistry samples (nitrogen in nitrite) were rejected because of very low MS recovery. A "UR" flag was applied to these samples.
- Two general chemistry samples (cyanide) were rejected because of very low matrix spike duplicate (MSD) recovery and poor MS/MSD precision. A "UR" flag was applied to these samples.

Appendix A contains a summary of the independent third party validation, including all flags assigned. The summary is presented by analyte class in Tables A-1 through A-7 (Appendix A).

5.3 Supplementary Data Evaluation—Detection Limits

The data set consists of 96,353 individual analytical results. Of these, approximately 45 percent were nondetected results. Table 5-1 is a constituent-by-constituent listing of the number of results per constituent and the number and percent of nondetected results. This table also shows the number and percent of the nondetected results where the reporting limit exceeded the regulatory action limit from Table 1-3.

Fifty-three constituents had all nondetected values and all reporting limits that were greater than the applicable regulatory action limit. These constituents are listed in Table 5-2. None of these are analytes that were identified as COPCs in the RI/FS Work Plan (DOE/RL-2007-18, Appendix A), but they were reported as method-based analytes. Data for these constituents cannot conclusively demonstrate that the action levels are not exceeded. However, the lack of detection, along with their non-COPC status suggests that there is a very low risk of their presence above regulatory thresholds.

An additional 34 constituents displayed a large percentage (greater than 25 percent) of detection limits that exceed regulatory action limits. These data must be considered carefully when using the data set for regulatory decision making, particularly when using the data to demonstrate achievement of an action level. These constituents are listed in Table 5-3.

Of the 87 constituents listed in Tables 5-2 and 5-3, only antimony and cadmium are analytes that were identified as COPCs in the RI/FS Work Plan (DOE/RL-2007-18, Appendix A).

5.4 Supplementary Data Evaluation—Groundwater Reports Review

The CHPRC S&GRP collects groundwater samples, as needed, to address characterization and monitoring requirements for the various compliance programs at the Hanford Site (i.e., RCRA, CERCLA, the *Atomic Energy Act of 1954*, HASQARD, and CHPRC-00189, *CH2M HILL Plateau Remediation Company Environmental Quality Assurance Program Plan*). The results from the analyses of these samples are evaluated and compiled into an annual Hanford Site groundwater monitoring report. The report includes an appendix that provides an overview of the QA/QC information generated to support these programs.

Table 5-1. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Entries	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
3+4 Methylphenol	SVOC	341	334	98	0	0
1,1,1,2-Tetrachloroethane	VOC	4	4	100	0	0
1,1,1-Trichloroethane	VOC	121	117	97	0	0
1,1,2,2-Tetrachloroethane	VOC	36	36	100	34	94
1,1,2-Trichloroethane	VOC	121	121	100	99	82
1,1-Dichloroethane	VOC	121	118	98	0	0
1,1-Dichloroethene	VOC	121	118	98	0	0
1,2,3,4,6,7,8-Heptachlorodibenzodioxin	Dioxins	1	0	0	0	0
1,2,3,4,6,7,8-Heptachlorodibenzofuran	Dioxins	1	0	0	0	0
1,2,3,4,7,8,9-Heptachlorodibenzofuran	Dioxins	1	1	100	0	0
1,2,3,4,7,8-Hexachlorodibenzofuran	Dioxins	1	1	100	0	0
1,2,3,4,7,8-Hexachlorodibenzo-*p*-dioxin	Dioxins	1	1	100	0	0
1,2,3,6,7,8-Hexachlorodibenzofuran	Dioxins	1	1	100	0	0
1,2,3,6,7,8-Hexachlorodibenzo-*p*-dioxin	Dioxins	1	1	100	0	0
1,2,3,7,8,9-Hexachlorodibenzofuran	Dioxins	1	1	100	0	0
1,2,3,7,8,9-Hexachlorodibenzo-*p*-dioxin	Dioxins	1	1	100	0	0
1,2,3,7,8-Pentachlorodibenzofuran	Dioxins	1	1	100	0	0

Table 5-1. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Entries	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
1,2,3,7,8-Pentachlorodibenzo-*p*-dioxin	Dioxins	1	1	100	0	0
1,2,3-Trichloropropane	VOC	4	4	100	4	100
1,2,4,5-Tetrachlorobenzene	SVOC	3	3	100	2	67
1,2,4-Trichlorobenzene	SVOC	91	88	97	0	0
1,2-Dibromo-3-chloropropane	VOC	4	4	100	4	100
1,2-Dibromoethane	VOC	4	4	100	4	100
1,2-Dichlorobenzene	SVOC	30	30	100	0	0
1,2-Dichloroethane	VOC	121	119	98	99	83
1,2-Dichloroethene (Total)	VOC	36	36	100	0	0
1,2-Dichloropropane	VOC	36	36	100	32	89
1,2-Propanediol	SVOC	5	0	0	0	0
1,3-Dichlorobenzene	SVOC	30	30	100	0	0
1,3-Isobenzofurandione	SVOC	1	0	0	0	0
1,4-Dichlorobenzene	SVOC	191	187	98	0	0
1,4-Dioxane	VOC	26	25	96	15	62
1,4-Naphthoquinone	SVOC	3	3	100	N/A	N/A
1,6-Hexanediol	SVOC	1	0	0	N/A	N/A

Table 5-1. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Entries	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
10-Dodecen-1-ol	SVOC	1	0	0	N/A	N/A
11-Bromoundecanoic Acid	SVOC	1	0	0	N/A	N/A
1-Butanol	VOC	108	108	100	0	0
1-Decene	SVOC	1	0	0	N/A	N/A
1-Heptanol	SVOC	1	0	0	0	0
1-Hexanol	SVOC	1	0	0	N/A	N/A
1-Methyl-2-pyrrolidinone	SVOC	10	0	0	N/A	N/A
1-Naphthylamine	SVOC	3	3	100	N/A	N/A
1-Penten-3-ol, 2-methyl	SVOC	1	0	0	N/A	N/A
2-(2-methyl-4-chlorophenoxy)propionic acid	Herbicides	1	1	100	1	100
2,3,4,6,7,8-Hexachlorodibenzofuran	Dioxins	1	1	100	0	0
2,3,4,6-Tetrachlorophenol	SVOC	257	244	95	0	0
2,3,4,7,8-Pentachlorodibenzofuran	Dioxins	1	1	100	0	0
2,3,7,8-Tetrachlorodibenzofuran	Dioxins	1	1	100	0	0
2,3,7,8-Tetrachlorodibenzo-*p*-dioxin	Dioxins	1	1	100	0	0
2,4,5-T(2,4,5-Trichlorophenoxyacetic Acid)	Herbicides	1	1	100	0	0

Table 5-1. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Entries	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
2,4,5-TP(2-(2,4,5-Trichlorophenoxy)propionic acid)Silvex	Herbicides	1	1	100	0	0
2,4,5-Trichlorophenol	SVOC	284	268	94	0	0
2,4,6-Trichlorophenol	SVOC	284	268	94	234	87
2,4-D(2,4-Dichlorophenoxyacetic acid)	Herbicides	1	1	100	0	0
2,4-DB(4-(2,4-Dichlorophenoxy)butanoic acid)	Herbicides	1	1	100	0	0
2,4-Dichlorophenol	SVOC	348	341	98	0	0
2,4-Dimethylphenol	SVOC	284	272	96	0	0
2,4-Dinitrophenol	SVOC	285	266	93	0	0
2,4-Dinitrotoluene	SVOC	91	87	96	87	100
2,6-Dichlorophenol	SVOC	257	236	92	N/A	N/A
2,6-Dinitrotoluene	SVOC	30	30	100	0	0
2-Acetylaminofluorene	SVOC	3	3	100	3	100
2-Butanone	VOC	121	114	94	0	0
2-Butoxyethanol	SVOC	9	0	0	0	0
2-Chloronaphthalene	SVOC	30	30	100	0	0
2-Chlorophenol	SVOC	339	317	94	0	0
2-Ethyl-1-hexanol	VOC	5	0	0	N/A	N/A

Table 5-1. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Entries	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
2-Ethylhexanoic Acid	SVOC	3	0	0	N/A	N/A
2-Fluoro-5-nitropyrimidine	SVOC	1	0	0	N/A	N/A
2-Hexanone	VOC	36	36	100	0	0
2-Methyl-4 Chlorophenoxyacetic Acid	Herbicides	1	1	100	1	100
2-Methylnaphthalene	SVOC	30	30	100	0	0
2-Methylphenol (Cresol, *o*-)	SVOC	384	339	88	0	0
2-Naphthylamine	SVOC	3	3	100	3	100
2-Nitroaniline	SVOC	30	30	100	0	0
2-Nitrophenol	SVOC	348	339	97	N/A	N/A
2-Pentanone, 4-Methyl	VOC	121	118	98	0	0
2-Picoline	SVOC	71	67	94	N/A	N/A
3,3'-Dichlorobenzidine	SVOC	30	30	100	30	100
3,3'-Dimethylbenzidine	SVOC	3	3	100	3	100
3,5-Di-*tert*-butyl-2,6-	SVOC	1	0	0	N/A	N/A
3-Chloro-3-methyl-1-butene	SVOC	1	0	0	N/A	N/A
3-Hydroxy-3-methyl-2-butanone	SVOC	2	0	0	N/A	N/A
3-Hydroxydecanoic Acid	SVOC	1	0	0	N/A	N/A

Table 5-1. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Entries	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
3-Methylcholanthrene	SVOC	3	3	100	3	100
3-Nitroaniline	SVOC	30	30	100	0	0
3-*tert*-Butyl-4-methoxyphenol	SVOC	1	0	0	N/A	N/A
4,4'-DDD (Dichlorodiphenyldichloroethane)	Pesticides/PCBs	2	2	100	2	100
4,4'-DDE (Dichlorodiphenyldichloroethylene)	Pesticides/PCBs	2	2	100	2	100
4,4'-DDT (Dichlorodiphenyltrichloroethane)	Pesticides/PCBs	2	2	100	2	100
4,6-Dinitro-2-methylphenol	SVOC	284	280	99	246	88
4-Aminobiphenyl	SVOC	3	3	100	3	100
4-Bromophenylphenyl Ether	SVOC	30	30	100	N/A	N/A
4-Chloro-3-methylphenol	SVOC	339	327	97	N/A	N/A
4-Chloroaniline	SVOC	30	30	100	30	100
4-Chlorophenylphenyl Ether	SVOC	30	30	100	N/A	N/A
4-Fluoroaniline	SVOC	1	0	0	N/A	N/A
4-Hexen-3-ol	SVOC	1	0	0	N/A	N/A
4'-Hydroxyacetanilide	SVOC	1	0	0	N/A	N/A
4-Methylphenol (Cresol, *p*-)	SVOC	5	5	100	0	0
4-Nitroaniline	SVOC	30	30	100	0	0

Table 5-1. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Entries	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
4-Nitrophenol	SVOC	339	316	93	0	0
4-Nitroquinoline-1-oxide	SVOC	3	3	100	N/A	N/A
5-Nitro-o-toluidine	SVOC	3	3	100	2	67
7,12-Dimethylbenz[a]anthracene	SVOC	3	3	100	3	100
Acenaphthene	SVOC	91	91	100	0	0
Acenaphthylene	SVOC	30	30	100	N/A	N/A
Acetone	VOC	121	112	93	0	0
Acetonitrile	VOC	4	4	100	N/A	N/A
Acetophenone	SVOC	3	3	100	0	0
Acrolein	VOC	4	4	100	0	0
Aldrin	Pesticides/PCBs	2	2	100	2	100
Alkalinity	Wet Chemistry	1,335	0	0	N/A	N/A
Allyl Chloride	VOC	4	4	100	0	0
alpha,alpha-Dimethylphenethylamine	SVOC	3	3	100	N/A	N/A
Alpha-BHC	Pesticides/PCBs	2	2	100	2	100
Aluminum	Metals	451	207	46	21	10
Americium-241	Radiochemistry	109	72	66	0	0

Table 5-1. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Entries	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
Ammonia	Wet Chemistry	10	5	50	N/A	N/A
Ammonium Ion	Wet Chemistry	39	8	21	N/A	N/A
Amylene/Hydrate	SVOC	3	0	100	0	0
Aniline	SVOC	3	3	100	0	0
Anthracene	SVOC	30	30	100	0	0
Antimony	Metals	2,139	1,999	94	1,919	96
Antimony-125	Radiochemistry	813	813	100	N/A	N/A
Aramite	SVOC	3	3	100	2	67
Aroclor 1016	Pesticides/PCBs	62	51	82	51	100
Aroclor 1221	Pesticides/PCBs	62	62	100	62	100
Aroclor 1232	Pesticides/PCBs	62	62	100	62	100
Aroclor 1242	Pesticides/PCBs	62	62	100	62	100
Aroclor 1248	Pesticides/PCBs	62	62	100	62	100
Aroclor 1254	Pesticides/PCBs	62	62	100	62	100
Aroclor 1260	Pesticides/PCBs	62	51	82	51	100
Arsenic	Metals	312	19	6	19	100
Azobenzene	SVOC	3	3	100	2	67

Table 5-1. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Entries	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
Barium	Metals	2,124	2	0.1	0	0
Benzene	VOC	121	117	97	98	84
Benzo(a)anthracene	SVOC	30	30	100	30	100
Benzo(a)pyrene	SVOC	30	30	100	30	100
Benzo(b)fluoranthene	SVOC	30	30	100	30	100
Benzo(ghi)perylene	SVOC	30	30	100	N/A	N/A
Benzo(k)fluoranthene	SVOC	30	30	100	30	100
Benzoic Acid	SVOC	4	0	0	0	0
Benzothiazole	SVOC	68	67	99	N/A	N/A
Benzyl Alcohol	SVOC	3	3	100	0	0
Beryllium	Metals	2,098	1,974	94	0	0
Beryllium-7	Radiochemistry	801	801	100	N/A	N/A
beta-1,2,3,4,5,6-Hexachlorocyclohexane (Beta-BHC)	Pesticides/PCBs	2	2	100	2	100
Bis(2-chloro-1-methylethyl)ether	SVOC	30	30	100	29	97
Bis(2-Chloroethoxy)methane	SVOC	30	30	100	0	0
Bis(2-chloroethyl) Ether	SVOC	30	30	100	30	100
Bis(2-ethylhexyl) phthalate	SVOC	98	73	75	1	1

Table 5-1. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Entries	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
Bisphenol A	SVOC	1	0	0	0	0
Bromide	Wet Chemistry	35	25	71	N/A	N/A
Bromodichloromethane	VOC	36	36	100	32	89
Bromoform	VOC	36	36	100	0	0
Bromomethane	VOC	36	36	100	0	0
Butylbenzylphthalate	SVOC	30	30	100	0	0
Cadmium	Metals	2,193	2,076	95	2,051	99
Calcium	Metals	2,131	0	0	N/A	N/A
Carbazole	SVOC	27	27	100	0	0
Carbon Disulfide	VOC	121	117	97	0	0
Carbon Tetrachloride	VOC	121	104	86	86	83
Carbon-14	Radiochemistry	96	55	57	0	0
Cesium-134	Radiochemistry	813	813	100	N/A	N/A
Cesium-137	Radiochemistry	840	820	98	0	0
Chlordane	Pesticides/PCBs	2	2	100	2	100
Chloride	Wet Chemistry	1,525	2	0.1	0	0
Chlorobenzene	VOC	103	103	100	0	0

Table 5-1. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Entries	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
Chlorobenzilate	SVOC	3	3	100	2	67
Chloroethane	VOC	36	36	100	N/A	N/A
Chloroform	VOC	121	114	94	0	0
Chloromethane	VOC	36	36	100	N/A	N/A
Chloroprene	VOC	4	4	100	0	0
Chromium	Metals	2,144	893	42	0	0
Chrysene	SVOC	30	30	100	30	100
cis-1,2-Dichloroethylene	VOC	109	106	98	0	0
cis-1,3-Dichloropropene	VOC	36	36	100	32	89
Cobalt	Metals	2,102	1,867	89	433	23
Cobalt-60	Radiochemistry	840	618	74	0	0
Coliform Bacteria	BIO	16	14	88	N/A	N/A
Copper	Metals	2,112	1,917	91	3	0.2
Cyanide	Wet Chemistry	1,157	514	44	1	0.2
Cyclohexanol, 2-methyl-5-(1-methylethyl)-, (1a,2b,5a)-	SVOC	1	0	0	N/A	N/A
Dalapon	Herbicides	1	1	100	0	0
Decanoic Acid	SVOC	1	0	0	N/A	N/A

Table 5-1. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Entries	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
Delta-BHC	Pesticides/PCBs	2	2	100	N/A	N/A
Diallate	SVOC	3	3	100	3	100
Dibenz[a,h]anthracene	SVOC	30	30	100	30	100
Dibenzofuran	SVOC	30	30	100	0	0
Dibromochloromethane	VOC	36	36	100	32	89
Dibromomethane	VOC	4	4	100	0	0
Dicamba	Herbicides	1	1	100	0	0
Dichlorodifluoromethane	VOC	4	4	100	0	0
Dichloroprop	Herbicides	1	1	100	N/A	N/A
Dieldrin	Pesticides/PCBs	2	2	100	2	100
Diethylphthalate	SVOC	30	29	97	0	0
Dimethoate	SVOC	4	4	100	0	0
Dimethyl phthalate	SVOC	30	26	87	0	0
Di-n-butylphthalate	SVOC	30	29	97	0	0
Di-n-octylphthalate	SVOC	30	30	100	0	0
Dinoseb(2-secButyl-4,6-dinitrophenol)	SVOC	258	239	93	0	0
Dissolved Oxygen	Wet Chemistry	1,102	0	0	N/A	N/A

Table 5-1. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Entries	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
Disulfoton	SVOC	3	3	100	2	67
Dithiocarbamic Acid	SVOC	1	0	0	N/A	N/A
Dodecanamide	SVOC	1	0	0	N/A	N/A
Enanthoic Acid	SVOC	3	0	0	N/A	N/A
Endosulfan I	Pesticides/PCBs	2	2	100	0	0
Endosulfan II	Pesticides/PCBs	2	2	100	0	0
Endosulfan Sulfate	Pesticides/PCBs	2	2	100	0	0
Endrin	Pesticides/PCBs	2	2	100	2	100
Endrin Aldehyde	Pesticides/PCBs	2	2	100	0	0
Ethyl Cyanide	VOC	92	91	99	N/A	N/A
Ethyl Methacrylate	VOC	4	4	100	0	0
Ethyl Methanesulfonate	SVOC	3	3	100	N/A	N/A
Ethylbenzene	VOC	121	121	100	0	0
Europium-152	Radiochemistry	806	806	100	0	0
Europium-154	Radiochemistry	813	812	100	0	0
Europium-155	Radiochemistry	813	813	100	0	0
Famphur	SVOC	3	3	100	N/A	N/A

Table 5-1. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Entries	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
Fluoranthene	SVOC	30	30	100	0	0
Fluorene	SVOC	30	30	100	0	0
Fluoride	Wet Chemistry	1,513	26	2	8	31
Gamma-BHC (Lindane)	Pesticides/PCBs	2	2	100	0	0
Gross Alpha	Radiochemistry	792	238	30	3	1
Gross Beta	Radiochemistry	1,089	6	0.6	N/A	N/A
Heptachlor	Pesticides/PCBs	2	2	100	2	100
Heptachlor Epoxide	Pesticides/PCBs	2	2	100	2	100
Heptachlorodibenzofurans	Dioxins	1	0	0	N/A	N/A
Heptachlorodibenzo-*p*-dioxins	Dioxins	1	0	0	N/A	N/A
Hexachlorobenzene	SVOC	30	30	100	30	100
Hexachlorobutadiene	SVOC	30	30	100	29	97
Hexachlorocyclopentadiene	SVOC	30	29	97	0	0
Hexachlorodibenzofurans	Dioxins	1	1	100	N/A	N/A
Hexachlorodibenzo-*p*-dioxin	Dioxins	1	0	0	N/A	N/A
Hexachloroethane	SVOC	30	30	100	15	50
Hexachlorophene	SVOC	3	3	100	2	67

Table 5-1. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Entries	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
Hexachloropropene	SVOC	3	3	100	N/A	N/A
Hexavalent Chromium	Metals	176	84	48	0	0
Indeno(1,2,3-cd)pyrene	SVOC	30	30	100	30	100
Iodine-129	Radiochemistry	584	322	55	68	21
Iodomethane	VOC	4	4	100	N/A	N/A
Iron	Metals	2,131	599	28	0	0
Isobutyl Alcohol	VOC	4	4	100	0	0
Isodrin	SVOC	3	3	100	N/A	N/A
Isophorone	SVOC	30	30	100	0	0
Isosafrole	SVOC	3	3	100	N/A	N/A
Kepone	SVOC	3	3	100	3	100
Lead	Metals	267	233	87	0	0
Lithium	Metals	14	2	14	0	0
Magnesium	Metals	2,130	0	0	N/A	N/A
Manganese	Metals	2,124	1,232	58	0	0
m-Dinitrobenzene	SVOC	3	3	100	0	0
Mercury	Metals	399	306	77	306	100

Table 5-1. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Entries	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
Methacrylonitrile	VOC	4	4	100	2	50
Methapyrilene	SVOC	3	3	100	0	0
Methoxychlor	Pesticides/PCBs	2	2	100	1	50
Methyl 2-hydroxyisobutyrate	SVOC	1	0	0	0	0
Methyl Methacrylate	VOC	4	4	100	0	0
Methyl Methanesulfonate	SVOC	3	3	100	2	67
Methyl Parathion	SVOC	3	3	100	0	0
Methylene Chloride	VOC	121	118	98	0	0
Naphthalene	SVOC	98	98	100	0	0
n-Butylbenzene	VOC	1	1	100	N/A	N/A
n-Decanamide	SVOC	1	0	0	N/A	N/A
Neptunium-237	Radiochemistry	107	97	91	0	0
Nickel	Metals	2,099	1,579	75	0	0
Nitrate	Wet Chemistry	1,545	1	0.1	0	0
Nitrite	Wet Chemistry	1,513	331	22	7	2
Nitrobenzene	SVOC	31	31	100	0	0
Nitrosopyrrolidine	SVOC	3	3	100	3	100

Table 5-1. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Entries	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
n-Nitrosodiethylamine	SVOC	3	3	100	3	100
n-Nitrosodimethylamine	SVOC	9	9	100	9	100
n-Nitrosodi-*n*-butylamine	SVOC	3	3	100	3	100
n-Nitrosodi-*n*-dipropylamine	SVOC	91	91	100	91	100
n-Nitrosodiphenylamine	SVOC	30	30	100	0	0
n-Nitrosomethylethylamine	SVOC	3	3	100	3	100
n-Nitrosomorpholine	SVOC	3	3	100	3	100
n-Nitrosopiperidine	SVOC	3	3	100	3	100
Nonanoic Acid	SVOC	2	0	0	N/A	N/A
O,*O*,*O*-Triethyl Phosphorothioate	SVOC	3	3	100	N/A	N/A
O,*O*-Diethyl *O*-2-pyrazinyl Phosphorothioate	SVOC	3	3	100	N/A	N/A
Octachlorodibenzofuran	Dioxins	1	0	0	0	0
Octachlorodibenzo-*p*-dioxin	Dioxins	1	0	0	0	0
Oil and Grease	General Organics	3	1	33	N/A	N/A
Oleic Acid	SVOC	1	0	0	N/A	N/A
o-Toluidine	SVOC	3	3	100	3	100
Oxidation Reduction Potential	Physical Properties	522	0	0	N/A	N/A

Table 5-1. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Entries	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
Parathion	SVOC	3	3	100	3	100
p-Dimethylaminoazobenzene	SVOC	3	3	100	3	100
Pentachlorobenzene	SVOC	3	3	100	2	67
Pentachlorodibenzofurans	Dioxins	1	1	100	N/A	N/A
Pentachlorodibenzo-*p*-dioxins	Dioxins	1	0	0	N/A	N/A
Pentachloroethane	SVOC	3	3	100	2	67
Pentachloronitrobenzene	SVOC	3	3	100	3	100
Pentachlorophenol	SVOC	348	325	93	325	100
Pentadecan-6-one	SVOC	1	0	0	N/A	N/A
pH Measurement	Physical Properties	3,115	0	0	N/A	N/A
Phenacetin	SVOC	3	3	100	0	0
Phenanthrene	SVOC	30	30	100	N/A	N/A
Phenol	SVOC	348	335	96	0	0
Phorate	SVOC	3	3	100	0	0
Phosphate	Wet Chemistry	85	31	37	N/A	N/A
Phosphorus	Metals	14	12	86	12	100
Plutonium-238	Radiochemistry	182	180	99	0	0

Table 5-1. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Entries	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
Plutonium-239/240	Radiochemistry	182	143	79	0	0
Potassium	Metals	2,131	3	0.1	N/A	N/A
Potassium-40	Radiochemistry	813	790	97	N/A	N/A
p-Phenylenediamine	SVOC	3	3	100	0	0
Preludin	SVOC	1	0	0	N/A	N/A
Pronamide	SVOC	3	3	100	0	0
Pyrene	SVOC	91	91	100	0	0
Pyridine	SVOC	3	3	100	0	0
Ricinoleic Acid	SVOC	4	0	0	N/A	N/A
Ruthenium-106	Radiochemistry	806	806	100	N/A	N/A
Safrol	SVOC	3	3	100	2	67
Sebacic Acid	SVOC	1	0	0	N/A	N/A
Selenium	Metals	23	6	26	6	100
Silicon	Metals	14	0	0	N/A	N/A
Silver	Metals	2,112	1,894	90	1,668	88
Sodium	Metals	2,143	0	0	N/A	N/A
Specific Conductance	Physical Properties	3,122	0	0	N/A	N/A

Table 5-1. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Entries	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
Strontium	Metals	2,105	1	0	0	0
Strontium-90	Radiochemistry	247	187	76	1	0.5
Styrene	VOC	36	36	100	0	0
Sulfate	Wet Chemistry	1,530	0	0	0	0
Sulfur	Metals	2	0	0	N/A	N/A
sym-Trinitrobenzene	SVOC	3	3	100	0	0
Technetium-99	Radiochemistry	1,405	137	10	1	0
Temperature	Physical Properties	3,075	0	0	N/A	N/A
Tetrachlorodibenzofurans	Dioxins	1	1	100	N/A	N/A
Tetrachlorodibenzo-*p*-dioxins	Dioxins	1	1	100	N/A	N/A
Tetrachloroethene	VOC	121	120	99	117	98
Tetradecanoic Acid	SVOC	2	0	0	N/A	N/A
Tetraethyl Dithiopyrophosphate (Sulfotepp)	SVOC	3	3	100	0	0
Tetrahydrofuran	VOC	91	90	99	N/A	N/A
Thallium	Metals	166	143	86	8	6
Thorium-228	Radiochemistry	79	76	96	N/A	N/A
Thorium-230	Radiochemistry	79	71	90	0	0

Table 5-1. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Entries	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
Thorium-232	Radiochemistry	79	79	100	N/A	N/A
Toluene	VOC	121	120	99	0	0
Total Cresols	SVOC	8	8	100	0	0
Total Organic Carbon	General Organics	2,169	966	44	N/A	N/A
Total Organic Halides	General Organics	2,028	1,254	62	N/A	N/A
Total Petroleum Hydrocarbons – Diesel Range	General Organics	16	12	75	0	0
Total Petroleum Hydrocarbons – Gasoline Range	General Organics	5	5	100	0	0
Total Petroleum Hydrocarbons – Kerosene Range	General Organics	15	15	100	0	0
Toxaphene	Pesticides/PCBs	2	2	100	2	100
trans-1,2-Dichloroethylene	VOC	109	107	98	0	0
trans-1,3-Dichloropropene	VOC	36	36	100	32	89
trans-1,4-Dichloro-2-butene	VOC	4	4	100	N/A	N/A
Tributyl Phosphate	SVOC	87	65	75	0	0
Trichloroethene	VOC	121	119	98	0	0
Trichloromonofluoromethane	VOC	21	21	100	0	0
Tris-2-chloroethyl Phosphate	SVOC	68	68	100	0	0
Tritium	Radiochemistry	1,274	156	12	0	0

Table 5-1. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Entries	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
Turbidity	Physical Properties	2,932	0	0	N/A	N/A
Undecanoic Acid	SVOC	1	0	0	0	0
Uranium	Metals	1,329	8	0.6	0	0
Uranium-233/234	Radiochemistry	27	0	0	N/A	N/A
Uranium-234	Radiochemistry	13	0	0	N/A	N/A
Uranium-235	Radiochemistry	40	12	30	N/A	N/A
Uranium-238	Radiochemistry	59	0	0	N/A	N/A
Vanadium	Metals	2,096	325	16	4	1
Vinyl Acetate	VOC	4	4	100	0	0
Vinyl Chloride	VOC	121	120	99	120	100
Xylenes (Total)	VOC	121	121	100	0	0
Zinc	Metals	2,096	1,284	61	0	0

Note: Shading denotes those analytes that were identified as COPCs in DOE/RL-2007-18, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-5 Groundwater Operable Unit*, Appendix A.

Table 5-2. Analytes for Which All Results Were Nondetects and All Detection Limits Exceeded Action Limits

1,2,3-Trichloropropane	Beta-1,2,3,4,5,6-Hexachlorocyclohexane
1,2-Dibromo-3-chloropropane	Bis(2-chloroethyl) Ether
1,2-Dibromoethane	Chlordane
2-(2-methyl-4-chlorophenoxy) Propionic Acid	Chrysene
2-Acetylaminofluorene	Diallate
2-Methyl-4 Chlorophenoxyacetic Acid	Dibenz[a,h]anthracene
2-Naphthylamine	Dieldrin
3,3'-Dichlorobenzidine	Endrin
3,3'-Dimethylbenzidine	Heptachlor
3-Methylcholanthrene	Heptachlor Epoxide
4,4'-DDD (Dichlorodiphenyldichloroethane)	Hexachlorobenzene
4,4'-DDE (Dichlorodiphenyldichloroethylene)	Indeno(1,2,3-cd)pyrene
4,4'-DDT (Dichlorodiphenyltrichloroethane)	Kepone
4-Aminobiphenyl	Nitrosopyrrolidine
4-Chloroaniline	*n*-Nitrosodiethylamine
7,12-Dimethylbenz[a]anthracene	*n*-Nitrosodimethylamine
Aldrin	*n*-Nitrosodi-*n*-butylamine
Alpha-BHC	*n*-Nitrosodi-*n*-dipropylamine
Aroclor 1221	*n*-Nitrosomethylethylamine
Aroclor 1232	*n*-Nitrosomorpholine
Aroclor 1242	*n*-Nitrosopiperidine
Aroclor 1248	*o*-Toluidine
Aroclor 1254	Parathion
Benzo(a)anthracene	*p*-Dimethylaminoazobenzene
Benzo(a)pyrene	Pentachloronitrobenzene
Benzo(b)fluoranthene	Toxaphene
Benzo(k)fluoranthene	

Table 5-3. Analytes with Greater than 25 Percent Nondetects Exceeding Action Limit

1,1,2,2-Tetrachloroethane	Benzene	Hexachlorophene
1,1,2-Trichloroethane	Bis(2-chloro-1-methylethyl)ether	Methacrylonitrile
1,2,4,5-Tetrachlorobenzene	Bromodichloromethane	Methoxychlor
1,2-Dichloroethane	Cadmium	Methylmethanesulfonate
1,2-Dichloropropane	Carbon Tetrachloride	Pentachlorobenzene
1,4-Dioxane	Chlorobenzilate	Pentachloroethane
2,4,6-Trichlorophenol	*cis*-1,3-Dichloropropene	Safrol
4,6-Dinitro-2-methylphenol	Dibromochloromethane	Silver
5-Nitro-*o*-toluidine	Disulfoton	Tetrachloroethene
Antimony	Fluoride	*trans*-1,3-Dichloropropene
Aramite	Hexachlorobutadiene	
Azobenzene	Hexachloroethane	

Note: Shading denotes those analytes that were identified as COPCs in DOE/RL-2007-18, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-5 Groundwater Operable Unit*, Appendix A.

Review of the Hanford Site annual groundwater monitoring report provides some information regarding the overall quality and performance of the groundwater sampling and analytical activities. The 200-BP-5 Groundwater OU data are a subset of the overall Hanford Site groundwater monitoring program described in the annual reports. As an evaluation of the quality of the 200-BP-5 Groundwater OU data, it is useful to compare the performance metrics of the 200-BP-5 Groundwater OU data to the overall Hanford Site groundwater data set.

Table 5-4 summarizes the QA/QC results for Hanford Site groundwater monitoring over the time period considered in this DQA report along with the QA/QC results for the 200-BP-5 Groundwater OU data set. Results are not provided for all QA/QC parameters for all years because of the variations in how the data are compiled in each annual report. Citations are provided for each annual report for readers who wish to review the details for a specific year. As shown in Table 5-4, the 200-BP-5 Groundwater OU data set was equivalent or better than the site-wide data set as summarized in the Hanford Site annual groundwater monitoring reports, in terms of field and laboratory QC performance.

Table 5-4. Quality Assurance/Quality Control Results for Groundwater Monitoring

Reporting Year Groundwater Monitoring Report	FY 2005 PNNL-15670	FY 2006 PNNL-16346	FY 2007 DOE/RL-2008-01	FY 2008 DOE/RL-2008-66	FY 2009 DOE/RL-2010-11	200-BP-5 Data 11-30-04 to 11-12-09
Results of National Performance Evaluation Studies—Percent of Acceptable Results	--	--	95	98	--	Not calculated
Field Blanks—Percent of Acceptable Results	97	96	97	96	97	95.7
Field Duplicates—Percent of Acceptable Results	98	98	98	97	99	97.4
Split Samples—Percent of Acceptable Results	--	--	--	89	91	97.1
Holding Times Met—Percent of Nonradiological Samples with Acceptable Results	97	95	96	99	99	Not calculated
Laboratory Duplicates—Percent of Results Within Acceptance Limits	--	--	--	97	99	98.3
Method Blanks—Percent Without Contamination	--	--	--	98	99.8	97.8
Laboratory Control Samples—Percent of Acceptable Results	--	--	--	99	99.4	99.2
Matrix Spike/Matrix Duplicates—Percent of Acceptable Results	--	--	--	96	99	94.8
Surrogates—Percent of Acceptable Results	--	--	--	99	--	97.5
Requests for Data Review—Number of Analytical Results	919	611	1,470	1,677	1,659	Not calculated

Table 5-4. Quality Assurance/Quality Control Results for Groundwater Monitoring

Reporting Year Groundwater Monitoring Report	FY 2005 PNNL-15670	FY 2006 PNNL-16346	FY 2007 DOE/RL-2008-01	FY 2008 DOE/RL-2008-66	FY 2009 DOE/RL-2010-11	200-BP-5 Data 11-30-04 to 11-12-09

DOE/RL-2008-01, *Hanford Site Groundwater Monitoring for Fiscal Year 2007*.

DOE/RL-2008-66, *Hanford Site Groundwater Monitoring for Fiscal Year 2008*.

DOE/RL-2010-11, *Hanford Site Groundwater Monitoring and Performance Report for 2009, Volumes I and II*.

PNNL-15670, *Hanford Site Groundwater Monitoring for Fiscal Year 2005*.

PNNL-16346, *Hanford Site Groundwater Monitoring for Fiscal Year 2006*.

5.4.1.1 Hanford Site Groundwater Quality Control and Quality Assurance

The Hanford Site groundwater program includes several QA elements that serve to verify the overall quality of the sampling and analysis activities and to highlight potential problems for corrective action. The following activities are included:

- **Proficiency testing program studies** involve the provision of blind known standards to all Hanford Site contract laboratories. These programs are administered by independent third party organizations and the results are available to data users on the Hanford Site.
- **Double-blind studies** involve providing known standards to the laboratory disguised as samples. These provide a measure of both inter- and intra-laboratory precision and accuracy. The studies also help groundwater staff troubleshoot analytical problems identified through data reviews and QC evaluations.
- **Laboratory audits** are performed either independently from the Hanford Site or as part of a DOE Contract Analytical Program national audit team.
- **Laboratory QA/QC evaluation** is performed on the entire Hanford Site data set annually and reported as part of the annual groundwater reports.

Review of the results of these evaluations did not identify any issues that could negatively affect the 200-BP-5 Groundwater OU data that had not already been evaluated and resolved, either with qualification flags or re-run samples.

5.4.1.2 Analytical Troubleshooting

If the results of any of the data QC or QA reviews indicate a potential anomaly in the results, Requests for data review (RDRs) are initiated by project scientists. During evaluations of RDR submittals, trends may be observed that warrant further investigation by the groundwater support staff. In 2008, RDRs had been filed for 1,677 of approximately 128,000 analytical results (1.3 percent), of which 578 were suspect, 112 rejected, and 1 questionable. About half of the issues occurred prior to receipt at the laboratories. Most issues were because of missed hold times, samples received outside of temperature specifications, chain-of-custody issues, and incorrect sample preservation. RDR resolution includes appropriate qualification flags applied to the affected data within HEIS.

5.5 Field Quality Control

The QC procedures must be followed in the field to ensure that reliable data are obtained. Field QC samples are collected to evaluate the potential for cross-contamination and to provide information pertinent to field variability. Field QC for sampling generally requires the collection of field replicates (duplicates), trip or field blanks, and equipment blanks. Field QC sampling is described here in general terms; actual field QC samples and the required frequency for collection are described in the SAPs for each sampling program for the 200-BP-5 Groundwater OU.

During the period of this assessment, 31,232 field QC results were generated, which is approximately 32 percent of the total groundwater samples results obtained for the 200-BP-5 Groundwater OU. These consisted of 5,308 field duplicate results; 1,201 field split results; and 24,723 blanks results, consisting of a combination of field transfer blanks, equipment rinsate blanks, full trip blanks, and trip blanks. A full trip blank is analyzed for all constituents, rather than just the volatile organics. The following subsections provide further information on field QC results and a breakdown of those results by analyte and field QC type. The field QC elements were evaluated against the criteria listed in Table 5-5.

Table 5-5. Field Quality Control Acceptance Criteria

QC Element	Acceptance Criteria
Field Duplicates	Field duplicates with a result greater than 5 times the MDL or MDA must have RPD ≤20 percent to be considered acceptable.
Field Split Samples	Split samples should have RPD ≤20 percent when the results from both laboratories are ≥5 times the respective reporting limits.
Field Blanks	The field blank limit is 2 times the MDL, IDL, or MDA. However, for common laboratory contaminants acetone, methylene chloride, 2-butanone, toluene, and phthalate esters, the QC limit is 5 times the MDL. In some cases, the MDL is estimated and not provided electronically. A ratio of the result to QC limit is provided to help evaluate the extent of the failure.

5.5.1 Field Duplicate Samples

Field duplicate samples are two separate samples collected from the same source, placed in separate sample containers, and analyzed independently to estimate precision, including sampling and analytical variability. The measure of precision for field duplicate samples is the relative percent difference (RPD) between duplicate pairs. The RPD is calculated for a field duplicate sample only when one result or the other is at least five times the detection limit. Table 5-6 lists the field duplicates analyzed by class. Table 5-7 shows field duplicate results by constituent.

Table 5-6. Total Field Duplicate Results by Analyte Class

Analyte Class	Results
Anions	551
General Chemistry	98
Metals	2,758
Radiochemistry	1,063
SVOCs	627
VOCs	211
Total	**5,308**

There are 5,308 pairs of field duplicates, and all analytes identified as COPCs in the RI/FS Work Plan (DOE/RL-2007-18, Appendix A), other than thorium-234, had some duplicate data. Of these, 136 or 2.6 percent had RPDs that exceeded the acceptance criteria listed in Table 5-5. Constituents and properties with very high RPDs (>50 percent) include nitrogen in nitrite, calcium, copper, magnesium, silver, sodium, and potassium-40.

Table 5-7. Summary of Field Duplicate Samples

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Bromide	Anions	2	--	--
Chloride	Anions	95	--	--
Cyanide	Anions	70	15	21
Fluoride	Anions	95	6	6.3

Table 5-7. Summary of Field Duplicate Samples

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Nitrate	Anions	4	--	--
Nitrite	Anions	4	--	--
Nitrogen in Ammonium	Anions	1	--	--
Nitrogen in Nitrate	Anions	91	2	2.2
Nitrogen in Nitrite	Anions	91	7	7.7
Phosphate	Anions	2	--	--
Phosphorus in Phosphate	Anions	3	--	--
Sulfate	Anions	94	--	--
Alkalinity	General Chemistry	90	2	2.2
Coliform Bacteria	General Chemistry	1	--	--
Oil and Grease	General Chemistry	1	--	--
Specific Conductance	General Chemistry	1	--	--
Total Petroleum Hydrocarbons – Diesel Range	General Chemistry	2	--	--
Total Petroleum Hydrocarbons – Gasoline Range	General Chemistry	2	--	--
Total Petroleum Hydrocarbons – Kerosene Range	General Chemistry	1	--	--
Aluminum	Metals	39	--	--
Antimony	Metals	144	--	--
Arsenic	Metals	19	--	--
Barium	Metals	144	--	--
Beryllium	Metals	144	--	--
Cadmium	Metals	144	--	--
Calcium	Metals	144	1	0.7
Chromium	Metals	144	6	4.2
Cobalt	Metals	144	--	--
Copper	Metals	144	2	1.4
Hexavalent Chromium	Metals	15	--	--
Iron	Metals	144	23	16
Lead	Metals	23	--	--

Table 5-7. Summary of Field Duplicate Samples

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Magnesium	Metals	144	1	0.7
Manganese	Metals	144	5	3.5
Mercury	Metals	28	2	7.1
Nickel	Metals	144	--	--
Potassium	Metals	144	4	--
Silver	Metals	144	1	0.7
Sodium	Metals	144	1	0.7
Strontium	Metals	144	--	--
Thallium	Metals	6	--	--
Vanadium	Metals	144	5	3.5
Zinc	Metals	144	9	6.3
Americium-241	Radiochemistry	6	--	--
Antimony-125	Radiochemistry	60	--	--
Beryllium-7	Radiochemistry	60	--	--
Carbon-14	Radiochemistry	5	--	--
Cesium-134	Radiochemistry	60	--	--
Cesium-137	Radiochemistry	60	--	--
Cobalt-60	Radiochemistry	60	2	3.3
Europium-152	Radiochemistry	57	--	--
Europium-154	Radiochemistry	60	--	--
Europium-155	Radiochemistry	60	--	--
Gross Alpha	Radiochemistry	53	9	17
Gross Beta	Radiochemistry	73	7	9.6
Iodine-129	Radiochemistry	44	13	30
Neptunium-237	Radiochemistry	8	--	--
Plutonium-238	Radiochemistry	17	--	--
Plutonium-239/240	Radiochemistry	17	--	--
Potassium-40	Radiochemistry	60	1	1.7

Table 5-7. Summary of Field Duplicate Samples

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Ruthenium-106	Radiochemistry	60	--	--
Strontium-90	Radiochemistry	14	--	--
Technetium-99	Radiochemistry	82	8	9.8
Thorium-228	Radiochemistry	4	--	--
Thorium-230	Radiochemistry	4	--	--
Thorium-232	Radiochemistry	4	--	--
Total Beta Radiostrontium	Radiochemistry	6	--	--
Tritium	Radiochemistry	81	3	3.7
Uranium	Radiochemistry	81	--	--
Uranium-234	Radiochemistry	1	--	--
Uranium-235	Radiochemistry	1	--	--
Uranium-238	Radiochemistry	1	--	--
1,2,3,4,6,7,8-Heptachlorodibenzodioxin	SVOC	1	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran	SVOC	1	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran	SVOC	1	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran	SVOC	1	--	--
1,2,3,4,7,8-Hexachlorodibenzo-*p*-dioxin	SVOC	1	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran	SVOC	1	--	--
1,2,3,6,7,8-Hexachlorodibenzo-*p*-dioxin	SVOC	1	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran	SVOC	1	--	--
1,2,3,7,8,9-Hexachlorodibenzo-*p*-dioxin	SVOC	1	--	--
1,2,3,7,8-Pentachlorodibenzofuran	SVOC	1	--	--
1,2,3,7,8-Pentachlorodibenzo-*p*-dioxin	SVOC	1	--	--
1,2,4,5-Tetrachlorobenzene	SVOC	1	--	--
1,2,4-Trichlorobenzene	SVOC	4	--	--
1,2-Dichlorobenzene	SVOC	1	--	--
1,3-Dichlorobenzene	SVOC	1	--	--
1,4-Dichlorobenzene	SVOC	10	--	--

Table 5-7. Summary of Field Duplicate Samples

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
1,4-Dioxane	SVOC	2	--	--
1,4-Naphthoquinone	SVOC	1	--	--
1-Naphthylamine	SVOC	1	--	--
2-(2-methyl-4-chlorophenoxy) Propionic Acid	SVOC	1	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran	SVOC	1	--	--
2,3,4,6-Tetrachlorophenol	SVOC	20	--	--
2,3,4,7,8-Pentachlorodibenzofuran	SVOC	1	--	--
2,3,7,8-Tetrachlorodibenzofuran	SVOC	1	--	--
2,3,7,8-Tetrachlorodibenzo-*p*-dioxin	SVOC	1	--	--
2,4,5-T(2,4,5-Trichlorophenoxyacetic acid)	SVOC	1	--	--
2,4,5-TP(2-(2,4,5-Trichlorophenoxy)propionic acid) Silvex	SVOC	1	--	--
2,4,5-Trichlorophenol	SVOC	20	--	--
2,4,6-Trichlorophenol	SVOC	20	--	--
2,4-D(2,4-Dichlorophenoxyacetic acid)	SVOC	1	--	--
2,4-DB(4-(2,4-Dichlorophenoxy)butanoic acid)	SVOC	1	--	--
2,4-Dichlorophenol	SVOC	23	--	--
2,4-Dimethylphenol	SVOC	20	--	--
2,4-Dinitrophenol	SVOC	20	--	--
2,4-Dinitrotoluene	SVOC	4	--	--
2,6-Dichlorophenol	SVOC	20	--	--
2,6-Dinitrotoluene	SVOC	1	--	--
2-Acetylaminofluorene	SVOC	1	--	--
2-Chloronaphthalene	SVOC	1	--	--
2-Chlorophenol	SVOC	23	--	--
2-Methyl-4 Chlorophenoxyacetic Acid	SVOC	1	--	--
2-Methylnaphthalene	SVOC	1	--	--
2-Methylphenol (cresol, *o*-)	SVOC	23	--	--

Table 5-7. Summary of Field Duplicate Samples

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
2-Naphthylamine	SVOC	1	--	--
2-Nitroaniline	SVOC	1	--	--
2-Nitrophenol	SVOC	23	--	--
2-Picoline	SVOC	4	--	--
3,3'-Dichlorobenzidine	SVOC	1	--	--
3,3'-Dimethylbenzidine	SVOC	1	--	--
3+4 Methylphenol (cresol, *m*+*p*)	SVOC	22	--	--
3-Methylcholanthrene	SVOC	1	--	--
3-Nitroaniline	SVOC	1	--	--
4,4'-DDD (Dichlorodiphenyldichloroethane)	SVOC	1	--	--
4,4'-DDE (Dichlorodiphenyldichloroethylene)	SVOC	1	--	--
4,4'-DDT (Dichlorodiphenyltrichloroethane)	SVOC	1	--	--
4,6-Dinitro-2-methylphenol	SVOC	20	--	--
4-Aminobiphenyl	SVOC	1	--	--
4-Bromophenylphenyl ether	SVOC	1	--	--
4-Chloro-3-methylphenol	SVOC	23	--	--
4-Chloroaniline	SVOC	1	--	--
4-Chlorophenylphenyl ether	SVOC	1	--	--
4-Methylphenol (cresol, *p*-)	SVOC	1	--	--
4-Nitroaniline	SVOC	1	--	--
4-Nitrophenol	SVOC	23	--	--
4-Nitroquinoline-1-oxide	SVOC	1	--	--
5-Nitro-*o*-toluidine	SVOC	1	--	--
7,12-Dimethylbenz[a]anthracene	SVOC	1	--	--
Acenaphthene	SVOC	4	--	--
Acenaphthylene	SVOC	1	--	--
Acetophenone	SVOC	1	--	--
Aldrin	SVOC	1	--	--

Table 5-7. Summary of Field Duplicate Samples

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Alpha,alpha-Dimethylphenethylamine	SVOC	1	--	--
Alpha-BHC	SVOC	1	--	--
Aniline	SVOC	1	--	--
Anthracene	SVOC	1	--	--
Aramite	SVOC	1	--	--
Aroclor 1016	SVOC	9	--	--
Aroclor 1221	SVOC	9	--	--
Aroclor 1232	SVOC	9	--	--
Aroclor 1242	SVOC	9	--	--
Aroclor 1248	SVOC	9	--	--
Aroclor 1254	SVOC	9	--	--
Aroclor 1260	SVOC	9	--	--
Azobenzene	SVOC	1	--	--
Benzo(a)anthracene	SVOC	1	--	--
Benzo(a)pyrene	SVOC	1	--	--
Benzo(b)fluoranthene	SVOC	1	--	--
Benzo(ghi)perylene	SVOC	1	--	--
Benzo(k)fluoranthene	SVOC	1	--	--
Benzothiazole	SVOC	3	--	--
Benzyl Alcohol	SVOC	1	--	--
Beta-1,2,3,4,5,6-Hexachlorocyclohexane (Beta-BHC)	SVOC	1	--	--
Bis(2-chloro-1-methylethyl)ether	SVOC	1	--	--
Bis(2-Chloroethoxy)methane	SVOC	1	--	--
Bis(2-chloroethyl)ether	SVOC	1	--	--
Bis(2-ethylhexyl)phthalate	SVOC	4	1	25
Butylbenzylphthalate	SVOC	1	--	--
Chlordane	SVOC	1	--	--

Table 5-7. Summary of Field Duplicate Samples

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Chlorobenzilate	SVOC	1	--	--
Chrysene	SVOC	1	--	--
Dalapon	SVOC	1	--	--
Delta-BHC	SVOC	1	--	--
Diallate	SVOC	1	--	--
Dibenz[a,h]anthracene	SVOC	1	--	--
Dibenzofuran	SVOC	1	--	--
Dicamba	SVOC	1	--	--
Dichloroprop	SVOC	1	--	--
Dieldrin	SVOC	1	--	--
Diethylphthalate	SVOC	1	--	--
Dimethoate	SVOC	1	--	--
Dimethyl Phthalate	SVOC	1	--	--
Di-*n*-butylphthalate	SVOC	1	--	--
Di-*n*-octylphthalate	SVOC	1	--	--
Dinoseb(2-secButyl-4,6-dinitrophenol)	SVOC	21	--	--
Disulfoton	SVOC	1	--	--
Endosulfan I	SVOC	1	--	--
Endosulfan II	SVOC	1	--	--
Endosulfan Sulfate	SVOC	1	--	--
Endrin	SVOC	1	--	--
Endrin Aldehyde	SVOC	1	--	--
Ethyl Methanesulfonate	SVOC	1	--	--
Famphur	SVOC	1	--	--
Fluoranthene	SVOC	1	--	--
Fluorene	SVOC	1	--	--
Gamma-BHC (Lindane)	SVOC	1	--	--
Heptachlor	SVOC	1	--	--

Table 5-7. Summary of Field Duplicate Samples

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Heptachlor Epoxide	SVOC	1	--	--
Heptachlorodibenzofurans	SVOC	1	--	--
Heptachlorodibenzo-*p*-dioxins	SVOC	1	--	--
Hexachlorobenzene	SVOC	1	--	--
Hexachlorobutadiene	SVOC	1	--	--
Hexachlorocyclopentadiene	SVOC	1	--	--
Hexachlorodibenzofurans	SVOC	1	--	--
Hexachlorodibenzo-*p*-dioxin	SVOC	1	--	--
Hexachloroethane	SVOC	1	--	--
Hexachlorophene	SVOC	1	--	--
Hexachloropropene	SVOC	1	--	--
Indeno(1,2,3-cd)pyrene	SVOC	1	--	--
Isodrin	SVOC	1	--	--
Isophorone	SVOC	1	--	--
Isosafrole	SVOC	1	--	--
Kepone	SVOC	1	--	--
m-Dinitrobenzene	SVOC	1	--	--
Methapyrilene	SVOC	1	--	--
Methoxychlor	SVOC	1	--	--
Methyl Methanesulfonate	SVOC	1	--	--
Methyl Parathion	SVOC	1	--	--
Naphthalene	SVOC	4	--	--
Nitrobenzene	SVOC	1	--	--
Nitrosopyrrolidine	SVOC	1	--	--
n-Nitrosodiethylamine	SVOC	1	--	--
n-Nitrosodimethylamine	SVOC	1	--	--
n-Nitrosodi-*n*-butylamine	SVOC	1	--	--
n-Nitrosodi-*n*-dipropylamine	SVOC	4	--	--

Table 5-7. Summary of Field Duplicate Samples

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
n-Nitrosodiphenylamine	SVOC	1	--	--
n-Nitrosomethylethylamine	SVOC	1	--	--
n-Nitrosomorpholine	SVOC	1	--	--
n-Nitrosopiperidine	SVOC	1	--	--
O,*O*,*O*-Triethyl Phosphorothioate	SVOC	1	--	--
O,*O*-Diethyl *O*-2-pyrazinyl Phosphorothioate	SVOC	1	--	--
Octachlorodibenzofuran	SVOC	1	--	--
Octachlorodibenzo-*p*-dioxin	SVOC	1	--	--
o-Toluidine	SVOC	1	--	--
Parathion	SVOC	1	--	--
p-Dimethylaminoazobenzene	SVOC	1	--	--
Pentachlorobenzene	SVOC	1	--	--
Pentachlorodibenzofurans	SVOC	1	--	--
Pentachlorodibenzo-*p*-dioxins	SVOC	1	--	--
Pentachloroethane	SVOC	1	--	--
Pentachloronitrobenzene	SVOC	1	--	--
Pentachlorophenol	SVOC	23	--	--
Phenacetin	SVOC	1	--	--
Phenanthrene	SVOC	1	--	--
Phenol	SVOC	23	--	--
Phorate	SVOC	1	--	--
p-Phenylenediamine	SVOC	1	--	--
Pronamide	SVOC	1	--	--
Pyrene	SVOC	4	--	--
Pyridine	SVOC	1	--	--
Safrol	SVOC	1	--	--
sym-Trinitrobenzene	SVOC	1	--	--
Tetrachlorodibenzofurans	SVOC	1	--	--

Table 5-7. Summary of Field Duplicate Samples

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Tetrachlorodibenzo-*p*-dioxins	SVOC	1	--	--
Tetraethyl Dithiopyrophosphate (Sulfotepp)	SVOC	1	--	--
Toxaphene	SVOC	1	--	--
Tributyl Phosphate	SVOC	4	--	--
Tris-2-chloroethyl Phosphate	SVOC	3	--	--
1,1,1,2-Tetrachloroethane	VOC	1	--	--
1,1,1-Trichloroethane	VOC	7	--	--
1,1,2,2-Tetrachloroethane	VOC	1	--	--
1,1,2-Trichloroethane	VOC	7	--	--
1,1-Dichloroethane	VOC	7	--	--
1,1-Dichloroethene	VOC	7	--	--
1,2,3-Trichloropropane	VOC	1	--	--
1,2-Dibromo-3-chloropropane	VOC	1	--	--
1,2-Dibromoethane	VOC	1	--	--
1,2-Dichloroethane	VOC	7	--	--
1,2-Dichloroethene (Total)	VOC	1	--	--
1,2-Dichloropropane	VOC	1	--	--
1-Butanol	VOC	6	--	--
2-Butanone	VOC	7	--	--
2-Hexanone	VOC	1	--	--
2-Pentanone, 4-Methyl	VOC	7	--	--
Acetone	VOC	7	--	--
Acetonitrile	VOC	1	--	--
Acrolein	VOC	1	--	--
Allyl Chloride	VOC	1	--	--
Benzene	VOC	7	--	--
Bromodichloromethane	VOC	1	--	--
Bromoform	VOC	1	--	--

Table 5-7. Summary of Field Duplicate Samples

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Bromomethane	VOC	1	--	--
Carbon Disulfide	VOC	7	--	--
Carbon Tetrachloride	VOC	7	--	--
Chlorobenzene	VOC	7	--	--
Chloroethane	VOC	1	--	--
Chloroform	VOC	7	--	--
Chloromethane	VOC	1	--	--
Chloroprene	VOC	1	--	--
cis-1,2-Dichloroethylene	VOC	7	--	--
cis-1,3-Dichloropropene	VOC	1	--	--
Dibromochloromethane	VOC	1	--	--
Dibromomethane	VOC	1	--	--
Dichlorodifluoromethane	VOC	1	--	--
Ethyl Cyanide	VOC	7	--	--
Ethyl Methacrylate	VOC	1	--	--
Ethylbenzene	VOC	7	--	--
Iodomethane	VOC	1	--	--
Isobutyl Alcohol	VOC	1	--	--
Methacrylonitrile	VOC	1	--	--
Methyl Methacrylate	VOC	1	--	--
Methylene Chloride	VOC	7	--	--
Styrene	VOC	1	--	--
Tetrachloroethene	VOC	7	--	--
Tetrahydrofuran	VOC	6	--	--
Toluene	VOC	7	--	--
trans-1,2-Dichloroethylene	VOC	7	--	--
trans-1,3-Dichloropropene	VOC	1	--	--
trans-1,4-Dichloro-2-butene	VOC	1	--	--

Table 5-7. Summary of Field Duplicate Samples

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Trichloroethene	VOC	7	--	--
Trichloromonofluoromethane	VOC	1	--	--
Vinyl Acetate	VOC	1	--	--
Vinyl Chloride	VOC	7	--	--
Xylenes (Total)	VOC	7	--	--
Totals		**5,308**	**136**	**2.6**

Note: Shading denotes those analytes that were identified as COPCs in DOE/RL-2007-18, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-5 Groundwater Operable Unit*, Appendix A.

* Field duplicates with a result greater than 5 times the MDL or MDA must have RPD <20 to be considered acceptable (within QC limits).

5.5.2 Field Split Samples

Field split samples are collected from a sampling location on the same day and time and submitted to two different laboratories for analysis. The purpose of such samples is to monitor the comparability of the data generated by different laboratories. The acceptance criterion is an RPD ≤20 for the two laboratory's results. The 200-BP-5 Groundwater OU data set contained 1,201 pairs of split samples, of which 35 pairs (2.9 percent) exceeded the acceptance criteria in Table 5-5. Table 5-8 lists the field splits analyzed by analyte class. Table 5-9 lists field split results by constituent. Constituents with very high RPDs (>50 percent) include calcium, cyanide, fluoride, gross beta, magnesium, potassium, and sodium.

Table 5-8. Total Field Split Results by Analyte Class

Analyte Class	Results
Anions	104
General Chemistry	674
Metals	312
Radiochemistry	102
SVOCs	9
VOCs	0
Total	**1,201**

Table 5-9. Summary of Field Split Samples

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Bromide	Anions	1	--	--
Chloride	Anions	14	4	29

Table 5-9. Summary of Field Split Samples

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Cyanide	Anions	16	5	31
Fluoride	Anions	14	5	36
Nitrate	Anions	26	2	7.7
Nitrite	Anions	14	--	--
Phosphate	Anions	3	--	--
Sulfate	Anions	16	--	--
Alkalinity	General Chemistry	4	1	25
pH Measurement	General Chemistry	4	--	--
Specific Conductance	General Chemistry	74	--	--
Total Organic Carbon	General Chemistry	276	--	--
Total Organic Halides	General Chemistry	316	--	--
Aluminum	Metals	7	--	--
Antimony	Metals	20	--	--
Arsenic	Metals	6	--	--
Barium	Metals	18	--	--
Beryllium	Metals	14	--	--
Cadmium	Metals	20	--	--
Calcium	Metals	18	4	22
Chromium	Metals	22	--	--
Cobalt	Metals	14	--	--
Copper	Metals	14	--	--
Hexavalent Chromium	Metals	2	--	--
Iron	Metals	18	1	5.6
Magnesium	Metals	18	3	17
Manganese	Metals	16	1	6.3
Nickel	Metals	12	--	--
Potassium	Metals	18	3	17
Silver	Metals	14	--	--

Table 5-9. Summary of Field Split Samples

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Sodium	Metals	20	3	15
Strontium	Metals	11	--	--
Thallium	Metals	4	--	--
Uranium	Metals	2	--	--
Vanadium	Metals	12	--	--
Zinc	Metals	12	--	--
Antimony-125	Radiochemistry	1	--	--
Beryllium-7	Radiochemistry	1	--	--
Carbon-14	Radiochemistry	1	--	--
Cesium-134	Radiochemistry	1	--	--
Cesium-137	Radiochemistry	1	--	--
Cobalt-60	Radiochemistry	1	--	--
Europium-152	Radiochemistry	1	--	--
Europium-154	Radiochemistry	1	--	--
Europium-155	Radiochemistry	1	--	--
Gross Alpha	Radiochemistry	7	--	--
Gross Beta	Radiochemistry	7	1	14
Iodine-129	Radiochemistry	30	--	--
Potassium-40	Radiochemistry	1	--	--
Ruthenium-106	Radiochemistry	1	--	--
Strontium-90	Radiochemistry	4	--	--
Technetium-99	Radiochemistry	31	2	6.5
Tritium	Radiochemistry	4	--	--
Uranium-238	Radiochemistry	8	--	--
2,4-Dichlorophenol	SVOC	1	--	--
2-Chlorophenol	SVOC	1	--	--
2-Methylphenol (cresol, *o*-)	SVOC	1	--	--
2-Nitrophenol	SVOC	1	--	--

Table 5-9. Summary of Field Split Samples

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
3+4 Methylphenol (cresol, *m*+*p*)	SVOC	1	--	--
4-Chloro-3-methylphenol	SVOC	1	--	--
4-Nitrophenol	SVOC	1	--	--
Pentachlorophenol	SVOC	1	--	--
Phenol	SVOC	1	--	--
Totals		**1,201**	**35**	**2.9**

Note: Shading denotes those analytes that were identified as COPCs in DOE/RL-2007-18, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-5 Groundwater Operable Unit*, Appendix A.

* Split samples should have RPD <20 when the results from both laboratories are >5 times the respective reporting limits.

5.5.3 Field Blank Samples

Three types of field blanks were gathered during the collection of 200-BP-5 Groundwater OU groundwater samples: equipment rinsate blanks, field transfer blanks, and trip blanks. Equipment rinsate blanks are high purity water samples used in the final rinse of sampling equipment before the equipment is reused to collect another sample. These blanks are not required for sampling events using disposable or dedicated sampling equipment.

Field transfer blanks are generated by pouring laboratory water into sample containers in the field during a sampling event to detect any contaminants that may be introduced into groundwater during the bottle-filling activities. Trip blanks are clean water samples that are prepared in the lab and taken into the field with the sampling crew. Trip blanks are a measure of potential contamination associated with sample collection and transportation to the laboratory.

For the purpose of the DQA, all blank results were pooled. Table 5-10 lists the laboratory blanks analyzed by analyte class. Table 5-11 displays the blank data by constituent. There were 24,723 individual blank results, of which 1,069 or 4.3 percent exceeded the QC acceptance criteria listed in Table 5-5. Constituents and properties with high (>10 percent) overall percentages of positive blanks include chloride, nitrogen in nitrate, specific conductance, total organic halides, calcium, magnesium, sodium, americium-241, methylene chloride, and oil and grease.

Table 5-10. Total Field Blank Results by Analyte Class

Analyte Class	Results
Anions	1,810
General Chemistry	2,406
Metals	15,905
Radiochemistry	2,597
SVOCs	1,356
VOCs	649
Total	**24,723**

Table 5-11. Summary of Field Blank Samples

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Bromide	Anions	3	--	--
Chloride	Anions	321	34	11
Cyanide	Anions	192	--	--
Fluoride	Anions	321	--	--
Nitrate	Anions	9	--	--
Nitrite	Anions	9	--	--
Nitrogen in Ammonia	Anions	2	--	--
Nitrogen in Nitrate	Anions	311	34	11
Nitrogen in Nitrite	Anions	315	--	--
Phosphate	Anions	4	--	--
Phosphorus in Phosphate	Anions	2	--	--
Sulfate	Anions	321	1	0.3
Alkalinity	General Chemistry	321	--	--
Coliform Bacteria	General Chemistry	3	--	--
Oil and Grease	General Chemistry	1	1	100
Specific Conductance	General Chemistry	6	1	17
Total Organic Carbon	General Chemistry	1,218	8	0.7
Total Organic Halides	General Chemistry	854	120	14
Total Petroleum Hydrocarbons – Diesel Range	General Chemistry	1	--	--
Total Petroleum Hydrocarbons – Gasoline Range	General Chemistry	1	--	--
Total Petroleum Hydrocarbons – Kerosene Range	General Chemistry	1	--	--
Aluminum	Metals	137	11	8
Antimony	Metals	853	--	--
Arsenic	Metals	79	1	1.3
Barium	Metals	851	--	--
Beryllium	Metals	853	--	--
Cadmium	Metals	853	--	--
Calcium	Metals	855	281	33

Table 5-11. Summary of Field Blank Samples

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Chromium	Metals	849	29	3.4
Cobalt	Metals	853	4	0.5
Copper	Metals	849	5	0.6
Hexavalent Chromium	Metals	30	1	3.3
Iron	Metals	852	6	0.7
Lead	Metals	77	--	--
Magnesium	Metals	853	217	25
Manganese	Metals	853	6	0.7
Mercury	Metals	110	--	--
Nickel	Metals	853	4	0.5
Potassium	Metals	853	4	0.5
Silver	Metals	851	22	2.6
Sodium	Metals	852	166	20
Strontium	Metals	820	1	0.1
Thallium	Metals	46	--	--
Vanadium	Metals	853	10	1.2
Zinc	Metals	854	62	7.3
Americium-241	Radiochemistry	13	2	15
Antimony-125	Radiochemistry	145	--	--
Beryllium-7	Radiochemistry	141	--	--
Carbon-14	Radiochemistry	12	--	--
Cesium-134	Radiochemistry	145	--	--
Cesium-137	Radiochemistry	145	--	--
Cobalt-60	Radiochemistry	145	--	--
Europium-152	Radiochemistry	145	--	--
Europium-154	Radiochemistry	145	--	--
Europium-155	Radiochemistry	145	--	--
Gross alpha	Radiochemistry	134	1	0.7

Table 5-11. Summary of Field Blank Samples

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Gross beta	Radiochemistry	213	15	7
Iodine-129	Radiochemistry	74	--	--
Neptunium-237	Radiochemistry	13	--	--
Plutonium-238	Radiochemistry	20	--	--
Plutonium-239/240	Radiochemistry	20	--	--
Potassium-40	Radiochemistry	143	4	2.8
Ruthenium-106	Radiochemistry	141	--	--
Strontium-90	Radiochemistry	19	--	--
Technetium-99	Radiochemistry	241	--	--
Thorium-228	Radiochemistry	10	--	--
Thorium-230	Radiochemistry	10	--	--
Thorium-232	Radiochemistry	10	--	--
Tritium	Radiochemistry	255	7	2.7
Uranium	Radiochemistry	229	6	2.6
1,2,4,5-Tetrachlorobenzene	SVOC	1	--	--
1,2,4-Trichlorobenzene	SVOC	11	--	--
1,2-Dichlorobenzene	SVOC	1	--	--
1,3-Dichlorobenzene	SVOC	1	--	--
1,4-Dioxane	SVOC	5	--	--
1,4-Naphthoquinone	SVOC	1	--	--
1-Naphthylamine	SVOC	1	--	--
2,3,4,6-Tetrachlorophenol	SVOC	52	--	--
2,4,5-Trichlorophenol	SVOC	52	--	--
2,4,6-Trichlorophenol	SVOC	52	--	--
2,4-Dichlorophenol	SVOC	63	--	--
2,4-Dimethylphenol	SVOC	52	--	--
2,4-Dinitrophenol	SVOC	52	--	--
2,4-Dinitrotoluene	SVOC	11	--	--

Table 5-11. Summary of Field Blank Samples

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
2,6-Dichlorophenol	SVOC	52	--	--
2,6-Dinitrotoluene	SVOC	1	--	--
2-Acetylaminofluorene	SVOC	1	--	--
2-Chloronaphthalene	SVOC	1	--	--
2-Chlorophenol	SVOC	62	--	--
2-Methylnaphthalene	SVOC	1	--	--
2-Methylphenol (cresol, *o*-)	SVOC	63	--	--
2-Naphthylamine	SVOC	1	--	--
2-Nitroaniline	SVOC	1	--	--
2-Nitrophenol	SVOC	63	--	--
2-Picoline	SVOC	12	--	--
3,3'-Dichlorobenzidine	SVOC	1	--	--
3,3'-Dimethylbenzidine	SVOC	1	--	--
3+4 Methylphenol (cresol, *m*+*p*)	SVOC	58	--	--
3-Methylcholanthrene	SVOC	1	--	--
3-Nitroaniline	SVOC	1	--	--
4,6-Dinitro-2-methylphenol	SVOC	52	--	--
4-Aminobiphenyl	SVOC	1	--	--
4-Bromophenyl Phenyl Ether	SVOC	1	--	--
4-Chloro-3-methylphenol	SVOC	62	--	--
4-Chloroaniline	SVOC	1	--	--
4-Chlorophenylphenyl ether	SVOC	1	--	--
4-Methylphenol (cresol, *p*-)	SVOC	1	--	--
4-Nitroaniline	SVOC	1	--	--
4-Nitrophenol	SVOC	62	--	--
4-Nitroquinoline-1-oxide	SVOC	1	--	--
5-Nitro-*o*-toluidine	SVOC	1	--	--
7,12-Dimethylbenz[a]anthracene	SVOC	1	--	--

Table 5-11. Summary of Field Blank Samples

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Acenaphthene	SVOC	11	--	--
Acenaphthylene	SVOC	1	--	--
Acetophenone	SVOC	1	--	--
alpha,alpha-Dimethylphenethylamine	SVOC	1	--	--
Aniline	SVOC	1	--	--
Anthracene	SVOC	1	--	--
Aramite	SVOC	1	--	--
Aroclor 1016	SVOC	19	--	--
Aroclor 1221	SVOC	19	--	--
Aroclor 1232	SVOC	19	--	--
Aroclor 1242	SVOC	19	--	--
Aroclor 1248	SVOC	19	--	--
Aroclor 1254	SVOC	19	--	--
Aroclor 1260	SVOC	19	--	--
Azobenzene	SVOC	1	--	--
Benzo(a)anthracene	SVOC	1	--	--
Benzo(a)pyrene	SVOC	1	--	--
Benzo(b)fluoranthene	SVOC	1	--	--
Benzo(ghi)perylene	SVOC	1	--	--
Benzo(k)fluoranthene	SVOC	1	--	--
Benzothiazole	SVOC	11	--	--
Benzyl alcohol	SVOC	1	--	--
Bis(2-chloro-1-methylethyl)ether	SVOC	1	--	--
Bis(2-Chloroethoxy)methane	SVOC	1	--	--
Bis(2-chloroethyl)ether	SVOC	1	--	--
Bis(2-ethylhexyl)phthalate	SVOC	12	--	--
Butylbenzylphthalate	SVOC	1	--	--
Chlorobenzilate	SVOC	1	--	--

Table 5-11. Summary of Field Blank Samples

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Chrysene	SVOC	1	--	--
Diallate	SVOC	1	--	--
Dibenz[a,h]anthracene	SVOC	1	--	--
Dibenzofuran	SVOC	1	--	--
Diethylphthalate	SVOC	1	--	--
Dimethoate	SVOC	1	--	--
Dimethyl Phthalate	SVOC	1	--	--
Di-*n*-butylphthalate	SVOC	1	--	--
Di-*n*-octylphthalate	SVOC	1	--	--
Dinoseb(2-secButyl-4,6-dinitrophenol)	SVOC	52	--	--
Disulfoton	SVOC	1	--	--
Ethyl Methanesulfonate	SVOC	1	--	--
Famphur	SVOC	1	--	--
Fluoranthene	SVOC	1	--	--
Fluorene	SVOC	1	--	--
Hexachlorobenzene	SVOC	1	--	--
Hexachlorobutadiene	SVOC	1	--	--
Hexachlorocyclopentadiene	SVOC	1	--	--
Hexachloroethane	SVOC	1	--	--
Hexachlorophene	SVOC	1	--	--
Hexachloropropene	SVOC	1	--	--
Indeno(1,2,3-cd)pyrene	SVOC	1	--	--
Isodrin	SVOC	1	--	--
Isophorone	SVOC	1	--	--
Isosafrole	SVOC	1	--	--
Kepone	SVOC	1	--	--
m-Dinitrobenzene	SVOC	1	--	--
Methapyrilene	SVOC	1	--	--

Table 5-11. Summary of Field Blank Samples

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Methyl Methanesulfonate	SVOC	1	--	--
Methyl Parathion	SVOC	1	--	--
Naphthalene	SVOC	12	--	--
Nitrobenzene	SVOC	1	--	--
Nitrosopyrrolidine	SVOC	1	--	--
n-Nitrosodiethylamine	SVOC	1	--	--
n-Nitrosodimethylamine	SVOC	1	--	--
n-Nitrosodi-*n*-butylamine	SVOC	1	--	--
n-Nitrosodi-*n*-dipropylamine	SVOC	11	--	--
n-Nitrosodiphenylamine	SVOC	1	--	--
n-Nitrosomethylethylamine	SVOC	1	--	--
n-Nitrosomorpholine	SVOC	1	--	--
n-Nitrosopiperidine	SVOC	1	--	--
O,*O*,*O*-Triethyl Phosphorothioate	SVOC	1	--	--
O,*O*-Diethyl O-2-pyrazinyl Phosphorothioate	SVOC	1	--	--
o-Toluidine	SVOC	1	--	--
Parathion	SVOC	1	--	--
p-Dimethylaminoazobenzene	SVOC	1	--	--
Pentachlorobenzene	SVOC	1	--	--
Pentachloroethane	SVOC	1	--	--
Pentachloronitrobenzene	SVOC	1	--	--
Pentachlorophenol	SVOC	63	--	--
Phenacetin	SVOC	1	--	--
Phenanthrene	SVOC	1	--	--
Phenol	SVOC	63	--	--
Phorate	SVOC	1	--	--
p-Phenylenediamine	SVOC	1	--	--
Pronamide	SVOC	1	--	--

Table 5-11. Summary of Field Blank Samples

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Pyrene	SVOC	11	--	--
Pyridine	SVOC	1	--	--
Safrol	SVOC	1	--	--
sym-Trinitrobenzene	SVOC	1	--	--
Tetraethyl Dithiopyrophosphate (Sulfotepp)	SVOC	1	--	--
Total Cresols	SVOC	1	--	--
Tributyl Phosphate	SVOC	12	--	--
Tris-2-chloroethyl Phosphate	SVOC	11	--	--
1,1,1,2-Tetrachloroethane	VOC	1	--	--
1,1,1-Trichloroethane	VOC	23	--	--
1,1,2,2-Tetrachloroethane	VOC	1	--	--
1,1,2-Trichloroethane	VOC	23	--	--
1,1-Dichloroethane	VOC	23	--	--
1,1-Dichloroethene	VOC	23	--	--
1,2,3-Trichloropropane	VOC	1	--	--
1,2-Dibromo-3-chloropropane	VOC	1	--	--
1,2-Dibromoethane	VOC	1	--	--
1,2-Dichloroethane	VOC	23	--	--
1,2-Dichloroethene (Total)	VOC	1	--	--
1,2-Dichloropropane	VOC	1	--	--
1,4-Dichlorobenzene	VOC	66	--	--
1-Butanol	VOC	23	--	--
2-Butanone	VOC	23	--	--
2-Hexanone	VOC	1	--	--
2-Pentanone, 4-Methyl	VOC	23	--	--
Acetone	VOC	23	--	--
Acetonitrile	VOC	1	--	--
Acrolein	VOC	1	--	--

Table 5-11. Summary of Field Blank Samples

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Allyl Chloride	VOC	1	--	--
Benzene	VOC	23	--	--
Bromodichloromethane	VOC	1	--	--
Bromoform	VOC	1	--	--
Bromomethane	VOC	1	--	--
Carbon Disulfide	VOC	23	--	--
Carbon Tetrachloride	VOC	23	--	--
Chlorobenzene	VOC	20	--	--
Chloroethane	VOC	1	--	--
Chloroform	VOC	23	--	--
Chloromethane	VOC	1	--	--
Chloroprene	VOC	1	--	--
cis-1,2-Dichloroethylene	VOC	23	--	--
cis-1,3-Dichloropropene	VOC	1	--	--
Dibromochloromethane	VOC	1	--	--
Dibromomethane	VOC	1	--	--
Dichlorodifluoromethane	VOC	1	--	--
Ethyl Cyanide	VOC	23	--	--
Ethyl Methacrylate	VOC	1	--	--
Ethylbenzene	VOC	23	--	--
Iodomethane	VOC	1	--	--
Isobutyl Alcohol	VOC	1	--	--
Methacrylonitrile	VOC	1	--	--
Methyl Methacrylate	VOC	1	--	--
Methylene Chloride	VOC	23	5	22
Styrene	VOC	1	--	--
Tetrachloroethene	VOC	23	--	--
Tetrahydrofuran	VOC	23	--	--

Table 5-11. Summary of Field Blank Samples

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Toluene	VOC	23	--	--
trans-1,2-Dichloroethylene	VOC	23	--	--
trans-1,3-Dichloropropene	VOC	1	--	--
trans-1,4-Dichloro-2-butene	VOC	1	--	--
Trichloroethene	VOC	23	--	--
Trichloromonofluoromethane	VOC	1	--	--
Vinyl Acetate	VOC	1	--	--
Vinyl Chloride	VOC	23	--	--
Xylenes (Total)	VOC	23	--	--
Totals		**24,723**	**1,069**	**4.3**

Note: Shading denotes those analytes that were identified as COPCs in DOE/RL-2007-18, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-5 Groundwater Operable Unit*, Appendix A.

***** The field blank limit is 2 times the MDL, IDL, or MDA. However, for common laboratory contaminants acetone, methylene chloride, 2-butanone, toluene, and phthalate esters, the QC limit is 5 times the MDL. In some cases, the MDL is not provided electronically and is estimated. A ratio of the result to QC limit is provided to help evaluate the extent of the failure.

5.6 Laboratory Quality Control

This section summarizes the review of the laboratory QC associated with the 200-BP-5 OU groundwater data set from the past 5 years. Laboratory contamination (Section 5.6.1), precision (Section 5.6.2), accuracy (Section 5.6.3), completeness (Section 6.1), and comparability (Section 4.2.1) are evaluated.

The data set consists of 550,147 laboratory QC results. This includes 51,394 lab blanks, 14,933 duplicate pairs, 44,453 laboratory control standards, 36,367 MSs, and over 403,000 individual surrogate results. Of these, 12.4 percent could not be evaluated because the data set did not include a reference to the associated method detection limit or minimum detectable activity value, which was necessary for evaluation. These lab QC results are applicable to the data set but cannot be associated with specific well sample results. The laboratory QC elements were evaluated against the criteria listed in Table 5-12.

Table 5-12. Laboratory Quality Control Acceptance Criteria

Quality Control Element	Acceptance Criteria
Lab Blanks	Lab blank limit is 2 times the MDL, IDL, or MDA. However, for common laboratory contaminants acetone, methylene chloride, 2-butanone, toluene, and phthalate esters, the QC limit is 5 times the MDL.
Lab Duplicates	Lab duplicates with a result greater than 5 times the MDL or MDA must have RPD ≤20 to be considered acceptable.
Laboratory Control Samples	LCS percent recovery must be between the laboratory provided minimum control limit and maximum control limit.
Lab Spikes	Lab spikes where the sample result is ≤4 times the spiking concentration are evaluated by comparing the percent recovery with the minimum and maximum control limits provided by the laboratory. In addition, where the sample result is ≤4 times the spiking concentration, the MS/MSD RPD must have RPD ≤20.

5.6.1 Laboratory Contamination

Hanford Site laboratory contracts require that laboratory method blanks be analyzed with each batch of up to 20 samples. A total of 51,394 lab blanks were reported with the lab QC associated with the 200-BP-5 Groundwater OU data set. This represents 53 percent of the total number of sample results. There were 18,697 lab blank results with no identified minimum detectable concentration or minimum detectable activity. These blanks were not evaluated.

Of the remaining 32,697 laboratory blanks, 32 individual analytes displayed an unacceptable positive result, indicating potential laboratory contamination. A total of 15,750 laboratory blank results are associated with these 32 analytes. Of these results, 348 or 2.2 percent displayed an unacceptable positive result indicating potential laboratory contamination.

Table 5-13 lists the total number of laboratory blanks analyzed by analyte class. Table 5-14 shows the distribution of the potential laboratory contamination, by analyte, in the positive blanks, as well as the total number of blanks collected for each of the 32 analytes. Of the 32 analytes, phosphate had 100 percent of its results out of limits.

Table 5-13. Total Laboratory Blank Results by Class

Analyte Class	Results
Anions	3,687
General Chemistry	1,045
Metals	15,451
Radiochemistry	4,868
SVOCs	3,845
VOCs	3,801
Total	**32,697**

Table 5-14. Distribution of Potential Lab Contamination in Lab Blank Results Exceeding Quality Control Criteria

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Calcium	Anions	766	46	6.0
Chloride	Anions	668	95	14
Cyanide	Anions	274	2	0.7
Fluoride	Anions	660	3	0.5
Nitrogen in Nitrate	Anions	688	3	0.4
Nitrogen in Nitrite	Anions	656	3	0.5
Phosphate	Anions	2	2	100
Sulfate	Anions	667	17	2.5
Alkalinity	General Chemistry	257	3	1.2
Total Organic Halides	General Chemistry	395	6	1.5
Aluminum	Metals	214	27	13
Arsenic	Metals	262	2	0.8
Barium	Metals	779	12	1.5
Beryllium	Metals	784	9	1.1
Copper	Metals	774	9	1.2
Iron	Metals	772	6	0.8
Lithium	Metals	26	2	7.7
Manganese	Metals	769	2	0.3
Mercury	Metals	189	2	1.1
Nickel	Metals	766	1	0.1
Potassium	Metals	765	3	0.4
Silver	Metals	779	8	1.0
Sodium	Metals	765	12	1.6
Strontium	Metals	760	2	0.3
Zinc	Metals	767	50	6.5
Gross Beta	Radiochemistry	241	2	0.8
Technetium-99	Radiochemistry	345	1	0.3
Uranium	Radiochemistry	527	4	0.8

Table 5-14. Distribution of Potential Lab Contamination in Lab Blank Results Exceeding Quality Control Criteria

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Benzene	VOC	133	3	2.3
Chloroform	VOC	133	3	2.3
Chloromethane	VOC	45	1	2.2
Methylene Chloride	VOC	122	7	5.7
Totals		**15,750**	**348**	**2.2**

Note: Shading denotes those analytes that were identified as COPCs in DOE/RL-2007-18, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-5 Groundwater Operable Unit*, Appendix A.

* Lab blank limit is 2 times the MDL, IDL, or MDA. However, for common laboratory contaminants acetone, methylene chloride, 2-butanone, toluene, and phthalate esters, the QC limit is 5 times the MDL.

5.6.2 Laboratory Precision

The laboratory precision is determined by the difference between duplicate sample pair results or between MS/MSD pairs. Normally, sample duplicates are used for metals and anions while MSs/MSDs are used for organic analyses.

There were a total of 14,933 laboratory duplicate pairs. This represents 15.5 percent of the total number of 200-BP-5 Groundwater OU results. This exceeds the minimum 1-in-20 QC requirement.

There were 2,982 lab duplicate pair results with no identified minimum detectable concentration or minimum detectable activity. These lab duplicate pairs were not evaluated.

Of the remaining 11,951 laboratory duplicates, 33 individual analytes exceeded the acceptance criteria in Table 5-12. A total of 10,222 laboratory duplicate pair results are associated with these 33 analytes. Of these results, 170 or 1.7 percent exceeded laboratory precision criteria.

Table 5-15 lists the total number of laboratory blanks analyzed by analyte class. Table 5-16 shows the distribution of the potential laboratory contamination, by analyte, in the positive blanks, as well as the total number of blanks collected for each of the 33 analytes. Of the 33 analytes, plutonium-242 and total petroleum hydrocarbons – gasoline range each had 100 percent of their results out of limits.

Table 5-15. Total Laboratory Duplicate Results by Class

Analyte Class	Results
Anions	4,958
General Chemistry	1,608
Radiochemistry	4,668
SVOCs	1
VOCs	661
Total	**11,951**

5.6.3 Accuracy

Three types of QC are used to assess accuracy. The laboratory control sample (LCS) is used to assess the performance of the laboratory with respect to the method and the accuracy of the laboratory

preparation and analysis processes. The MSs are used to assess the accuracy of the published method on the sample matrix and evaluate matrix effects that may bias the data.

Table 5-16. Distribution of Analytes in Laboratory Duplicate Pairs with Relative Percent Differences Exceeding Quality Control Criteria

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Chloride	Anions	944	13	1.4
Cyanide	Anions	166	11	6.6
Fluoride	Anions	943	20	2.1
Nitrogen in Nitrate	Anions	954	6	0.6
Nitrogen in Nitrite	Anions	933	24	2.6
Sulfate	Anions	944	9	1.0
Alkalinity	General Chemistry	674	1	0.1
Total Organic Carbon	General Chemistry	571	2	0.4
Total Organic Halides	General Chemistry	323	7	2.2
Total Petroleum Hydrocarbons – Gasoline Range	General Chemistry	4	4	100
Hexavalent Chromium	Metals	37	1	2.7
Antimony-125	Radiochemistry	285	1	0.4
Beryllium-7	Radiochemistry	276	1	0.4
Carbon-14	Radiochemistry	47	4	8.5
Cesium-134	Radiochemistry	285	1	0.4
Cobalt-60	Radiochemistry	285	9	3.2
Europium-154	Radiochemistry	285	1	0.4
Europium-155	Radiochemistry	285	1	0.4
Gross Alpha	Radiochemistry	188	2	1.1
Gross Beta	Radiochemistry	229	7	3.1
Iodine-129	Radiochemistry	250	14	5.6
Plutonium-239/240	Radiochemistry	53	2	3.8
Plutonium-242	Radiochemistry	1	1	100
Potassium-40	Radiochemistry	285	1	0.4

Table 5-16. Distribution of Analytes in Laboratory Duplicate Pairs with Relative Percent Differences Exceeding Quality Control Criteria

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Ruthenium-106	Radiochemistry	277	1	0.4
Strontium-90	Radiochemistry	93	1	1.1
Technetium-99	Radiochemistry	336	5	1.5
Tritium	Radiochemistry	181	2	1.1
1,4-Dioxane	VOC	19	6	32
1-Butanol	VOC	19	4	21
2-Butanone	VOC	22	4	18
Acetone	VOC	22	3	14
Acrolein	VOC	6	1	17
Totals		**10,222**	**170**	**1.7**

Note: Shading denotes those analytes that were identified as COPCs in DOE/RL-2007-18, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-5 Groundwater Operable Unit*, Appendix A.

* Lab duplicates with a result greater than 5 times the MDL or MDA must have RPD ≤20 to be considered acceptable.

5.6.3.1 Laboratory Control Samples

There were 44,453 LCSs results reported for the 200-BP-5 Groundwater OU data set, 53 of which were not accompanied by method detection limit or minimum detectable activity and were not included in the evaluation.

Of the remaining 44,400 LCS results, 80 individual analytes exceeded the acceptance criteria in Table 5-12. A total of 35,444 LCS results are associated with these 80 analytes. Of these results, 280 or 0.8 percent exceeded QC requirements for the LCS percent recovery to be within the minimum and maximum laboratory control limits.

Table 5-17 lists the total number of LCS analyzed by analyte class. Table 5-18 shows the distribution of the analytes that exceeded these limits, as well as the total number of samples collected for each of the 80 analytes. Of the 280 exceedences, 11 recoveries were greater than 200 percent; these include antimony, beryllium, cadmium, calcium, copper, iron, magnesium, potassium, sodium, strontium, and zinc.

Table 5-17. Total Laboratory Control Sample Results by Class

Analyte Class	Results
Anions	6,331
General Chemistry	2,999
Metals	24,624
Radiochemistry	5,244
SVOCs	3,382
VOCs	1,820
Total	**44,400**

Table 5-18. Laboratory Control Sample Results Exceeding Quality Control Criteria

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Chloride	Anions	1,123	3	0.3
Cyanide	Anions	546	17	3.1
Nitrogen in Nitrate	Anions	1,144	3	0.3
Nitrogen in Nitrite	Anions	1,111	9	0.8
Sulfate	Anions	1,122	4	0.4
Total Organic Carbon	General Chemistry	371	8	2.2
Aluminum	Metals	356	1	0.3
Antimony	Metals	1,185	6	0.5
Barium	Metals	1,189	4	0.3
Beryllium	Metals	1,184	1	0.1
Cadmium	Metals	1,199	1	0.1
Calcium	Metals	1,159	6	0.5
Chromium	Metals	1,256	1	0.1
Cobalt	Metals	1,184	1	0.1
Copper	Metals	1,184	1	0.1
Iron	Metals	1,167	2	0.2
Magnesium	Metals	1,160	1	0.1
Manganese	Metals	1,180	1	0.1
Mercury	Metals	356	19	5.3
Nickel	Metals	1,175	1	0.1
Potassium	Metals	1,159	10	0.9
Silver	Metals	1,183	1	0.1
Sodium	Metals	1,158	1	0.1
Strontium	Metals	1,164	4	0.3
Uranium	Metals	1,311	9	0.7
Vanadium	Metals	1,177	1	0.1
Zinc	Metals	1,168	1	0.1
Carbon-14	Radiochemistry	49	2	4.1

Table 5-18. Laboratory Control Sample Results Exceeding Quality Control Criteria

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Cesium-137	Radiochemistry	331	1	0.3
Gross Alpha	Radiochemistry	534	9	1.7
Gross Beta	Radiochemistry	613	10	1.6
Iodine-129	Radiochemistry	254	7	2.8
Neptunium-237	Radiochemistry	59	1	1.7
Plutonium-239/240	Radiochemistry	116	2	1.7
Plutonium-242	Radiochemistry	5	1	20
Technetium-99	Radiochemistry	836	3	0.4
Thorium-232	Radiochemistry	3	3	100
Tritium	Radiochemistry	1,058	23	2.2
Uranium-235	Radiochemistry	1	1	100
2,3,4,6-Tetrachlorophenol	SVOC	106	3	2.8
2,4,5-Trichlorophenol	SVOC	112	4	3.6
2,4,6-Trichlorophenol	SVOC	112	3	2.7
2,4-Dichlorophenol	SVOC	133	3	2.3
2,4-Dimethylphenol	SVOC	115	3	2.6
2,4-Dinitrophenol	SVOC	114	7	6.1
2,6-Dichlorophenol	SVOC	106	4	3.8
2-Chlorophenol	SVOC	175	4	2.3
2-Methylphenol (cresol, *o*-)	SVOC	136	3	2.2
2-Nitrophenol	SVOC	133	2	1.5
3+4 Methylphenol (cresol, *m*+*p*)	SVOC	110	3	2.7
4,6-Dinitro-2-methylphenol	SVOC	112	2	1.8
4-Chloro-3-methylphenol	SVOC	173	4	2.3
4-Nitrophenol	SVOC	175	3	1.7
Anthracene	SVOC	9	2	22
Aroclor 1016	SVOC	27	1	3.7
Aroclor 1260	SVOC	27	1	3.7

Table 5-18. Laboratory Control Sample Results Exceeding Quality Control Criteria

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Benzo(a)anthracene	SVOC	6	2	33
Benzo(a)pyrene	SVOC	9	2	22
Benzo(b)fluoranthene	SVOC	6	2	33
Benzo(k)fluoranthene	SVOC	6	2	33
Bis(2-ethylhexyl) phthalate	SVOC	29	2	6.9
Butylbenzylphthalate	SVOC	6	2	33
Chrysene	SVOC	6	2	33
Di-*n*-octylphthalate	SVOC	12	2	17
Dinoseb(2-secButyl-4,6-dinitrophenol)	SVOC	107	3	2.8
Fluoranthene	SVOC	6	2	33
Hexachlorobenzene	SVOC	11	2	18
Pentachlorophenol	SVOC	177	2	1.1
Phenanthrene	SVOC	6	2	33
Phenol	SVOC	179	2	1.1
Pyrene	SVOC	69	2	2.9
1,1-Dichloroethene	VOC	169	2	1.2
1,2-Dichloroethane	VOC	34	2	5.9
1,2-Dichloroethane-d4	VOC	38	3	7.9
1,4-Dioxane	VOC	22	1	4.5
4-Methyl-2-pentanone	VOC	34	1	2.9
Bromomethane	VOC	8	2	25
Carbon Disulfide	VOC	34	3	8.8
Chloroform	VOC	34	1	2.9
cis-1,2-Dichloroethylene	VOC	31	2	6.5
Totals		**35,444**	**280**	**0.8**

Note: Shading denotes those analytes that were identified as COPCs in DOE/RL-2007-18, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-5 Groundwater Operable Unit*, Appendix A.

* LCS percent recovery must be between the laboratory provided minimum control limit and maximum control limit.

5.6.3.2 Laboratory Spike Recovery

Laboratory spike recovery is also used as a measure of laboratory accuracy. For the 200-BP-5 Groundwater OU data set, there were 36,367 individual spiked sample results, of which 10,646 did not have associated method detection limits or minimum detectable activity data and were not evaluated. The laboratory spikes are listed by class in Table 5-19.

Table 5-19. Total Laboratory Spikes by Class

Analyte Class	Results
Anions	3,421
General Chemistry	1,040
Metals	14,761
Radiochemistry	458
SVOCs	4,185
VOCs	1,856
Total	**25,721**

Of the remaining 25,721 MS results, 91 individual analytes exceeded the minimum and/or maximum control limits set up by the laboratory. A total of 23,966 MS results are associated with these 91 analytes. Of these results, 1,245 or 5.2 percent exceeded the minimum and/or maximum control limits set up by the laboratory. Table 5-20 shows the distribution of analytes in these spike recovery failures.

Table 5-20. Laboratory Matrix Spike Results Outside of Quality Control Criteria

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Chloride	Anions	629	47	7.5
Cyanide	Anions	211	47	22
Fluoride	Anions	620	51	8.2
Nitrogen in Ammonia	Anions	8	5	63
Nitrogen in Nitrate	Anions	615	52	8.5
Nitrogen in Nitrite	Anions	619	180	29
Phosphorus in Phosphate	Anions	60	2	3.3
Sulfate	Anions	618	43	7.0
Alkalinity	General Chemistry	235	3	1.3
Specific Conductance	General Chemistry	13	1	7.7
Total Organic Carbon	General Chemistry	329	26	7.9
Total Organic Halides	General Chemistry	450	6	1.3
Total Petroleum Hydrocarbons – Gasoline Range	General Chemistry	12	4	33
Aluminum	Metals	266	3	1.1
Antimony	Metals	754	4	0.5

Table 5-20. Laboratory Matrix Spike Results Outside of Quality Control Criteria

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Arsenic	Metals	258	2	0.8
Barium	Metals	756	3	0.4
Beryllium	Metals	752	3	0.4
Cadmium	Metals	763	4	0.5
Calcium	Metals	727	4	0.6
Chromium	Metals	797	18	2.3
Cobalt	Metals	744	3	0.4
Copper	Metals	747	3	0.4
Hexavalent Chromium	Metals	36	3	8.3
Iron	Metals	734	33	4.5
Magnesium	Metals	730	15	2.1
Manganese	Metals	733	3	0.4
Mercury	Metals	205	4	2.0
Nickel	Metals	732	3	0.4
Potassium	Metals	732	18	2.5
Silver	Metals	759	17	2.2
Sodium	Metals	725	5	0.7
Strontium	Metals	725	9	1.2
Thallium	Metals	95	2	2.1
Uranium	Metals	336	8	2.4
Vanadium	Metals	735	3	0.4
Zinc	Metals	726	4	0.6
Technetium-99	Radiochemistry	288	16	5.6
1,2,4-Trichlorobenzene	SVOC	52	2	3.8
1,2-Dichlorobenzene	SVOC	6	2	33
1,3-Dichlorobenzene	SVOC	6	2	33
1,4-Dichlorobenzene	SVOC	110	12	11
2,3,4,6-Tetrachlorophenol	SVOC	170	21	12

Table 5-20. Laboratory Matrix Spike Results Outside of Quality Control Criteria

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
2,4,5-Trichlorophenol	SVOC	176	19	11
2,4,6-Trichlorophenol	SVOC	176	17	9.7
2,4-Dichlorophenol	SVOC	202	18	8.9
2,4-Dimethylphenol	SVOC	180	19	11
2,4-Dinitrophenol	SVOC	178	19	11
2,4-Dinitrotoluene	SVOC	47	3	6.4
2,6-Dichlorophenol	SVOC	170	21	12
2-Chlorophenol	SVOC	216	28	13
2-Methylphenol (cresol, *o*-)	SVOC	203	20	9.9
2-Nitrophenol	SVOC	202	20	9.9
2-Picoline	SVOC	17	7	41
3,3'-Dichlorobenzidine	SVOC	10	2	20
3+4 Methylphenol (cresol, *m*+*p*)	SVOC	178	17	9.6
4,6-Dinitro-2-methylphenol	SVOC	176	19	11
4-Chloro-3-methylphenol	SVOC	216	32	15
4-Chloroaniline	SVOC	11	2	18
4-Nitrophenol	SVOC	215	37	17
Aroclor 1016	SVOC	42	13	31
Aroclor 1260	SVOC	42	12	29
Benzo(ghi)perylene	SVOC	6	2	33
Benzo(k)fluoranthene	SVOC	6	2	33
Chrysene	SVOC	6	4	67
Dibenz[a,h]anthracene	SVOC	6	2	33
Di-n-octylphthalate	SVOC	13	2	15
Dinoseb(2-secButyl-4,6-dinitrophenol)	SVOC	172	31	18
Hexachlorobutadiene	SVOC	6	2	33
Hexachlorocyclopentadiene	SVOC	8	6	75
Hexachloroethane	SVOC	14	2	14

Table 5-20. Laboratory Matrix Spike Results Outside of Quality Control Criteria

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Indeno(1,2,3-cd)pyrene	SVOC	6	2	33
Pentachlorophenol	SVOC	223	29	13
Phenol	SVOC	222	36	16
1,1,1-Trichloroethane	VOC	59	10	17
1,1-Dichloroethane	VOC	58	8	14
1,1-Dichloroethene	VOC	109	7	6.4
1,2-Dichloroethane	VOC	58	8	14
1,4-Dioxane	VOC	34	8	24
4-Methyl-2-pentanone	VOC	58	2	3.4
Acetone	VOC	58	2	3.4
Benzene	VOC	115	8	7.0
Bromomethane	VOC	8	4	50
Carbon Disulfide	VOC	58	4	6.9
Carbon Tetrachloride	VOC	55	6	11
Chloroform	VOC	58	8	14
cis-1,2-Dichloroethylene	VOC	52	8	15
Iodomethane	VOC	8	2	25
trans-1,2-Dichloroethylene	VOC	54	8	15
Trichloroethene	VOC	111	1	0.9
Vinyl Chloride	VOC	58	2	3.4
Totals		**23,966**	**1,245**	**5.2**

Note: Shading denotes those analytes that were identified as COPCs in DOE/RL-2007-18, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-5 Groundwater Operable Unit*, Appendix A.

* Lab spikes where the sample result is ≤4 times the spiking concentration are evaluated by comparing the percent recovery with the minimum and maximum control limits provided by the laboratory. In addition, where the sample result is ≤4 times the spiking concentration, the MS/MSD RPD must have RPD ≤20.

Table 5-21 lists the samples where the associated MS recovery was between 0 and 10 percent for specific analytes. The data for these specific analytes in these samples should not be used for regulatory decision making.

Table 5-21. Samples with Associated Laboratory Matrix Spike Exhibiting Recovery of Zero to Ten Percent for Specific Analytes

Sample with 0 to 10 Percent Spike Recovery	Analyte
B221X7	2-Nitrophenol
B1DRN7	Alkalinity
B1CBY6	Arsenic
B20W46	Calcium
B1XN51	Calcium
B21B02	Calcium
B215J6	Calcium
B20HC9	Calcium
B205D0	Calcium
B20DX0	Calcium
B1BXT4	Carbon Tetrachloride
B1FP10	Chloride
B1BRT4	Cyanide
B1K2H0	Cyanide
B1N4N4	Cyanide
B1N4T3	Cyanide
B1CJB2	Cyanide
B1L3T5	Cyanide
B1KF68	Fluoride
B1KT08	Fluoride
B1X713	Magnesium
B20519	Magnesium
B1DKY7	Nitrogen in Nitrate
B1FP10	Nitrogen in Nitrate
B1KF96	Nitrogen in Nitrite
B1KTC0	Nitrogen in Nitrite
B1KT08	Nitrogen in Nitrite
B1KCY5	Nitrogen in Nitrite
B1HD14	Nitrogen in Nitrite

Table 5-21. Samples with Associated Laboratory Matrix Spike Exhibiting Recovery of Zero to Ten Percent for Specific Analytes

Sample with 0 to 10 Percent Spike Recovery	Analyte
B1MPC0	Nitrogen in Nitrite
B1KBH4	Nitrogen in Nitrite
B221X7	Pentachlorophenol
B1W5C1	Phenol
B1W534	Silver
B1X7V7	Sodium
B21B02	Sodium
B20P64	Sodium
B20W47	Sodium
B1W559	Sodium
B20519	Sodium
B1YJR5	Sodium
B1FP10	Sulfate
B1CTR3	Total Organic Carbon
B1LRT1	Total Organic Carbon
B1KD75	Total Organic Carbon
B1L6M5	Total Organic Carbon
B1L944	Total Organic Carbon
B1KRR9	Total Organic Carbon
B1JBT8	Total Organic Halides
B1JCK4	Total Organic Halides
B1H662	Total Organic Halides

Note: Shading denotes those analytes that were identified as COPCs in DOE/RL-2007-18, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-5 Groundwater Operable Unit*, Appendix A.

5.6.3.3 Laboratory Surrogates

Finally, as part of volatile and semivolatile organic analyses, a compound that is not likely to be contained in an environmental sample (a surrogate) is injected into each sample as a measure of overall method performance on that specific sample. The 200-BP-5 Groundwater OU data set contained over 403,000 individual surrogate results. Of these, 10,230 or approximately 2.5 percent were outside of the

laboratory-specified acceptability criteria. Table 5-22 shows the distribution of analytes in these surrogate failures.

Table 5-22. Laboratory Surrogates Exceeding Quality Control Criteria

Analyte	Compound Class	Total Results Out of Limits
1,2-Dichloroethane-d4	SVOC	572
2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl	SVOC	133
2,4,6-Tribromophenol	SVOC	4,534
2-Fluorobiphenyl	SVOC	265
2-Fluorophenol	SVOC	2,231
4-Fluorobromobenzene	VOC	520
Dibromofluoromethane	VOC	286
Nitrobenzene-d5	VOC	84
o-Terphenyl	VOC	3
Phenol-d5	VOC	804
Terphenyl-d14 (7CI)	VOC	382
Toluene-d8	VOC	416
Total		**10,230**

6 Data Usability

Data from each category of information are summarized in the following sections. These categories include QC review from the following:

- Five percent of the monitoring data collected from November 2004 through November 2009, which were selected for formal independent third party validation, including data for depth discrete samples collected between November 2006 and May 2010
- Five previous years of data from the Hanford Site annual groundwater monitoring report
- Summary of all field QC from November 2004 through November 2009, including data for depth discrete samples collected between November 2006 and May 2010
- Summary of all laboratory QC from November 2004 through November 2009, including data for depth discrete samples collected between November 2006 and May 2010
- Summary of the detection limit evaluation

Analytical results associated with sample B1V569 from Well 299-E33-205 were not considered representative due to the addition of drilling fluid prior to sample collection and completion of limited purging. As such, the data associated with these samples are not considered useable for regulatory decision making.

6.1 Formal Validation

No major deficiencies were identified in the validated volatile organic, semivolatile organic, herbicide and pesticide, dioxins and furans, inorganic, or radiochemical data. However, in the validated general chemistry results, 23 samples were rejected. Table 6-1 lists the rejected sample results.

Table 6-1. Sample Data Rejected by Third Party Validator

Sample Number	Analyte	Qualifier	Reason
B20W44	Cyanide	UR	Very low matrix spike recovery and poor replicate precision
B1HD88 B1HD90 B1HC09 B1HDT3 B1HDM0 B1HDM4 B1HDL6	Nitrite	UR	Very low matrix spike recovery
B1BTW3 B1BTV5 B1BRT4 B1BRT1	Cyanide	UR	Analysis beyond two times the holding time and lack of MS data

Table 6-1. Sample Data Rejected by Third Party Validator

Sample Number	Analyte	Qualifier	Reason
B1BRT1 B1BRT4 B1BT38 B1BT32	Cyanide	UR	Very low MS recovery
B1P8P1 B1P8L2 B1P9K4 B1P8N6 B1P8L7 B1P8R1	Nitrogen in Nitrite	UR	Analysis beyond two times the holding time
B1W1B1	Cyanide	UR	Very low MSD recovery and poor MS/MSD precision

Note: A UR qualifier indicates that the constituent was analyzed for and not detected; however, because of an identified QC deficiency, the data should be considered unusable for decision making purposes.

Minor deficiencies were identified by the validation process, which resulted in the application of "J" or "UJ" flags. These flagged sample results are summarized by analyte class in Tables A-1 through A-7 in Appendix A of this report.

All flags identified during the validation process have been applied or corrected in HEIS. Overall completeness is estimated to be 98 percent of the subset of data (minimum 5 percent) validated by the third party validator. Completeness is a measure of the amount of valid data that needed to be obtained from a measurement system. The number of valid measurements completed (samples collected or samples analyzed) are compared with those established by the project's quality criteria (DQOs or performance acceptance criteria).

Data users should pay attention to applied flags within HEIS and review the laboratory QC for sample results, which are specifically relied upon, particularly for those parameters for which some validated data were found to be rejectable.

6.2 Annual Groundwater Report Review

Comparison of the 200-BP-5 Groundwater OU data set with the overall Hanford Site groundwater data set as described in the annual Hanford Site groundwater reports showed that the 200-BP-5 Groundwater OU data is at least as good, in terms of accuracy, precision, and minimization of blank contamination, as the overall site groundwater data set. Both field and laboratory performance parameters are equal to or better than those for the Hanford Site groundwater data as a whole.

6.3 Summary of Field Quality Control Data

Field QC consisted of field blanks, field duplicates, and field splits. Performance overall was very good as summarized in Table 6-2.

Table 6-2. Summary of Field Quality Control Results for the 200-BP-5 Groundwater Operable Unit Data Set

Field QC Element	Total Number of Field QC Values in the Data Set	Number of Field QC Values Outside of Acceptance Criteria	Percent of Field QC Values Meeting Acceptance Criteria
Field Duplicates	5,308 pairs	136 pairs	97.4
Field Splits	1,201 pairs	35 pairs	97.1
Field Blanks	24,723	1,069	95.7

While the overall performance was very good, the following specific observed deficiencies should be considered by any data user:

- Constituents and properties with high percentages of unacceptable field duplicate results include nitrogen in nitrite, calcium, copper, magnesium, silver, sodium, and potassium-40.
- Constituents and properties with high percentages of unacceptable field split results include calcium, cyanide, fluoride, gross beta, magnesium, potassium, and sodium.
- Constituents and properties with high percentages of positive field blank results include chloride, nitrogen in nitrate, specific conductance, total organic halides, calcium, magnesium, sodium, americium-241, methylene chloride, and oil and grease.

Users of the data reported for any of these parameters should look specifically at the well-specific and constituent-specific field QC to validate the use of the individual data points.

6.4 Summary of Laboratory Quality Control Data

Laboratory QC includes lab blanks, duplicates, laboratory control standards, MSs, and surrogates. Overall, the laboratory performance was very good, as summarized in Table 6-3.

Table 6-3. Summary of Laboratory Quality Control for the 200-BP-5 Groundwater Operable Unit Data Set

Laboratory QC Element	Total Number of Laboratory QC Values in the Data Set	Number of Laboratory QC Values Outside of Acceptance Criteria	Percent of Laboratory QC Meeting Acceptance Criteria
Laboratory Blanks	32,697	348	97.8
Laboratory Duplicates*	11,951 pairs	170 pairs	98.3
Laboratory Control Sample	35,444	280	99.2
Matrix Spike Recovery	23,966	1,245	94.8
Surrogates	>403,000	10,230	97.5

* Includes matrix spike and matrix spike duplicate pairs.

Although the laboratory performance was excellent overall, some isolated data batches exhibited problems. The appropriate qualifiers have been added in the HEIS database. Data users that rely on single data results should ensure they understand the qualifiers identified in HEIS and confirm that laboratory batch data associated with the specific result is also good.

6.5 Detection Limits

Using nondetect data to demonstrate performance to a specific threshold requires the laboratory reporting limit to be less than the threshold. Several constituents, including some analytes that were identified as COPCs in the RI/FS Work Plan (DOE/RL-2007-18, Appendix A), exhibit large percentages of nondetected values where the reporting limit exceeds the identified regulatory threshold. Positive detected results can be compared with the threshold to evaluate whether or not the constituent exceeds the limit. However, nondetected results are only useful for comparison to regulatory action levels if the reporting limit is below the applicable action limit. The following findings are associated with the detection limit comparison:

- Data for 53 constituents had 100 percent nondetected values and 100 percent of the reporting limits greater than the applicable regulatory action limit. These constituents are listed in Table 5-2. None of these are 200-BP-5 Groundwater OU RI/FS constituents but are constituents that were reported as method-based analytes. Data users must look carefully at data detection limits relative to action limits when using these data.
- An additional 34 constituents displayed a large percentage (25 percent or more) of detection limits that exceeded regulatory action limits. These data must be considered carefully when using the data set for regulatory decision making, particularly when using the data to demonstrate achievement of a remediation goal. These constituents are listed in Table 5-3. Data users must look carefully at data detection limits relative to action limits when using these data.

Of the 87 constituents listed in Tables 5-2 and 5-3, only antimony and cadmium are analytes that were identified as COPCs in the RI/FS Work Plan (DOE/RL-2007-18, Appendix A).

6.6 Conclusion

The conclusion of this assessment is that the 200-BP-5 Groundwater OU data are of the right type, quality, and quantity for direct regulatory use (e.g., in the BRA) as part of the RI/FS process. Detection limits, precision, accuracy, and data completeness were analyzed to determine if any analytical data should be rejected as a result of QA or QC deficiencies. Other than those results that were noted as unusable, the analytical data were found to be acceptable for the intended use noted above.

7 References

40 CFR 141, "National Primary Drinking Water Regulations," *Code of Federal Regulations*. Available at: http://www.access.gpo.gov/nara/cfr/waisidx_09/40cfr141_09.html.

141.61, "Maximum Contaminant Levels for Organic Contaminants."

141.62, "Maximum Contaminant Levels for Inorganic Contaminants."

141.66, "Maximum Contaminant Levels for Radionuclides."

40 CFR 143, "National Secondary Drinking Water Regulations," *Code of Federal Regulations*. Available at: http://www.access.gpo.gov/nara/cfr/waisidx_09/40cfr143_09.html.

143.3, "Secondary Maximum Contaminant Levels."

40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," Appendix B, "National Priorities List," *Code of Federal Regulations*. Available at: http://edocket.access.gpo.gov/cfr_2010/julqtr/40cfr300AppB.htm.

Atomic Energy Act of 1954, 42 USC 2011, et seq. Available at: http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr0980/ml022200075-vol1.pdf.

CHPRC-00189, 2010, *CH2M HILL Plateau Remediation Company Environmental Quality Assurance Program Plan,* Rev. 5, CH2M HILL Plateau Remediation Company, Richland, Washington.

Clean Water Act of 1977, 33 USC 1251, et seq. Available at: http://epw.senate.gov/water.pdf.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601, et seq. Available at: http://uscode.house.gov/download/pls/42C103.txt.

DOE/RL-92-23, 1992, *Hanford Site Groundwater Background*, Rev. 0A, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D196102655. http://www5.hanford.gov/arpir/?content=findpage&AKey=D196121580.

DOE/RL-96-61, 1997, *Hanford Site Background: Part 3, Groundwater Background*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D197226378.

DOE/RL-96-68, 2007, *Hanford Analytical Services Quality Assurance Requirements Documents*, Rev. 3, *Volume 1, Administrative Requirements*; *Volume 2, Sampling Technical Requirements*; *Volume 3, Field Analytical Technical Requirements*; and *Volume 4, Laboratory Technical Requirements*, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www.hanford.gov/orp/?page=141&parent=14.

DOE/RL-99-07, 2000, *200-CW-1 Operable Unit RI/FS Work Plan and 216-B-3 RCRA TSD Unit Sampling Plan*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=D8434692.

DOE/RL-99-44, 2000, *200-CS-1 Operable Unit RI/FS Work Plan and RCRA TSD Unit Sampling Plan*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D8434677.

DOE/RL-2001-49, 2004, *Groundwater Sampling and Analysis Plan for the 200-BP-5 Operable Unit*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D7379978.

DOE/RL-2006-55, 2010, *Sampling and Analysis Plan for FY 2006 200-BP-5 Groundwater Operable Unit Remedial Investigation/Feasibility Study*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2007-18, 2008, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-5 Groundwater Operable Unit*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=0901220536.

DOE/RL-2008-01, 2008, *Hanford Site Groundwater Monitoring for Fiscal Year 2007*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=00098824.

DOE/RL-2008-66, 2009, *Hanford Site Groundwater Monitoring for Fiscal Year 2008*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=0905131281. http://www2.hanford.gov/arpir/?content=findpage&AKey=0905131282.

DOE/RL-2010-11, *Hanford Site Groundwater Monitoring and Performance Report for 2009: Volumes 1 & 2*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

EPA/240/B-06/002, 2006, *Data Quality Assessment: A Reviewer's Guide*, EPA QA/G-9R, Office of Environmental Information, U.S. Environmental Protection Agency, Washington, D.C. Available at: http://www.epa.gov/quality/qs-docs/g9r-final.pdf.

EPA/240/B-06/003, 2006, *Data Quality Assessment: Statistical Methods for Practitioners*, EPA QA/G-9S, Office of Environmental Information, U.S. Environmental Protection Agency, Washington, D.C. Available at: http://www.epa.gov/quality/qs-docs/g9s-final.pdf.

EPA/600/4-79/020, 1983, *Methods of Chemical Analysis of Water and Wastes*, Environmental Monitoring and Support Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D196019611.

EPA/600/R-94/111, 1994, *Methods for the Determination of Metals in Environmental Samples, Supplement I*, Environmental Monitoring Systems Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio.

GRP-EE-01-1.22, 2009, *Data Quality Assessment*, Rev. 1, CH2M HILL Plateau Remediation Company, Richland, Washington.

Hanford Environmental Information System, Hanford Site database, Richland, Washington.

HNF-20433, 2004, *Data Validation Procedure for Chemical Analyses*, Rev. 0, Fluor Hanford, Inc., Richland, Washington.

HNF-20434, 2004, *Data Validation Procedure for Radiochemical Analyses*, Rev. 0, Fluor Hanford, Inc., Richland, Washington.

PNNL-15670, 2006, *Hanford Site Groundwater Monitoring for Fiscal Year 2005*, Pacific Northwest National Laboratory, Richland, Washington. Available at: http://www.pnl.gov/main/publications/external/technical_reports/PNNL-15670.pdf.

PNNL-16346, 2007, *Hanford Site Groundwater Monitoring for Fiscal Year 2006*, Pacific Northwest National Laboratory, Richland, Washington. Available at: http://www.pnl.gov/main/publications/external/technical_reports/PNNL-16346.pdf.

Resource Conservation and Recovery Act of 1976, 42 USC 6901, et seq. Available at: http://www4.law.cornell.edu/uscode/42/6901.html.

Safe Drinking Water Act of 1974, 42 USC 300, et seq. Available at: http://www.epa.gov/ogwdw/sdwa/.

SW-846, 2007, *Test Methods for Evaluation Solid Waste: Physical/Chemical Methods, Third Edition; Final Update IV-B*, as amended, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C. Available at: www.epa.gov/SW-846/main.htm.

WAC 173-201A, "Water Quality Standards for Surface Waters of the State of Washington," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-201A.

WAC 173-340-720, "Model Toxic Control Act—Cleanup," "Ground Water Cleanup Standards," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-340-720.

WAC 173-340-730, "Model Toxics Control Act—Cleanup," "Surface Water Cleanup Standards," *Washington Administrative Code,* Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-340-730.

WAC 173-340-900, "Model Toxics Control Act—Cleanup," "Tables," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-340-900.

WAC 246-290-310, "Group A Public Water Supplies," "Maximum Contaminant Levels (MCLs) and Maximum Residual Disinfectant Levels (MRDLs)," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=246-290-310.

WMP-28945, 2007, *Data Quality Objective Summary Report in Support of the 200-BP-5 Groundwater Operable Unit Remedial Investigation/Feasibility Study Process*, Rev. 0, Fluor Hanford, Inc., Richland, Washington.

Appendix A

Third Party Validation Qualifier Listing

Terms

COD	chemical oxygen demand
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
MDL	minimum detection limit
MS	matrix spike
MSD	matrix spike duplicate
QC	quality control
SAP	sampling and analysis plan
TOC	toxic organic carbon
TOX	toxic organic halides

A1 Qualifiers

During the generation of environmental data, any of several qualification flags may be assigned to an individual result. The Hanford Environmental Information System database carries qualification flags applied by three sources: the laboratory, the third party validator, or a data user. The tables of data within this appendix show all of these applied qualification flags. Potential flags and their meaning include:

- **B** (Inorganics and Wet Chemistry) – The analyte was detected at a value less than the contract required detection limit, but greater than or equal to the minimum detection limit (MDL). The data should be considered usable for decision making purposes.
- **C** (Inorganics and Wet Chemistry) – The analyte was detected in both the sample and the associated quality control (QC) blank, and the sample concentration was less than or equal to five times the blank concentration. The data should be considered unusable for decision making purposes.
- **D** (Organics and Wet Chemistry) – The analyte was identified in an analysis at a secondary dilution factor (i.e., dilution factor different than 1.0). The data should be considered usable for decision making purposes.
- **N** (All) – The spike sample recovery is outside control limits. The data should be considered usable for decision making purposes.
- **J** (Organics) – The constituent was analyzed for and detected. The associated value is estimated because of a QC deficiency identified during data validation. The data should be considered usable for decision making purposes.
- **U** (All) – The constituent was analyzed for and was not detected. The data should be considered usable for decision making purposes.
- **UJ** – The constituent was analyzed for and was not detected. Because of a QC deficiency identified during data validation, the value reported may not accurately reflect the MDL. The data should be considered usable for decision making purposes.
- **UR** – The constituent was analyzed for and not detected; however, because of an identified QC deficiency, the data should be considered unusable for decision making purposes.
- **R** – The constituent was analyzed for and detected; however, because of an identified QC deficiency, the data should be considered unusable for decision making purposes.
- **X** (All) – The result-specific translation of this qualifier code is provided in the data report and/or case narrative.

Table A-1. Third Party Validation Summary for Volatile Organics

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B20951	Tetrahydrofuran	UJ	Low MS/MSD recoveries	Data Validation Report, VSR10-002, performed in conjunction with DOE/RL-2001-49 and DOE/RL-2007-18
B20F54 B20F55	Bromodichloromethane Chloromethane Carbon Disulfide Chloroform	J	Low surrogate recovery	
	Bromomethane	J	Low surrogate recovery; high LCS/LCSD recoveries	
	Tetrachloroethene	J	Low surrogate recovery and high MSD recovery	
	Carbon Tetrachloride	J	High LCSD recovery	
B20F54	Iodomethane	UJ	Blank contamination; low surrogate recovery; high LCS/LCSD recoveries; low MS/MSD recoveries	
	All analytes except: Trichloroethene Bromomethane Iodomethane Bromodichloromethane Chloromethane Carbon Disulfide Chloroform Tetrachloroethene Carbon Tetrachloride Chlorobenzene Ethyl Benzene Styrene 1,4-Dichlorobenzene Benzene 1-Butanol	UJ	Low surrogate recovery	
B20F55	All analytes except: Trichloroethene Bromomethane Bromodichloromethane	UJ	Low surrogate recovery	

Table A-1. Third Party Validation Summary for Volatile Organics

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
	Chloromethane Carbon Disulfide Chloroform Tetrachloroethene Carbon Tetrachloride Chlorobenzene Ethyl Benzene Styrene 1,4-Dichlorobenzene Benzene 1-Butanol			
B207K5	Styrene	U	Blank contamination	
B1WYC5 B1WYD1	4-Methyl-2-Pentanone Acetone Carbon Disulfide 2-Butanone Tetrahydrofuran Ethyl Cyanide	UJ	Nonrepresented MS/MSD and LCS Data	
B1YY71 B1YVC3 B1YV84 B1YV65 B1YV81 B1YV04 B1YTX8	1-Butanol Acetone Carbon Disulfide Methyl Ethyl Ketone Tetrahydrofuran Propionitrile	UJ	Nonrepresented MS/MSD and LCS Data	
B1TBF3 B1RDM5	Methylene Chloride	U	Blank Contamination	Data Validation Report, VSR10-004, performed in conjunction with DOE/RL-2001-49
B1TBF3 B1RDM5 B1RDM8	1-Butanol 4-Methyl-2-Pentanone Acetone Carbon Disulfide 2-Butanone Tetrahydrofuran Ethyl Cyanide	UJ	Nonrepresented MS/MSD and LCS data	

Table A-1. Third Party Validation Summary for Volatile Organics

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1PK63	Methylene Chloride	U	Blank contamination	Data Validation Report, VSR10-005, performed in conjunction with DOE/RL-2001-49 and DOE/RL-2006-55
B1PK61	Methylene Chloride	U	Blank contamination	
B1P695	Trichloroethene	J	High surrogate recovery	
B1PYL2	Trichloroethene Tetrachloroethene	J	High surrogate recovery	
B1PYL2	Chloroform	J	High surrogate recovery	
B1P695	Chloroform	J	Low LCS recovery and high surrogate recovery	
B1P5Y3	Chloroform	J	Low LCS recovery	
B1PV97 B1P5Y7 B1PV98 B1PV99 B1P5X3 B1PVB0	Chloroform	UJ	Low LCS recovery	
B1P941	1,1-Dichloroethane Trichloroethene	J	High LCS recovery	
B1P941	1-Butanol 2-Butanone	UJ	Poor LCS/LCSD precision	
B1P5K9 B1P886 B1P887 B1P974 B1PK59 B1PK60 B1NX55	1,4-Dioxane 1-Butanol	UJ	Poor MS/MSD precision	
B1PV97 B1P5Y7 B1PV98 B1PV99 B1P5Y3 B1P695 B1P5X3 B1PVB0	1,4-Dioxane	UJ	Poor MS/MSD precision	

Table A-1. Third Party Validation Summary for Volatile Organics

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1PK61 B1P5M3 B1P5J3 B1PYL2 B1P8K6 B1P5N0 B1P5L6 B1PK62 B1PK63 B1P5T5 B1P5R8	Acetone	UJ	Poor LCS/LCSD and MS/MSD precision	
B1PK61 B1P5M3 B1P5J3 B1PYL2 B1P8K6 B1P5N0 B1P5L6 B1PK62 B1PK63 B1P5T5 B1P5R8	Propionitrile 1-Butanol	UJ	Poor MS/MSD precision	
B1PFB0 B1PJX1 B1P5T2 B1PFV0 B1RF22 B1RBH4	1-Butanol 4-Methyl-2-Pentanone Acetone Carbon Disulfide 2-Butanone Tetrahydrofuran Ethyl Cyanide	UJ	Nonrepresented MS/MSD and LCS data	

Table A-1. Third Party Validation Summary for Volatile Organics

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1NFT3 B1NFT7 B1NFV1 B1NFV5	Trichloroethene 1,1,1-Trichloroethene Carbon Tetrachloride Bromodichloromethane Dibromochloromethane 1,1,2-Trichloroethane Tetrachloroethene 1,1,2,2-Tetrachloroethane	UJ	Low MSD recovery and poor MS/MSD precision	Data Validation Report, VSR10-006, performed in conjunction with DOE/RL-2001-49 and DOE/RL-2006-55
B1L852 B1L853	*cis*-1,3-Dichloropropene *trans*-1,3-Dichloropropene 4-Methyl-2-Pentanone 2-Hexanone Acetone Carbon Disulfide 2-Butanone	UJ	Nonrepresented MS/MSD and LCS data	
B1NFT3 B1NFT7 B1NFV1 B1NFV5	1-Butanol *cis*-1,3-Dichloropropene *trans*-1,3-Dichlrorpropene 4-Methyl-2-Pentanone 2-Hexanone Carbon Disulfide 2-Butanone	UJ	Nonrepresented MS/MSD and LCS data	
B1NFT3 B1NFT7 B1NFV1	Acetone	J	Nonrepresented MS/MSD and LCS data	
B1NFV5	Acetone	UJ	Nonrepresented MS/MSD and LCS data	
B1BV51 (1/11/05 analysis)	Chloroform Carbon Tetrachloride Trichloroethene Tetrachloroethene	J	Analyzed beyond the holding time but within 2 times the holding time; high surrogate recovery	Data Validation Report, VSR10-007, performed in conjunction with DOE/RL-2001-49
B1BV51 (1/11/05 analysis)	All analytes except: Propionitrile Tetrahydrofuran 1,4-Dioxane 1-Butanol	UJ	Analyzed beyond the holding time but within 2 times the holding time	

Table A-1. Third Party Validation Summary for Volatile Organics

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
	Chloroform Carbon Tetrachloride Trichloroethene Tetrachlrorethene			
B1BV51 (1/11/05 analysis)	Propionitrile Tetrahydrofuran 1,4-Dioxane 1-Butanol	UJ	Analyzed beyond the holding time but within 2 times the holding time; nonrepresented MS/MSD and LCS data	
B1BV51 (1/6/05 analysis)	Chloroform Trichloroethene Tetrachloroethene	J	High surrogate recovery	
B1BMN5 B1BMN6 B1BMN8 B1BMN9 B1BMP0	Propionitrile	J	Nonrepresented MS/MSD and LCS data	
B1BV57	Methylene Chloride	U	Blank contamination	
B1BMP0	Methylene Chloride	U	Blank contamination	
B1BTP8	Trichloroethene	J	High surrogate recovery	
B1BXV2 (1/12/09 analysis)	*cis*-1,2-Dichloroethene	J	Above linear range	
B1HHT4	Chloroform Trichloroethene	J	High surrogate recovery	
B1HHW5	Chloroform Trichloroethene	J	High surrogate recovery	
B1HHY6	Chloroform	J	High surrogate recovery	
B1HC09	Tetrachlorethene	J	High LCS recovery	
B1HHW5	Tetrachlrorethene	J	High LCS recovery and high surrogate recovery	
B1HHT4 B1HHW5 B1HHY6 B1HFP9	Vinyl Chloride	UJ	Poor replicate precision	

Table A-1. Third Party Validation Summary for Volatile Organics

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1HBV1 B1HBV2 B1HBV6 B1HBV9 B1HBW3 B1HBW6 B1HDT0 B1HC09 B1HDT3 B1HBT5 B1HDM0 B1HDM4 B1HDL6				
B1BTP4 B1BV26 B1BTP8 B1BTW5 B1BV59 B1BV57 B1BV56 B1BV36 B1BV53 B1BXY0 B1BXX7 B1BXY3 B1BXY9 B1BXV8 B1BXW0 B1BY08 B1BYM1 B1BYM2 B1BYM7 B1BXV4 B1BXV6 B1BXV0 B1BXT8 B1BXT6	Propionitrile Tetrahydrofuran 1,4-Dioxane 1-Butanol	UJ	Nonrepresented MS/MSD and LCS data	

Table A-1. Third Party Validation Summary for Volatile Organics

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1BXV2				
B1HHT4				
B1HHW5				
B1HHY6				
B1HFP9				
B1HBV1				
B1HBV2				
B1HBV6				
B1HBV9				
B1HBW3				
B1HBW6				
B1HDT0				
B1HC09				
B1HDT3				
B1HBT5				
B1HDM0				
B1HDM4				
B1HDL6				

Table A-2. Third Party Validation Summary for Semivolatile Organics

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1XF34 B1XF56 B1XF35 B1XF22 B1XF23 B20DY0 B1XF15 B1XF36 B1XF57 B1XF46 B1XF47	1,4-Dioxane	UJ	Lack of MS/MSD and LCS data	Data Validation Report, VSR10-002, performed in conjunction with DOE/RL-2001-49 and DOE/RL-2007-18

Table A-2. Third Party Validation Summary for Semivolatile Organics

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B20W33 B20W35	2-Picoline Benzothiazole Tributyl Phosphate Tris(2-Chloroethyl) phosphate	UJ	Nonrepresented MS/MSD and LCS data	
B207K5	1,4-Dioxane 2-Picoline Dimethoate Benzothiazole Tributyl Phosphate Tris(2-Chloroethyl) phosphate	UJ	Nonrepresented MS/MSD and LCS data	
B1WYD1	4-Nitrophenol Phenol *N*-nitroso-di-*n*-propylamine 2-Nitrophenol Bis(2-Ethylhexyl)phthalate 2-Methylphenol ¾-Methyl Phenol (Total)	UJ	Low surrogate recovery	
B1WYD1 B1WYC5	1,4-Dichlorobenzene	UJ	Lack of MS/MSD data	
B1WYD1 B1WYC5 B1YV04 B1WTX8	2-Picoline Benzothiazole Tris(2-Chloroethyl) phosphate	UJ	Nonrepresented MS/MSD and LCS data	
B1YV04 B1YTX8	Tributyl Phosphate	J	Nonrepresented MS/MSD and LCS data	
B1WYD1 B1WYC5	Tributyl Phosphate	J	Nonrepresented MS/MSD and LCS data	
B1X812 B1X8R1 B1X8R2 B1X825 B1X834 B1X8F0	4,6-Dinitro-2-Methylphenol	UJ	High MS/MSD relative percent difference	

Table A-2. Third Party Validation Summary for Semivolatile Organics

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1X8D9 B1X7Y0				
B1X846 B1X7W9	All analytes except: 4,6-Dinitro-2-Methylphenol	UJ	Low surrogate recoveries	
B1X846 B1X7W9	4,6-Dinitro-2-Methylphenol	UJ	Low surrogate recoveries and high MS/MSD relative percent difference	
B20J18 B20J07 B20HY0 B20HX9	Phenol	UJ	Low LCS recovery	
B1PYJ3 B1P5L1 B1PFV0 B1RBH4	Cresols 2-Picoline Benzothiazole Tributyl Phosphate Tris(2-Chloroethyl) Phosphate	UJ	Nonrepresented MS and LCS recovery	Data Validation Report, VSR10-005, performed in conjunction with DOE/RL-2001-49 and DOE/RL-2006-55
B1RBH4	WTPH-G	UJ	Low MS and LCS recovery	
B1L853	Carbazole	UJ	Nonrepresented MS/MSD and LCS data	Data Validation Report, VSR10-006, performed in conjunction with DOE/RL-2001-49 and DOE/RL-2006-55
B1NFT5 B1NFT9 B1NFV3 B1NFV7	Carbazole Cylcohexanone	UJ	Nonrepresented MS/MSD and LCS data	
B1NFT5 B1NFT9 B1NFV3 B1NFV7	Phenol Bis(2-Ethylhexyl)phthalate Di-*n*-Octylphthalate Dimethyl Phthalate Dibenzofuran Isophorone Di-*n*-Butyl Phthalate Buytlbenzylphthalate 2-Methylphenol	UJ	Low LCS recovery	

Table A-2. Third Party Validation Summary for Semivolatile Organics

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1NFT5 B1NFT9 B1NFV3	Diethyl Phthalate	UJ	Low LCS recovery	
B1NFV7	Diethyl Phthalate	J	Low LCS recovery	
B1NFV3	Oil and Grease	J	Lack of MS/MSD data	
B1MDC7	WTPH-G	J	Low surrogate recovery	
B1MDC7	WTPH-D	J	Lack of surrogate and MS/MSD data because of dilution	
B1KCH6	2-Picoline Benzothiazole Tributyl Phosphate Tris(2-Chloroethyl) Phosphate	UJ	Nonrepresented MS/MSD and LCS data	Data Validation Report, VSR10-007, performed in conjunction with DOE/RL-2001-49
B1HC09 B1HDT3	2-Chlorophenol 3-Methylphenol 4-Methylphenol 2-Methylphenol 2,4-Dichlorophenol 2,6-Dicholorophenol 4,6-Dinitro-2-methylphenol 2-Nitrophenol Phenol	UJ	Poor duplicate precision	
B1X8M5 B1X8N6 B1X7V0 B1X801 B1X7P8 B1X7K7	4,6-Dinitro-2-methylphenol	UJ	Poor MS/MSD precision	Data Validation Report, VSR10-022, performed in conjunction with DOE/RL-2007-18
B1X7V5 B1X7V6	4,6-Dinitro-2-methylphenol 2-Nitrophenol 4-Nitrophenol Phenol Dinoseb	UJ	Poor MS/MSD precision	

Table A-3. Third Party Validation Summary for Herbicides and Pesticides

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1V9T5	Dalapon Dinoseb Pentachlorophenol	UJ	Low LCS/LCSD; low MS/MSD	Data Validation Report, VSR10-004, performed in conjunction with DOE/RL-2007-18
B1V9T5	Dicambra Dichloroprop 2,4,5-TP 2,4,5-T	UJ	Poor MS/MSD precision	
B1X8M5 B1X8N6 B1X8H8	Aroclor 1016 1221 1232 1242 1248 1254 1260	UJ	Poor MS/MSD precision	Data Validation Report, VSR10-022, performed in conjunction with DOE/RL-2007-18
B1W4W3 B1W593 B1W5C7 B1W587 B1W569 B1W5D9B1W 5H7 B1W539	4,4'-DDT Heptachlor	UJ	Poor MS/MSD precision	

Table A-4. Third Party Validation Summary for Dioxins and Furans

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1CK11	Total PeCDD Total HxCDD 1,2,3,4,6,7,8-HpCDF Total HpCDF OCDF	UJ	Blank contamination and extraction beyond 2 times the holding time	Data Validation Report, VSR10-007, performed in conjunction with DOE/RL-2001-49
B1CK11	1,2,3,4,6,7,8-HpCDD Total HpCDD OCDD	J	Extraction beyond 2 times the holding time	

Table A-4. Third Party Validation Summary for Dioxins and Furans

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1CK11	All analytes except: Total PeCDD Total HxCDD 1,2,3,4,6,7,8-HpCDF Total HpCDF OCDF 1,2,3,4,6,7,8-HpCDD Total HpCDD OCDD	UJ	Extraction beyond 2 times the holding time	

Table A-5. Third Party Validation Summary for Inorganics

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B20W47 B20W38 B20W30 B20W24 B20W41 B20W44 B20W21 B20W27	Potassium	J	High MS/MSD recoveries	Data Validation Report, VSR10-002, performed in conjunction with DOE/RL-2001-49 and DOE/RL-2007-18
B20W46 B20W47 B20W37 B20W38 B20W29 B20W30 B20W23 B20W24 B20W40 B20W41 B20W43 B20W44 B20W20 B20W21	Strontium	J	High MS/MSD recoveries	

Table A-5. Third Party Validation Summary for Inorganics

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B20W26 B20W27				
B20W26 B20M91 B20M92	Zinc	UJ	Laboratory blank contamination	
B20W32 B20W33	Thallium	J	Low MS/MSD recoveries	
B20W34 B20W35	Thallium	UJ	Low MS/MSD recoveries	
B1WY81 B1X183 B1X184	Uranium	J	Poor replicate precision	
B1WY82	Uranium	UJ	Poor replicate precision	
B1YTX7 B1YTX8 B1YV30 B1YV26 B1YV31 B1YV27	Magnesium Sodium	J	Poor replicate precision	
B1YTX7 B1YTX8 B1YV30 B1YV26 B1YV31 B1YV27	Iron	UJ	Laboratory blank contamination	
B1T595 B1T596 B1T5J6 B1T5J9 B1T5K8 B1T5N9 B1T5P0 B1T5R5 B1T5T1 B1T5T2	Vanadium	UJ	Laboratory blank contamination	Data Validation Report, VSR10-004, performed in conjunction with DOE/RL-2001-49

Table A-5. Third Party Validation Summary for Inorganics

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1T5W6 B1T5X0 B1T5Y1 B1T5Y5 B1T5Y9 B1T603 B1RB59 B1RB89				
B1RFL0	Copper Zinc	UJ	Laboratory blank contamination	
B1RDK6 B1RDK7 B1RJ19 B1RJ20 B1RJ82 B1RJ83	Iron	UJ	Laboratory blank contamination	
B1RB62 B1T595 B1T596 B1T5J6 B1T5J9 B1T5K8 B1T5N9 B1T5P0 B1T5R5 B1T5T1 B1T5T2 B1T5W6 B1T5X0 B1T5Y1 B1T5Y5 B1T5Y9 B1T603 B1RB59 B1RB89 B1RB60 B1RB63	Sodium	J	Poor replicate precision	

Table A-5. Third Party Validation Summary for Inorganics

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1RB65 B1RB66 B1RB80 B1RB81 B1RB89 B1RB90 B1T4Y0 B1T4Y7 B1T501 B1T505				
B1T5X8	Sodium	UJ	Poor replicate precision	
B1T5X7 B1T5X8	Calcium	UJ	Poor replicate precision	
B1RB62 B1T5J5 B1T5J8 B1T5K7 B1T5R4 B1T5W5 B1T5W9 B1T5Y0 B1T5Y4 B1T5Y8 B1T602 B1T595 B1T596 B1T5J6 B1T5J9 B1T5K8 B1T5N9 B1T5P0 B1T5R5 B1T5T1 B1T5T2 B1T5W6 B1T5X0	Calcium	J	Poor replicate precision	

Table A-5. Third Party Validation Summary for Inorganics

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1T5Y1 B1T5Y5 B1T5Y9 B1T603 B1RB59 B1RB89 B1RB60 B1RB63 B1RB65 B1RB66 B1RB80 B1RB81 B1RB89 B1RB90 B1T4Y0 B1T4Y7 B1T501 B1T505 B1T4Y1 (re-analysis)				
B1RB62 B1T595 B1T596 B1T5J6 B1T5J9 B1T5K8 B1T5N9 B1T5P0 B1T5R5 B1T5T1 B1T5T2 B1T5W6 B1T5X0 B1T5Y1 B1T5Y5 B1T5Y9 B1T603	Magnesium	J	Poor replicate precision	

Table A-5. Third Party Validation Summary for Inorganics

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1RB59 B1RB89 B1RB60 B1RB63 B1RB65 B1RB66 B1RB80 B1RB81 B1RB89 B1RB90 B1T4Y0 B1T4Y7 B1T501 B1T505				
B1T5X8	Magnesium	UJ	Laboratory blank contamination and poor replicate precision	
B1T4Y5	Magnesium	UJ	Laboratory blank contamination	
B1T4Y1	Copper	UJ	Laboratory blank contamination	
B1P9B5 B1NK69 B1PDX1 B1N563	Potassium Strontium	J	High MS recoveries	Data Validation Report, VSR10-005, performed in conjunction with DOE/RL-2001-49 and DOE/RL-2006-55
B1N563	Silver	UJ	Laboratory blank contamination	
B1RCM6 B1RFV4 B1RFX7 B1RFX8 B1RH47 B1RH48 B1RJD8 B1RJH4 B1RJF4 B1RJH7	Nickel	UJ	Laboratory blank contamination	

Table A-5. Third Party Validation Summary for Inorganics

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1RCM7 B1RFV3 B1RFX7 B1RFX8 B1RH48 B1RJD8 B1RJF3 B1RJH3 B1RJH4 B1RJF4 B1RJH6 B1RJH7	Copper	UJ	Laboratory blank contamination	
B1PJ14 B1PJ15 B1PJN2	Manganese Nickel Silver Cobalt Vanadium Zinc	UJ	Laboratory blank contamination	
B1PJN3	Nickel Silver Cobalt Zinc	UJ	Laboratory blank contamination	
B1PDW0	Silver Cobalt Vanadium Zinc	UJ	Laboratory blank contamination	
B1PFT9 B1PFV0	Nickel Silver Cobalt Vanadium Zinc	UJ	Laboratory blank contamination	
B1RBH3 B1RBH4 B1RCM6 B1RCM7 B1RFV3	Calcium Magnesium Sodium	J	Lack of replicate precision	

Table A-5. Third Party Validation Summary for Inorganics

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1RFV4 B1RFX7 B1RFX8 B1RH47 B1RH48 B1RJD7 B1RJD8 B1RJF3 B1RJF4 B1RJH3 B1RJH4 B1RJH6 B1RJH7				
B1L853 B1LCB1 B1LCJ2 B1LCK2	Sodium	J	Lack of replicate precision	Data Validation Report, VSR10-006, performed in conjunction with DOE/RL-2001-49 and DOE/RL-2006-55
B1LCB1 B1LCJ2 B1LCK2	Calcium Magnesium	J	Lack of replicate precision	
B1BTP3 B1BTP5 B1BTP9 B1BTX2	Zinc	UJ	Blank contamination	Data Validation Report, VSR10-007, performed in conjunction with DOE/RL-2001-49
B1B8F8 B1BY19 B1BXX9 B1BYF3 B1BY13 B1BY17 B1BXX6 B1BXY2 B1BXY8	Aluminum	UJ	Blank contamination	
B1BY10 B1BY07	Aluminum Zinc	UJ	Blank contamination	
B1HDT2	Calcium	UJ	Blank contamination	

Table A-5. Third Party Validation Summary for Inorganics

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1JC72	Iron Potassium	UJ	Blank contamination	
B1KFJ4 B1KDH9	Potassium	UJ	Blank contamination	
B1KFJ4 B1KDH9 B1KDJ0 B1KF20 B1KF09	Cadmium	UJ	Low MS/MSD recoveries	
B1BTP3 B1BTX2 B1BTW6	Iron	J	High LCS recovery	
B1JC72	Antimony	UJ	Poor MS/MSD precision	

Table A-6. Third Party Validation Summary for General Chemistry

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B20W44	Cyanide	UR	Very low MS recovery and poor replicate precision	Data Validation Report, VSR10-002, performed in conjunction with DOE/RL-2001-49 and DOE/RL-2007-18
B20W47 B20W38 B20W30 B20W24 B20W41 B20W21 B20W27 B20VF3 B20J48 B20VP8 B20VP5	Cyanide	J	Very low MS recovery and poor replicate precision	
B20W35	Nitrate	UJ	Poor duplicate precision	
B20W33	Nitrate	J	Poor duplicate precision	

Table A-6. Third Party Validation Summary for General Chemistry

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1X589	Chromium (VI)	UJ	Analysis beyond the holding time but within 2 times the holding time	
B1X618 B1XHW8 B1XHX6 B1XJ85	Chromium (VI)	J	Analysis beyond the holding time but within 2 times the holding time	
B1WY82 B1YVC3	Alkalinity	J	Lack of MS analysis	
B1WY81 B1X099 B1X183 B1X184 B1YV74 B1YV61 B1YV63 B1YV84 B1YV65 B1YV81 B1YV04 B1YW74	Alkalinity	J	Lack of MS analysis	
B1X183 B1X184	Fluoride	J	Poor MS/MSD precision	
B1YV04 B1YTX8	Cyanide	J	Poor MS/MSD precision	
B1RFK3 B1RJ16 B1RJ17 B1RJ18 B1RJ80	TOX	J	Analytical problems	Data Validation Report, VSR10-004, performed in conjunction with DOE/RL-2001-49
B1RFK4 B1RFK5 B1RFK6	TOX	UJ	Analysis >1 time but <2 times the holding time	
B1RFK3 B1RFK4	TOC	J	Low MS recovery	

Table A-6. Third Party Validation Summary for General Chemistry

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1RFK5 B1RFK6 B1RJ15 B1RJ16 B1RJ17 B1RJ18 B1RJ78 B1RJ79 B1RJ80 B1RJ81				
B1T5X8	Alkalinity	UJ	Lack of MS analysis	
B1T596 B1T5B0 B1T5B4 B1T5B8 B1T5C2 B1T5J6 B1T5J9 B1T5K5 B1T5K8 B1T5L1 B1T5P0 B1T5P7 B1T5R1 B1T5R5 B1T5T2 B1T5W6 B1T5X0 B1T5X4 B1T5Y1 B1T5Y5 B1T5Y9 B1T603 B1RFL0 B1RDK7 B1RDM5 B1RDM8	Alkalinity	J	Lack of MS analysis	

Table A-6. Third Party Validation Summary for General Chemistry

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1T4Y1 B1T4Y5 B1T4Y8 B1T502 B1T506 B1RJ20 B1RJ83				
B1RBH4 B1RH43	TOX	J	Analytical problem	Data Validation Report, VSR10-005, performed in conjunction with DOE/RL-2001-49 and DOE/RL-2006-55
B1NX55 B1RJH4	Nitrate	J	Analysis >1 time but <2 times the holding time	
B1N3N9	Nitrite	UJ	Analysis >1 time but <2 times the holding time	
B1P976	COD	UJ	Negative associated blank	
B1RFV4 B1RFX8 B1RH48 B1RHP3 B1RJH7 B1RJD8 B1RJF4 B1RJH4 B1PJF3 B1RJF7 B1PJN3	Alkalinity	J	Lack of MS analysis	
B1PMH3 B1PMH5 B1PMH7 B1PN75	Nitrate/Nitrite	J	Lack of MS and duplicate analysis	
B1NX55 B1N3N1	Fluoride	J	High MS recovery	
B1N3N9	Nitrite	UJ	Low MS recovery	
B1PDX2 B1N564 B1RH48	Fluoride	J	Poor duplicate precision	

Table A-6. Third Party Validation Summary for General Chemistry

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1MD43 B1MJH3	Nitrate	J	Low MS recovery	Data Validation Report, VSR10-006, performed in conjunction with DOE/RL-2001-49 and DOE/RL-2006-55
B1NFT5 B1NFT9 B1NFV3	Chloride Sulfate	UJ	Analysis >1 time but <2 times the holding time	
B1MKJ2	Cyanide	UJ	Blank contamination	
B1LCB2 B1LCJ3 B1LCK3 B1LFV5 B1LJ59 B1LJ64 B1LJH9	Alkalinity	J	Lack of MS analysis	
B1BTP6 B1BY18	Nitrite	J	High MS recovery	Data Validation Report, VSR10-007, performed in conjunction with DOE/RL-2001-49
B1B8F9 B1BV53 B1BY20 B1BXY0 B1BY14 B1BY18 B1BXX7 B1BXY3 B1BXY9	Alkalinity	J	Lack of MS data	
B1BYY5 B1BYY7 B1BY08 B1BYY8 B1BYY9 B1C000	TOX	J	Poor lab prep precision	
B1HHT4 B1HHW5 B1HHY6 B1HCJ2 B1HCV8	Nitrate	J	Analyzed beyond the holding time but within 2 times the holding time	

Table A-6. Third Party Validation Summary for General Chemistry

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1HD67 B1HD59 B1HDC6 B1HDC2 B1HDB8 B1HDB4 B1KF88				
B1HD67 B1HD59 B1HDC6 B1HDB8 B1HDB4 B1HD88 B1HD90	Alkalinity	J	Low MS recovery	
B1HCH7	TOC	UJ	Analyzed beyond the holding time but within 2 times the holding time	
B1HCV4 B1HCV5 B1HCV6	TOC	J	Poor lab rep precision	
B1HD88 B1HD90 B1HC09 B1HDT3 B1HDM0 B1HDM4 B1HDL6	Nitrite	UR	Very low MS recovery	
B1HDT7	TOX	UJ	Poor lab rep precision	
B1HC04 B1HDT6	TOX	J	Poor lab rep precision	
B1HC04	TOC	UJ	Analyzed beyond the holding time but within 2 times the holding time	
B1HC06	TOC	J	Analyzed beyond the holding time but within 2 times the holding time	

Table A-6. Third Party Validation Summary for General Chemistry

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1HC05 B1HC07 B1HDT4 B1HDT5 B1HDT6 B1HDT7	TOC	J	Poor lab rep precision	
B1HDF8 B1HDH3 B1KFJ5	Nitrite	UJ	Low MS recovery	
B1J9H2 B1KCC4 B1KDJ0 B1KF21 B1KF21	Nitrite	J	Low MS recovery	
B1J9H2 B1KCC4 B1KDJ0 B1KF21 B1KF10 B1KF43 B1KF68 B1KF72	Fluoride	J	High MS recovery	
B1J9H2	Total Cyanide	J	Poor lab rep precision	
B1KF68 B1KF72 B1KF80 B1KF88 B1KF84 B1KF92	Total Cyanide	UJ	Poor lab rep precision	

Table A-6. Third Party Validation Summary for General Chemistry

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1JCK6 B1JCK7 B1KDJ0 B1KF16 B1KF17 B1KF18 B1KF19 B1KF05 B1KF06 B1KF07 B1KF08 B1KF38 B1KF39 B1KF40 B1KF41	TOC	UJ	Analyzed beyond the holding time but within 2 times the holding time	
B1KF43 B1KF68 B1KF72 B1KCF1 B1KF80 B1KF88 B1KF84 B1KF92 B1KDK1 B1KDM8 B1KDN8 B1KDP8 B1KCH6 B1K612 B1K619	Nitrite	J	High MS recovery	
B1KCF1 B1KF80 B1KF88 B1KF84 B1KF92 B1KDK1 B1KDM8	Chloride	J	High MS recovery	

Table A-6. Third Party Validation Summary for General Chemistry

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1KDN8 B1KDP8 B1KCH6 B1K612 B1K619				
B1KDR0	Chloride	UJ	Laboratory blank contamination	
B1KDR4	TOX	UJ	Poor lab rep precision	
B1KCH6	TOX	J	High MS recovery and poor lab rep precision	
B1BTW3 B1BTV5 B1BRT4 B1BRT1	Cyanide	UR	Analysis beyond 2 times the holding time and lack of MS data	Data Validation Report, VSR10-023, performed in conjunction with DOE/RL-2007-18
B1BTT6	Cyanide	J	Analysis beyond 2 times the holding time and lack of MS data	
B1BRT1 B1BRT4 B1BT38 B1BT32	Cyanide	UR	Very low MS recovery	
B1BRW5	TOX	UJ	Poor laboratory duplicate precision	
BIBRV6 BIBVF4 BIBVF5 BIBRV3 B1BVF1 B1BVF3 B1BT02 B1BVK1 B1BVK2 B1BVK3 B1BRR2 B1BVH3 B1BVH4	TOX	J	Poor laboratory duplicate precision	

Table A-6. Third Party Validation Summary for General Chemistry

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1BVH5 B1BVB4				
B1P8P1 B1P8L2 B1P9K4 B1P8N6 B1P8L7 B1P8R1	N in nitrite	UR	Analysis beyond 2 times the holding time	Data Validation Report, VSR10-022, performed in conjunction with DOE/RL-2007-18
B1P8P1 B1P8L2 B1P9K4 B1P8N6 B1P861	N in nitrate	J	Analysis beyond 2 times the holding time	
B1W1B1	Cyanide	UR	Very low MSD recovery and poor MS/MSD precision	
B1W1B2	Cyanide	J	Very low MSD recovery and poor MS/MSD precision	
B1W1B1 B1W1B2	Hexavalent chromium	UJ	Analysis beyond the holding time but within 2 times the holding time	
B1W1B1 B1W1B2	pH	J	Analysis beyond the holding time	

Table A-7. Third Party Validation Summary for Radiochemical

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1X618 B1XHW8 B1XJ65 B20MW5 B20Y21 B21C43 B21C44 B21C45 B20Y17	Tritium	J	MSs not performed	Data Validation Report, VSR10-002, performed in conjunction with DOE/RL-2001-49 and DOE/RL-2007-18

Table A-7. Third Party Validation Summary for Radiochemical

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1YTX8	Tritium	UJ	Poor replicate precision	
B1YV31 B1YV27	Tritium	J	Poor replicate precision	
B20RV1	Selenium-79	J	Lack laboratory control sample	
B1X628 B1X627 B21K32 B21K33 B21JY5	Carbon-14	UJ	MSs not performed	
B1X618 B1X660 B1X610 B1X664 B1X5V3 B1X612 B1X603 B1X602	Carbon-14	J	MSs not performed	
B1WYD1 B1WYC5	Strontium-89/90	UJ	Replicate analysis not performed	
B1V211 B1VBY5 B1TJ43 B1VC02 B1TWX7 B1TVY0 B1TVY3 B1VC06 B1VBY8 B1VC12 B1VC00 B1VC05 B1VC13 B1VC26 B1VC04	Tritium	J	MSs not performed	Data Validation Report, VSR10-004, performed in conjunction with DOE/RL-2001-49 and DOE/RL-2007-18

Table A-7. Third Party Validation Summary for Radiochemical

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1VC28 B1VC27 B1VC10 B1VC20 B1V630 B1VC58 B1VC19 B1VC21 B1VC29 B1VC18 B1VC42 B1TWH4 B1TX06 B1VC57 B1TWF3 B1TWK5 B1TN41 B1TNP2				
B1V231 B1V215 B1VBY3 B1VC11 B1VC56 B1TWJ2 B1TW29 B1TX39 B1TWF4 B1TWL2 B1TWL3 B1TWK1 B1TNP6	Tritium	UJ	Poor replicate precision	
B1V211 B1V231 B1VC56 B1TWF4 B1TN41 B1TNP2	Carbon-14	UJ	MSs not performed	

Table A-7. Third Party Validation Summary for Radiochemical

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1TVY0 B1V215 B1TVY3 B1V630 B1VC58 B1TWF0 B1TWF3 B1VC57 B1TWH4 B1TNP6	Carbon-14	J	MSs not performed	
B1TN41 B1TNP2 B1TNP6	Radium-226	J	MSs not performed	
B1RB60 B1RB90 B1RB63 B1RB66	Gross Beta	J	Poor replicate precision	
B1RB81	Gross Beta	UJ	Poor replicate precision	
B1TWX7	Iodine-129	J	High carrier recovery	
B1P5C8	Carbon-14	UJ	MSs not performed	Data Validation Report, VSR10-005, performed in conjunction with DOE/RL-2001-49, DOE/RL-2007-18, and DOE/RL-2006-55
B1P5C8	Selenium-79	UJ	LCS not performed	
B1P9X3 B1P9W8 B1PB09 B1PB00 B1P9Y9 B1P9Y0 B1PB14 B1P9Y5 B1P9W3 B1P9V8 B1NXJ0 B1NXH9 B1NK72	Tritium	J	MSs not performed	

Table A-7. Third Party Validation Summary for Radiochemical

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1NXH2 B1NXH3 B1XHB1				
B1NLC8 B1P6V8 B1P6V9 B1R2H7 B1XH91	Tritium	UJ	MSs not performed	
B1P5Y6 B1P9B8	Uranium (total)	J	MSs not performed	
B1R5K4	Technetium-99	J	Analysis beyond the holding time but within 2 times the holding time	
B1XT81	Iodine-129	J	Analysis beyond the holding time but within 2 times the holding time	
B1NKH5	Carbon-14	J	Blank contamination and MS not performed	Data Validation Report, VSR10-006, performed in conjunction with DOE/RL-2001-49 and DOE/RL-2006-55
B1NXJ4 B1NXJ5 B1PB19 B1NXN3 B1NXM5	Tritium	J	MSs not performed	
B1NXN5 B1P344	Tritium	UJ	MSs not performed	
B1NFV3	Plutonium-239/240	J	Blank contamination	
B1NFV3 B1NFV7	Americium-241	J	Blank contamination	
B1NFT9	Radium-226	J	Blank contamination	
B1H241 B1H7C6 B1HF48 B1J358	Tritium	UJ	Lack of MS data	Data Validation Report, VSR10-007, performed in conjunction with DOE/RL-2001-49

Table A-7. Third Party Validation Summary for Radiochemical

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1H1T1 B1H747 B1H740 B1H739 B1H7F2 B1H7H0 B1H7H2 B1H7F8 B1J418 B1J426 B1J430 B1J405 B1J403 B1J449 B1J465 B1J3R4 B1J441 B1J442	Tritium	J	Lack of MS data	
B1H7D3 B1H7D5	Tritium	J	Analysis beyond the holding time but within 2 times the holding time	

Table A-7. Third Party Validation Summary for Radiochemical

Sample Number	Analyte	Qualifier	Reason	Associated Validation Report and SAP
B1N4V1	Tritium	UJ	Lack of MS data	Data Validation Report, VSR10-022, performed in conjunction with DOE/RL-2007-18
B1N5V1 B1N5V6 B1N5T8 B1N5W1 B1N4V0 B1MDR1 B1N593 B1N5B3 B1N598 B1N5F3 B1N5D5	Tritium	J	Lack of MS data	
B1RBH7	Carbon-14	UJ	Lack of MS data	
B1PTW7 B1PTP4 B1PTX1 B1RRC3 B1RRC4	Carbon-14	J	Lack of MS data	
B1RBH7	Selenium-79	UJ	Lack of LCS data	
B1RDM2 B1RDN3 B1RDK9	Tritium	UJ	Analysis beyond the holding time but within 2 times the holding time and lack of MS data	
B1W1B1	Uranium-235	J	Laboratory blank contamination	

A2 References

DOE/RL-2001-49, 2004, *Groundwater Sampling and Analysis Plan for the 200-BP-5 Operable Unit*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D7379978.

DOE/RL-2006-55, 2010, *Sampling and Analysis Plan for FY 2006 200-BP-5 Groundwater Operable Unit Remedial Investigation/Feasibility Study*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2007-18, 2008, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-5 Groundwater Operable Unit*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=0901220536.

VSR10-002, 2009, *Data Validation Report for CH2M HILL Plateau Remediation Company, Project BP-5, Chemical & Radiochemical Validation – Level C*, Analytical Quality Associates, Inc., Albuquerque, New Mexico.

VSR10-004, 2009, *Data Validation Report for CH2M HILL Plateau Remediation Company, Project BP-5, Chemical & Radiochemical Validation – Level C*, Analytical Quality Associates, Inc., Albuquerque, New Mexico.

VSR10-005, 2009, *Data Validation Report for CH2M HILL Plateau Remediation Company, Project BP-5, Chemical & Radiochemical Validation – Level C*, Analytical Quality Associates, Inc., Albuquerque, New Mexico.

VSR10-006, 2009, *Data Validation Report for CH2M HILL Plateau Remediation Company, Project BP-5, Chemical & Radiochemical Validation – Level C*, Analytical Quality Associates, Inc., Albuquerque, New Mexico.

VSR10-007, 2009, *Data Validation Report for CH2M HILL Plateau Remediation Company, Project BP-5, Chemical & Radiochemical Validation – Level C*, Analytical Quality Associates, Inc., Albuquerque, New Mexico.

VSR10-022, 2010, *Data Validation Report for CH2M HILL Plateau Remediation Company, Project BP-5, Chemical & Radiochemical Validation – Level C*, Analytical Quality Associates, Inc., Albuquerque, New Mexico.

VSR10-023, 2010, *Data Validation Report for CH2M HILL Plateau Remediation Company, Project BP-5, Chemical & Radiochemical Validation – Level C*, Analytical Quality Associates, Inc., Albuquerque, New Mexico.

Appendix B

Depth Discrete Data Quality Assessment

Terms

BRA	baseline risk assessment
CHPRC	CH2M HILL Plateau Remediation Company
COPC	contaminant of potential concern
DQA	data quality assessment
FS	feasibility study
HEIS	Hanford Environmental Information System
IDL	instrument detection limit
LCS	laboratory control sample
LERF	Liquid Effluent Retention Facility
MDA	minimum detectable activity
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
N/A	not available
OU	operable unit
QA	quality assurance
QC	quality control
RCRA	*Resource Conservation and Recovery Act of 1976*
RI	remedial investigation
RPD	relative percent difference
SAP	sampling and analysis plan
SVOA	semivolatile organic analysis
SVOC	semivolatile organic compound
VOA	volatile organic analysis
VOC	volatile organic compound

B1 Introduction

This supplement to the data quality assessment (DQA) assesses laboratory data for depth discrete groundwater samples obtained from 28 wells in the 200-BP-5 Groundwater Operable Unit (OU) from December 2, 2009 through May 14, 2010.

The Depth Discrete Groundwater Sampling Project, conducted by Pacific Northwest National Laboratory on behalf of CH2M HILL Plateau Remediation Company (CHPRC), was focused on delivering groundwater samples from selected horizons within select groundwater wells residing in the 200-BP-5 Groundwater OU. The data obtained from these samples are expected to provide information for the remedial investigation (RI) report and feasibility study (FS) for the 200-BP-5 Groundwater OU.

The locations of the 28 wells selected for depth discrete sampling are depicted in Figure B-1. This appendix evaluates data for 19 of the 28 wells from which depth discrete samples were collected. The remaining 9 wells were evaluated as part of the main text of this document and are highlighted in Table B-1.

The following sections and chapters in the main text of this document contain information pertaining to the evaluation of data presented in this appendix:

- Section 1.1—Background information regarding the 200-BP-5 Groundwater OU
- Section 1.3—Target analytes and contaminants of potential concern (COPCs)
- Section 1.4—Associated action levels
- Chapter 2—Purpose of the DQA report
- Chapter 3—Scope of the DQA report
- Chapter 4—Data quality objectives, sampling design, and analytical performance requirements

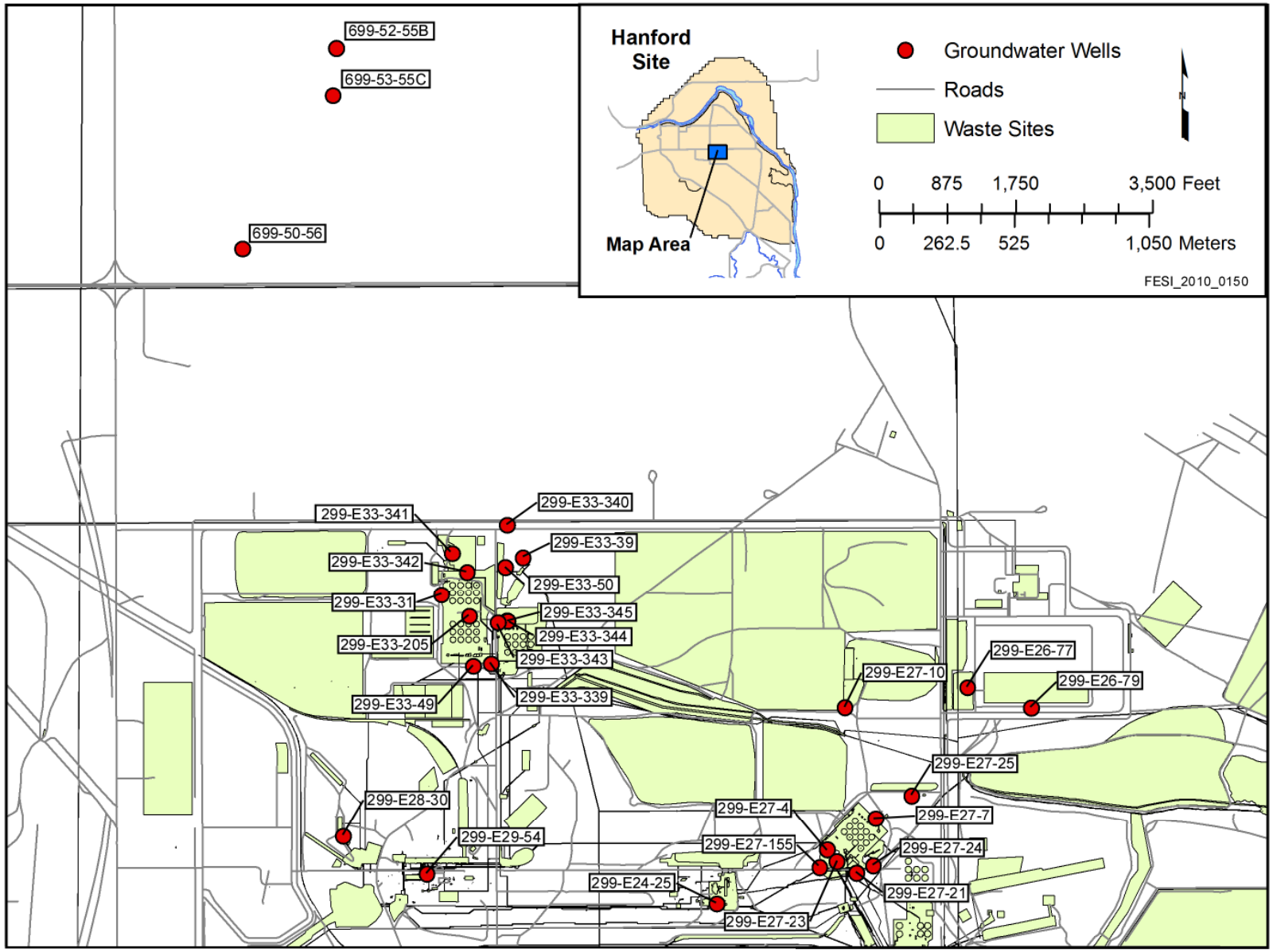

Figure B-1. Location of Groundwater Wells from which Depth Discrete Samples were Collected

Table B-1. List of Wells in which Depth Discrete Samples were Collected

Well Number	Associated Sampling and Analysis Plan(s)	Comments
299-E24-25	DOE/RL-2007-18	200-BP-5 Groundwater OU RI Well "L"
299-E26-77	DOE/RL-2008-41	RCRA well at LERF
299-E26-79	DOE/RL-2008-41	RCRA well at LERF
299-E27-10	PNNL-19129	Existing well sampled per PNNL-19129
299-E27-155	DOE/RL-2007-18	200-BP-5 Groundwater OU RI Well "O"
299-E27-21	PNNL-19129	Existing well sampled per PNNL-19129
299-E27-23	PNNL-19129	Existing well sampled per PNNL-19129
299-E27-24	SGW-44067	Waste Management Area C Monitoring Well
299-E27-25	SGW-44067	Waste Management Area C Monitoring Well
299-E27-4	PNNL-19129	Existing well sampled per PNNL-19129
299-E27-7	PNNL-19129	Existing well sampled per PNNL-19129
299-E28-30	DOE/RL-2007-18	200-BP-5 Groundwater OU RI Well "M"
299-E29-54	DOE/RL-2007-18	200-BP-5 Groundwater OU RI Well "K"
299-E33-205	DOE/RL-2007-18	200-BP-5 Groundwater OU RI Well "C"
299-E33-31	PNNL-19129	Existing well sampled per PNNL-19129
299-E33-339	PNNL-19129	Existing well sampled per PNNL-19129
299-E33-340	DOE/RL-2007-18	200-BP-5 Groundwater OU RI Well "G"
299-E33-341	DOE/RL-2007-18	200-BP-5 Groundwater OU RI Well "D"
299-E33-342	DOE/RL-2007-18, PNNL-19129	200-BP-5 Groundwater OU RI Well "E"
299-E33-343	DOE/RL-2007-18, PNNL-19129	200-BP-5 Groundwater OU RI Well "A"
299-E33-344*	DOE/RL-2007-18	200-BP-5 Groundwater OU RI Well "B"; perched zone
299-E33-345*	DOE/RL-2007-18, PNNL-19129	200-BP-5 Groundwater OU RI Well "B"; unconfined zone
299-E33-39	PNNL-19129	Existing well sampled per PNNL-19129
299-E33-49	PNNL-19129	Existing well sampled per PNNL-19129
299-E33-50	DOE/RL-2007-18	200-BP-5 Groundwater OU RI Well "F"; completed in confined aquifer
699-50-56	DOE/RL-2007-18, PNNL-19129	200-BP-5 Groundwater OU RI Well "J"
699-52-55B	DOE/RL-2007-18	200-BP-5 Groundwater OU RI Well "H"; completed in confined aquifer

Table B-1. List of Wells in which Depth Discrete Samples were Collected

Well Number	Associated Sampling and Analysis Plan(s)	Comments
699-53-55C	PNNL-19129	Existing well sampled per PNNL-19129

Sources:

DOE/RL-2006-55, *Sampling and Analysis Plan for FY 2006 200-BP-5 Groundwater Operable Unit Remedial Investigation/Feasibility Study*.

DOE/RL-2007-18, *Sampling and Analysis Plan for the 200-BP-5 Groundwater Operable Unit Remedial Investigation/Feasibility Study*, Appendix A.

DOE/RL-2008-41, *Sampling and Analysis Plan for the Liquid Effluent Retention Facility (LERF) Replacement RCRA Wells.*

PNNL-19129, *Discrete Sampling Test Plan for the 200-BP-5 Operable Unit.*

SGW-44067, *Sampling and Analysis Plan for Waste Management Area C Assessment Groundwater Monitoring Well Installation.*

Note: Shading denotes those wells that have depth discrete data that are evaluated in the main body of this document.

* A perched zone was unexpectedly encountered while drilling 299-E33-344; the well was completed to monitor this perched water zone, and replacement Well 299-E22-345 was drilled in the same approximate location to monitor the unconfined aquifer as planned.

B1.1 Monitoring Well Selection

Twenty-eight wells were selected for collection of depth discrete samples and subsequent inclusion in this DQA. Of the 28 wells, 9 were evaluated in the main text of this document, and the remaining 19 wells were evaluated in this appendix. These 19 wells, which represent a subset of the total number of wells in the 200-BP-5 Groundwater OU, were sampled during the December 2009 to May 2010 timeframe. A list of the 28 wells is presented in Table B-1, and the 9 wells evaluated in the main text of this document are identified.

The 200-BP-5 Groundwater OU data being assessed by this DQA have been collected in accordance with the sampling and analysis plans listed in Table B-1. Depth discrete groundwater samples were collected during drilling of wells for the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* RI of the 200-BP-5 Groundwater OU in accordance with DOE/RL-2006-55, *Sampling and Analysis Plan for FY 2006 200-BP-5 Groundwater Operable Unit Remedial Investigation/Feasibility Study*, and DOE/RL-2007-18, *Sampling and Analysis Plan for FY 2006 200-BP-5 Groundwater Operable Unit Remedial Investigation/Feasibility Study*, Appendix A. Samples were collected during drilling of RCRA wells within the 200-BP-5 OU in accordance with DOE/RL-2008-41, *Sampling and Analysis Plan for the Liquid Effluent Retention (LERF) Replacement RCRA Wells*, and SGW-44067, *Sampling and Analysis Plan for Waste Management Area C Assessment Groundwater Monitoring Well Installation*. Depth discrete samples were collected from 14 existing wells in the 200-BP-5 OU in accordance with PNNL-19129, *Discrete Sampling Test Plan for the 200-BP-5 Operable Unit*. Some of the RI wells initially sampled during drilling were later sampled as existing wells.

Because the data were originally collected in accordance with various documents, it is not necessary to evaluate the sampling implementation against the requirements of these documents. Rather, the adequacy of the data set in terms of comprehensiveness must be evaluated by the individual data user, based on the unique requirements of the application (e.g., the baseline risk assessment [BRA]).

B2 Sample Results

Table B-2 provides a listing of sample results generated for depth discrete samples from the 19 wells evaluated in this appendix. The data, presented by well number and analyte class, represent the data set of 2,479 results. The analytes classes shown include the following:

- General organics (e.g., total organic halides)
- Metals (e.g., arsenic and barium)
- Physical properties (e.g., pH and specific conductance)
- Radiochemistry (e.g., plutonium-238 and technetium-99)
- Semivolatile organics (e.g., pentachlorophenol)
- Volatile organics (e.g., chloroform and methylene chloride)
- Wet chemistry (e.g., ammonia, chloride, and fluoride)

Table B-3 lists the sampling depth interval, sampling date, and Hanford Environmental Information System (HEIS) sample number by well.

Table B-2. Sample Results by Well and Analyte Class

Well	General Organics	Metals	Physical Properties	Radiochemistry	SVOA	VOA	Wet Chemistry	Total By Well
299-E24-25	--	55	5	70	322	165	31	**648**
299-E27-10	--	--	--	1	--	--	5	**6**
299-E27-21	--	--	--	10	--	--	31	**41**
299-E27-23	--	--	4	8	--	--	20	**32**
299-E27-24	4	34	15	4	--	--	13	**70**
299-E27-25	4	34	10	6	--	--	14	**68**
299-E27-4	--	--	--	6	--	--	--	**6**
299-E27-7	--	--	--	12	--	--	30	**42**
299-E28-30	--	55	10	70	338	165	35	**673**
299-E29-54	--	64	19	70	323	169	34	**679**
299-E33-31	--	5	--	10	--	--	30	**45**
299-E33-339	--	1	--	6	--	--	20	**27**
299-E33-342	--	2	--	4	--	--	10	**16**
299-E33-343	--	3	--	6	--	--	16	**25**
299-E33-345	--	1	--	4	--	--	5	**10**
299-E33-39	--	--	--	6	--	--	15	**21**
299-E33-49	--	--	--	4	--	--	15	**19**
699-50-56	--	--	--	4	--	--	5	**9**
699-53-55C	--	--	--	12	--	--	30	**42**
Totals	**8**	**254**	**63**	**313**	**983**	**499**	**359**	**2,479**

Table B-3. Depth Discrete Sampling Summary

Well Name	Sample Date	Sample Interval (m)	Sample Number
299-E24-25	12/2/2009	87.48	B23358
299-E24-25	12/2/2009	90.53	B23353
299-E24-25	12/8/2009	95.1	B23354
299-E24-25	12/8/2009	95.1	B23355
299-E24-25	12/8/2009	95.1	B23359
299-E24-25	1/6/2010	102.672	B23357
299-E24-25	1/6/2010	102.672	B23362
299-E24-25	12/28/2009	103.3	B23356
299-E24-25	12/8/2009	103.3	B23360
299-E24-25	12/28/2009	103.3	B23361
299-E27-10	2/17/2010	70.775	B22WF6
299-E27-10	2/17/2010	70.775	B22WF8
299-E27-21	2/25/2010	86.87	B248D9
299-E27-21	2/25/2010	86.87	B248F0
299-E27-21	2/25/2010	89.92	B248F2
299-E27-21	2/25/2010	89.92	B248F3
299-E27-21	2/25/2010	92.96	B248F5
299-E27-21	2/25/2010	92.96	B248F6
299-E27-23	1/13/2010	87.48	B22W86
299-E27-23	1/13/2010	87.48	B22W91
299-E27-23	4/21/2010	87.48	B248C5
299-E27-23	4/21/2010	87.48	B248C6
299-E27-23	4/21/2010	90.678	B248C8
299-E27-23	4/21/2010	90.678	B248C9
299-E27-23	4/21/2010	93.88	B248D0
299-E27-23	4/21/2010	93.88	B248D1
299-E27-23	4/21/2010	93.88	B248D2
299-E27-24	5/13/2010	84.978	B24949
299-E27-24	5/13/2010	84.978	B24951

Table B-3. Depth Discrete Sampling Summary

Well Name	Sample Date	Sample Interval (m)	Sample Number
299-E27-24	5/13/2010	84.978	B24954
299-E27-24	5/13/2010	91.074	B24955
299-E27-24	5/13/2010	91.074	B24957
299-E27-24	5/14/2010	96.62	B24964
299-E27-24	5/14/2010	96.62	B24965
299-E27-24	5/14/2010	96.62	B24966
299-E27-25	4/6/2010	69.007	B24958
299-E27-25	4/6/2010	69.007	B24959
299-E27-25	4/7/2010	75.194	B24961
299-E27-25	4/7/2010	75.194	B24962
299-E27-25	4/7/2010	75.194	B24978
299-E27-4	4/20/2010	87.48	B22W98
299-E27-4	4/20/2010	90.678	B22W99
299-E27-4	4/20/2010	93.88	B22WB0
299-E27-7	2/16/2010	73.914	B22WB9
299-E27-7	2/16/2010	73.914	B22WC4
299-E27-7	2/16/2010	76.048	B22WC0
299-E27-7	2/16/2010	76.048	B22WC5
299-E27-7	2/16/2010	77.72	B22WC1
299-E27-7	2/16/2010	77.72	B22WC6
299-E27-7	2/16/2010	77.72	B22WC9
299-E27-7	2/16/2010	77.72	B22WD0
299-E27-7	2/16/2010	80.77	B22WC2
299-E27-7	2/16/2010	80.77	B22WC7
299-E27-7	2/16/2010	83.82	B22WC3
299-E27-7	2/16/2010	83.82	B22WC8
299-E27-7	1/7/2010	86.87	B22WD6
299-E27-7	1/7/2010	86.87	B22WF0
299-E27-7	1/7/2010	89.92	B22WD7

Table B-3. Depth Discrete Sampling Summary

Well Name	Sample Date	Sample Interval (m)	Sample Number
299-E27-7	1/7/2010	89.92	B22WF1
299-E28-30	2/9/2010	96.62	B23PT8
299-E28-30	2/9/2010	96.62	B23PV3
299-E28-30	2/12/2010	100.6	B23PT9
299-E28-30	2/12/2010	100.6	B23PV0
299-E28-30	2/12/2010	100.6	B23PV4
299-E28-30	2/12/2010	100.6	B23PV5
299-E28-30	2/25/2010	107	B23PV2
299-E28-30	2/25/2010	107	B23PV7
299-E28-30	2/25/2010	107	B24DP5
299-E28-30	2/22/2010	107.02	B23PV1
299-E28-30	2/22/2010	108.84	B23PV6
299-E29-54	1/7/2010	95.128	B233N6
299-E29-54	1/7/2010	95.128	B233P1
299-E29-54	1/18/2010	100.3	B233N7
299-E29-54	1/18/2010	100.3	B233N8
299-E29-54	1/18/2010	100.3	B233P2
299-E29-54	1/18/2010	100.3	B233P3
299-E29-54	2/3/2010	105.49	B233N9
299-E29-54	2/3/2010	105.49	B233P4
299-E29-54	2/11/2010	112.41	B233P0
299-E29-54	2/11/2010	112.41	B233P5
299-E33-31	1/19/2010	76.352	B22W75
299-E33-31	1/19/2010	76.352	B22W77
299-E33-31	1/19/2010	76.352	B22W79
299-E33-31	2/23/2010	76.352	B248M2
299-E33-31	2/23/2010	76.352	B248M3
299-E33-31	2/23/2010	76.352	B248M4
299-E33-31	1/19/2010	77.876	B22W76

Table B-3. Depth Discrete Sampling Summary

Well Name	Sample Date	Sample Interval (m)	Sample Number
299-E33-31	1/19/2010	77.876	B22W78
299-E33-31	1/19/2010	77.876	B22W80
299-E33-31	2/23/2010	77.876	B248M6
299-E33-31	2/23/2010	77.876	B248M7
299-E33-31	2/23/2010	77.876	B248M8
299-E33-31	2/23/2010	77.876	B248M9
299-E33-31	2/23/2010	77.876	B248N0
299-E33-31	2/23/2010	77.876	B248N1
299-E33-339	1/5/2010	82.3	B22W39
299-E33-339	1/5/2010	82.3	B22W43
299-E33-339	1/5/2010	83.82	B22W40
299-E33-339	1/5/2010	83.82	B22W44
299-E33-339	2/22/2010	84.887	B22W41
299-E33-339	2/22/2010	84.887	B22W45
299-E33-342	12/22/2009	73	B22VY5
299-E33-342	12/22/2009	73	B22W03
299-E33-342	12/22/2009	73.884	B22VY6
299-E33-342	12/22/2009	73.884	B22W04
299-E33-343	12/17/2009	77.876	B22W11
299-E33-343	12/17/2009	77.876	B22W19
299-E33-343	12/17/2009	78.486	B22W12
299-E33-343	12/17/2009	78.486	B22W20
299-E33-343	12/17/2009	79.461	B22W13
299-E33-343	12/17/2009	79.461	B22W17
299-E33-343	12/17/2009	79.461	B22W21
299-E33-345	1/12/2010	78.03	B22W26
299-E33-345	1/12/2010	78.03	B22W32
299-E33-345	1/12/2010	79.278	B22W27
299-E33-345	1/12/2010	79.278	B22W33

Table B-3. Depth Discrete Sampling Summary

Well Name	Sample Date	Sample Interval (m)	Sample Number
299-E33-39	2/18/2010	68.428	B22W70
299-E33-39	2/18/2010	69.8754	B22W65
299-E33-39	2/18/2010	69.8754	B22W66
299-E33-39	2/18/2010	69.8754	B22W71
299-E33-39	2/18/2010	69.8754	B22W72
299-E33-49	2/18/2010	68.428	B22W64
299-E33-49	1/4/2010	82.3	B22W56
299-E33-49	1/4/2010	84.277	B22W52
299-E33-49	1/4/2010	84.277	B22W57
299-E33-49	1/4/2010	86.319	B22W53
299-E33-49	1/4/2010	86.319	B22W58
699-50-56	1/11/2010	48.16	B22VN7
699-50-56	1/11/2010	48.16	B22VP3
699-50-56	1/11/2010	49.07	B22VP4
699-53-55C	1/14/2010	60.838	B22VW3
699-53-55C	1/14/2010	60.838	B22VX3
699-53-55C	1/14/2010	63.7	B22VW4
699-53-55C	1/14/2010	63.7	B22VX4
699-53-55C	1/14/2010	64.62	B22VW5
699-53-55C	1/14/2010	64.62	B22VX5
699-53-55C	1/14/2010	64.62	B22VX8
699-53-55C	1/14/2010	64.62	B22VY0
699-53-55C	1/18/2010	65.23	B22VW6
699-53-55C	1/18/2010	65.23	B22VX6
699-53-55C	1/18/2010	67.06	B22VW7
699-53-55C	1/18/2010	67.06	B22VX7

B3 Data Validation

This section describes data validation activities, including formal validation, data set review, and evaluation of field and laboratory quality control (QC) data.

B3.1 Review Data Quality

The CHPRC Soil and Groundwater Remediation Project generated 2,479 distinct analytical results from the 19 target 200-BP-5 Groundwater OU wells from December 2, 2009 through May 14, 2010. As required by the RI/FS Work Plan SAP (DOE/RL-2007-18, Appendix A), the analytical data were evaluated in accordance with EPA/240/B-06/003, *Data Quality Assessment: Statistical Methods for Practitioners*, to ensure that specific quality assurance (QA) objectives of the project were achieved. This evaluation consisted of the following activities:

- Formal validation of a minimum of 5 percent of a randomly selected segment of the data
- Detection limits against regulatory action levels
- Evaluation of the field QC sample data
- Evaluation of the laboratory QC data

The results of these activities are summarized in the following sections.

B3.2 Formal Data Validation

A third party independent data validation was performed by Analytical Quality Associates, Inc., of Albuquerque, New Mexico. Two SAPs were used to identify the quantity and the level of data validation to be completed for the 200-BP-5 Groundwater OU analytical data (DOE/RL-2006-55 and DOE/RL-2007-18, Appendix A).

Based on a per-method survey of the analytical results, at least 5 percent of the characterization data by method were selected for depth discrete samples, collected between December 2, 2009 and May 14, 2010, and validated to Level C, per HNF-20433, *Data Validation Procedure for Chemical Analyses*, and HNF-20434, *Data Validation Procedure for Radiochemical Analyses*.

B3.2.1 Validation Results

The majority of the data did not require qualification. However, qualifiers were applied to some percentage of the analytical results, based on lack of traceability to standards, holding time exceedences, blank contamination, lack of QC data, QC data out-of-tolerance, or method blank contamination. Qualified results included results from volatile organics, semivolatile organics, inorganics, radiochemical, general chemistry, herbicides and pesticides, and dioxins and furans analyte classes.

Nearly all of the qualifiers were either “J,” indicating that the result is usable but should be considered an estimate rather than absolute quantitative value, or “UJ,” indicating that the sample was not detected but the absolute detection limit should be considered an estimate.

For the sample results addressed in this appendix, the validation resulted in no data rejections.

Appendix A of this document contains a summary of the independent third party validation, including all flags assigned. The summary is presented by analyte class in Tables A-1 through A-7 (Appendix A).

B3.3 Supplementary Data Evaluation—Detection Limits

The data set consists of 2,479 individual analytical results. Of these, approximately 64 percent were nondetected results. Table B-4 lists the number of results per constituent and the number and percent of nondetected results. This table also shows the number and percent of the nondetected results where the reporting limit exceeded the regulatory action limits listed in Table 1-3.

Sixteen constituents had all nondetected values and all reporting limits that were greater than the applicable regulatory action limit. These constituents are listed in Table B-5. None of these are RI/FS constituents, but they were reported as method-based analytes.

An additional 31 constituents displayed a large percentage (greater than 25 percent) of detection limits that exceed regulatory action limits. These data must be considered carefully when using the data set for regulatory decision making, particularly when using the data to demonstrate achievement of an action level. These constituents are listed in Table B-6.

Of the 47 constituents listed in Tables B-5 and B-6, only arsenic, cadmium, and pentachlorophenol were identified as COPCs in the RI/FS Work Plan (DOE/RL-2007-18, Appendix A).

Table B-4. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Results	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
Total Organic Carbon	General Organics	4	2	50	N/A	N/A
Total Organic Halides	General Organics	4	4	100	N/A	N/A
Aluminum	Metals	15	6	41	0	0
Antimony	Metals	15	11	73.3	0	0
Arsenic	Metals	15	7	46.7	7	100
Barium	Metals	5	0	0	0	0
Beryllium	Metals	4	4	100	0	0
Cadmium	Metals	19	18	94.7	5	27.8
Calcium	Metals	5	0	0	N/A	N/A
Chromium	Metals	19	15	78.9	0	0
Cobalt	Metals	4	4	100	4	100
Copper	Metals	4	0	0	0	0
Hexavalent Chromium	Metals	15	15	100	0	0
Iron	Metals	19	4	21	0	0
Lithium	Metals	1	1	100	0	0
Magnesium	Metals	5	0	0	N/A	N/A
Manganese	Metals	5	1	20	0	0
Mercury	Metals	15	14	93.3	14	100
Nickel	Metals	4	4	100	0	0

Table B-4. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Results	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
Phosphorus	Metals	1	0	0	0	0
Potassium	Metals	5	0	0	N/A	N/A
Silicon	Metals	1	0	0	N/A	0
Silver	Metals	4	4	25	4	100
Sodium	Metals	19	0	0	N/A	N/A
Strontium	Metals	1	0	0	0	0
Thallium	Metals	15	14	93.3	1	7.1
Tin	Metals	4	4	100	0	0
Uranium	Metals	27	1	3.7	0	0
Vanadium	Metals	4	1	25	0	0
Zinc	Metals	4	0	0	0	0
Oxidation-Reduction Potential	Physical Properties	11	0	0	N/A	N/A
pH Measurement	Physical Properties	13	0	0	N/A	N/A
Specific Conductance	Physical Properties	13	0	0	N/A	N/A
Temperature	Physical Properties	13	0	0	N/A	N/A
Turbidity	Physical Properties	13	0	0	N/A	N/A
Americium-241	Radiochemistry	15	14	93.3	0	0
Carbon-14	Radiochemistry	15	15	100	0	0
Cesium-137	Radiochemistry	15	15	100	0	0

Table B-4. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Results	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
Cobalt-60	Radiochemistry	15	15	100	0	0
Gross Beta	Radiochemistry	4	0	0	N/A	N/A
Iodine-129	Radiochemistry	16	14	87.5	0	0
Neptunium-237	Radiochemistry	15	15	100	0	0
Plutonium-238	Radiochemistry	15	15	100	0	0
Plutonium-239/240	Radiochemistry	15	15	100	0	0
Strontium-90	Radiochemistry	15	15	100	0	0
Technetium-99	Radiochemistry	66	9	13.6	0	0
Thorium-228	Radiochemistry	15	15	100	N/A	N/A
Thorium-230	Radiochemistry	15	15	100	0	0
Thorium-232	Radiochemistry	15	14	93.3	N/A	N/A
Tritium	Radiochemistry	62	0	0	0	0
1,2,4-Trichlorobenzene	SVOA	15	15	100	0	0
1,2-Benzenedicarboxylic Acid Butyl 2-ethylhexyl Ester	SVOA	1	0	0	0	0
1,2-Dichlorobenzene	SVOA	15	15	100	0	0
1,3-Dichlorobenzene	SVOA	15	15	100	0	0
1,4-Dichlorobenzene	SVOA	15	15	100	0	0
1-Decyn-4-ol	SVOA	1	0	0	0	0

Table B-4. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Results	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
1-Methyl-2-pyrrolidinone	SVOA	4	0	0	N/A	N/A
1-Pentanol	SVOA	1	0	0	0	0
2,4,5-Trichlorophenol	SVOA	15	15	100	0	0
2,4,6-Trichlorophenol	SVOA	15	15	100	1	6.7
2,4-Dichlorophenol	SVOA	15	15	100	0	0
2,4-Dimethylphenol	SVOA	15	15	100	0	0
2,4-Dinitrophenol	SVOA	15	15	100	0	0
2,4-Dinitrotoluene	SVOA	15	15	100	15	100
2,6-Dinitrotoluene	SVOA	15	15	100	0	0
2,6-Nonadienal, (e,e)-	SVOA	1	0	0	0	0
2-Chloronaphthalene	SVOA	15	15	100	0	0
2-Chlorophenol	SVOA	15	15	100	0	0
2-Iminoimidazolidin-4-one	SVOA	1	0	0	0	0
2-Methylcyclohex-5-en	SVOA	1	0	0	0	0
2-Methylnaphthalene	SVOA	15	15	100	0	0
2-Methylphenol (cresol, *o*-)	SVOA	15	15	100	0	0
2-Nitroaniline	SVOA	15	15	100	0	0
2-Nitrophenol	SVOA	15	15	100	N/A	N/A
3,3'-Dichlorobenzidine	SVOA	15	15	100	15	100

Table B-4. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Results	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
3+4 Methylphenol	SVOA	15	15	100	0	0
3-Nitroaniline	SVOA	15	15	100	0	0
4,6-Dinitro-2-methylphenol	SVOA	15	15	100	1	6.7
4-Bromophenylphenyl Ether	SVOA	15	15	100	N/A	N/A
4-Chloro-3-methylphenol	SVOA	15	15	100	N/A	N/A
4-Chloroaniline	SVOA	15	15	100	15	100
4-Chlorophenylphenyl Ether	SVOA	15	15	100	N/A	N/A
4-Hydroxy-2-butanone	SVOA	1	0	0	0	0
4-Nonanol	SVOA	1	0	0	0	0
4-Nitroaniline	SVOA	15	15	100	0	0
4-Nitrophenol	SVOA	15	15	100	0	0
Acenaphthene	SVOA	15	15	100	0	0
Acenaphthylene	SVOA	15	15	100	N/A	N/A
Amylene Hydrate	SVOA	1	0	0	0	0
Anthracene	SVOA	15	15	100	0	0
Benzo(a)anthracene	SVOA	15	15	100	15	100
Benzo(a)pyrene	SVOA	15	15	100	15	100
Benzo(b)fluoranthene	SVOA	15	15	100	15	100
Benzo(ghi)perylene	SVOA	15	15	100	N/A	N/A

Table B-4. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Results	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
Benzo(k)fluoranthene	SVOA	15	15	100	15	100
Bis(2-chloro-1-methylethyl)ether	SVOA	15	15	100	1	6.7
Bis(2-Chloroethoxy)methane	SVOA	15	15	100	0	0
Bis(2-chloroethyl)ether	SVOA	15	15	100	15	15
Bis(2-ethylhexyl)phthalate	SVOA	15	14	93.3	0	0
Butylbenzylphthalate	SVOA	15	15	100	0	0
Carbazole	SVOA	15	15	100	0	0
Chrysene	SVOA	15	15	100	15	100
Decanoic Acid	SVOA	1	0	0	N/A	N/A
Dibenz[a,h]anthracene	SVOA	15	15	100	15	100
Dibenzofuran	SVOA	15	15	100	0	0
Diethylphthalate	SVOA	15	14	93.3	0	0
Dimethyl Phthalate	SVOA	15	15	100	0	0
Di-*n*-butylphthalate	SVOA	15	15	100	0	0
Di-*n*-octylphthalate	SVOA	15	14	93.3	0	0
Fluoranthene	SVOA	15	15	100	0	0
Fluorene	SVOA	15	15	100	0	0
Glycine	SVOA	1	0	0	0	0
Hexachlorobenzene	SVOA	15	15	100	15	100

Table B-4. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Results	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
Hexachlorobutadiene	SVOA	15	15	100	15	100
Hexachlorocyclopentadiene	SVOA	15	15	100	0	0
Hexachloroethane	SVOA	15	15	100	0	0
Indeno(1,2,3-cd)pyrene	SVOA	15	15	100	15	100
Isophorone	SVOA	15	15	100	0	0
Lauric Acid	SVOA	1	0	0	0	0
Lineatin	SVOA	1	0	0	0	0
Naphthalene	SVOA	15	15	100	0	0
Nitrobenzene	SVOA	15	15	100	0	0
n-Heptyl Aldehyde	SVOA	1	0	0	0	0
n-Hexanoic Acid	SVOA	1	0	0	0	0
n-Nitrosodi-*n*-dipropylamine	SVOA	15	15	100	15	100
n-Nitrosodiphenylamine	SVOA	15	15	100	0	0
p,*p*,*p*-Triphenyl-phosphine Imide	SVOA	1	0	0	0	0
Pentachlorophenol	SVOA	15	15	100	15	100
Pentanoic Acid	SVOA	1	0	0	0	0
Phenanthrene	SVOA	15	15	100	N/A	N/A
Phenol	SVOA	15	15	100	0	0
Phosphine Oxide, Triphenyl-	SVOA	2	0	0	0	0

Table B-4. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Results	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
Pyrene	SVOA	15	15	100	0	0
1,1,1-Trichloroethane	VOA	15	15	100	0	0
1,1,2,2-Tetrachloroethane	VOA	15	15	100	14	93.3
1,1,2-Trichloroethane	VOA	15	15	100	14	93.3
1,1-Dichloroethane	VOA	15	15	100	0	0
1,1-Dichloroethene	VOA	15	15	100	0	0
1,2-Dichloroethane	VOA	15	15	100	14	93.3
1,2-Dichloroethene (Total)	VOA	15	15	100	0	0
1,2-Dichloropropane	VOA	15	15	100	14	93.3
1-Butanol	VOA	1	1	100	0	0
2-Butanone	VOA	15	15	100	0	0
2-Pentanone, 4-Methyl	VOA	15	15	100	0	0
Acetone	VOA	15	15	100	0	0
Benzene	VOA	15	15	100	14	93.3
Bromodichloromethane	VOA	15	15	100	14	93.3
Bromoform	VOA	15	15	100	0	0
Bromomethane	VOA	15	14	93.3	0	0
Carbon Disulfide	VOA	15	15	100	0	0
Carbon Tetrachloride	VOA	15	13	86.7	12	92.3

Table B-4. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Results	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
Chlorobenzene	VOA	15	15	100	0	0
Chloroethane	VOA	15	15	100	N/A	N/A
Chloroform	VOA	15	14	93.3	0	0
Chloromethane	VOA	15	15	100	N/A	N/A
cis-1,2-Dichloroethylene	VOA	1	1	100	0	0
cis-1,3-Dichloropropene	VOA	15	15	100	14	93.3
Dibromochloromethane	VOA	15	15	100	14	93.3
Ethylbenzene	VOA	15	15	100	0	0
Methylene Chloride	VOA	15	15	100	0	0
Styrene	VOA	15	15	100	0	0
Tetrachloroethene	VOA	15	15	100	14	93.3
Toluene	VOA	15	15	100	0	0
trans-1,2-Dichloroethylene	VOA	1	1	100	0	0
trans-1,3-Dichloropropene	VOA	15	15	100	14	93.3
Trichloroethene	VOA	15	15	100	14	93.3
Trichloromonofluoromethane	VOA	1	1	100	0	0
Vinyl Chloride	VOA	15	15	100	15	100
Xylenes (Total)	VOA	15	15	100	0	0
Alkalinity	Wet Chemistry	19	0	0	N/A	N/A

Table B-4. Detection Limit Comparison

Analyte Name	Analyte Class	Number of Results	Number of Nondetects	Percent Nondetect	Number of Nondetects Exceeding Action Limit	Percent of Nondetects Exceeding Action Limit
Bromide	Wet Chemistry	4	3	75	N/A	N/A
Chloride	Wet Chemistry	62	0	0	0	0
Cyanide	Wet Chemistry	27	16	59.3	0	0
Dissolved Oxygen	Wet Chemistry	12	0	0	N/A	N/A
Fluoride	Wet Chemistry	45	8	17.8	0	0
Nitrate	Wet Chemistry	62	1	1.6	0	0
Nitrite	Wet Chemistry	62	51	82.2	0	0
Phosphate	Wet Chemistry	4	4	100	N/A	N/A
Sulfate	Wet Chemistry	62	0	0	0	0

Note: Shading denotes those analytes that were identified as COPCs in DOE/RL-2007-18, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-5 Groundwater Operable Unit*, Appendix A.

Table B-5. Analytes for Which All Results Were Nondetects and All Detection Limits Exceeded Action Limits

Cobalt	2,4-Dinitrotoluene
3,3'-Dichlorobenzidine	4-Chloroaniline
Benzo(a)anthracene	Benzo(a)pyrene
Benzo(b)fluoranthene	Benzo(k)fluoranthene
Chrysene	Dibenz[a,h]anthracene
Hexachlorobenzene	Hexachlorobutadiene
Indeno(1,2,3-cd)pyrene	*n*-Nitrosodi-*n*-dipropylamine
Pentachlorophenol	Vinyl Chloride

Note: Shading denotes those analytes that were identified as COPCs in DOE/RL-2007-18, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-5 Groundwater Operable Unit*, Appendix A.

Table B-6. Analytes with Greater than 25 Percent Nondetects Exceeding Action Limit

Arsenic	Cadmium	Cobalt
Mercury	Silver	2,4-Dinitrotoluene
3,3'-Dichlorobenzidine	4-Chloroaniline	Benzo(a)anthracene
Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(k)fluoranthene
Chrysene	Dibenz[a,h]anthracene	Hexachlorobenzene
Hexachlorobutadiene	Indeno(1,2,3-cd)pyrene	Pentachlorophenol
1,1,2,2-Tetrachloroethane	1,1,2-Trichloroethane	1,2-Dichloroethane
1,2-Dichloropropane	Benzene	Bromodichloromethane
Carbon Tetrachloride	*cis*-1,3-Dichloropropene	Dibromochloromethane
Tetrachloroethene	*trans*-1,3-Dichloropropene	Trichloroethene
Vinyl Chloride		

Note: Shading denotes those analytes that were identified as COPCs in DOE/RL-2007-18, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-5 Groundwater Operable Unit*, Appendix A.

B3.4 Field Quality Control

The QC procedures must be followed in the field to ensure that reliable data are obtained. Field QC samples are collected to evaluate the potential for cross-contamination and to provide information pertinent to field variability. Field QC for sampling generally requires the collection of field replicates (duplicates), trip or field blanks, and equipment blanks. Field QC sampling is described here in general terms; actual field QC samples and the required frequency for collection are described in the SAPs.

During the period of this assessment (i.e., December 2009 through May 2010), 1,945 field QC results were generated, which is approximately 32 percent of the total groundwater samples results obtained for the depth discrete samples assessed in this appendix. These consisted of 176 field duplicate results. No field split or field blank samples were collected for the depth discrete samples assessed in this appendix. The following subsections provide further information on field QC results and a breakdown of those results by analyte and field QC type. The field QC elements were evaluated against the criteria listed in Table B-7.

Table B-7. Field Quality Control Acceptance Criteria

QC Element	Acceptance Criteria
Field Duplicates	Field duplicates with a result greater than 5 times the MDL or MDA must have RPD ≤20 to be considered acceptable.

B3.4.1 Field Duplicate Samples

Field duplicate samples are two separate samples collected from the same source, given different sample numbers, placed in separate sample containers, and analyzed independently to estimate precision, including sampling and analytical variability. The measure of precision for field duplicate samples is the relative percent difference (RPD) between duplicate pairs. The RPD is calculated for a field duplicate sample only when one result or the other is at least five times the detection limit. Table B-8 lists the field duplicates analyzed by class.

Table B-8. Total Field Duplicate Results by Analyte Class

Analyte Class	Results
Anions	35
General Chemistry	1
Metals	10
Radiochemistry	130
Total	**176**

There are 176 pairs of field duplicates and 8 analytes (americium-241, cobalt-60, carbon-14, neptunium-237, plutonium-238, thorium-232, chloride, and hexavalent chromium) identified as COPCs in the RI/FS Work Plan (DOE/RL-2007-18, Appendix A) that had duplicate data. No duplicates had RPDs that exceeded the acceptance criteria listed in Table B-7.

B3.5 Laboratory Quality Control

This section summarizes the review of the laboratory QC associated with the 200-BP-5 OU Groundwater OU depth discrete sampling data set. Laboratory contamination, precision, accuracy, completeness, and comparability are evaluated.

The data set consists of 3,697 laboratory QC results. This includes 1,769 lab blanks, 1,087 laboratory control standards, 613 matrix spikes (MSs), and 228 surrogate results. The laboratory QC elements were evaluated against the criteria listed in Table B-9.

Table B-9. Laboratory Quality Control Acceptance Criteria

Quality Control Element	Acceptance Criteria
Laboratory Blanks	Lab blank limit is 2 times the MDL, IDL, or MDA. However, for common laboratory contaminants acetone, methylene chloride, 2-butanone, toluene, and phthalate esters, the QC limit is 5 times the MDL.
Laboratory Control Samples	LCS percent recovery must be between the laboratory provided minimum control limit and maximum control limit.
Laboratory Spikes	Lab spikes where the sample result is ≤4 times the spiking concentration are evaluated by comparing the percent recovery with the minimum and maximum control limits provided by the laboratory. In addition, where the sample result is ≤4 times the spiking concentration, the MS/MSD RPD must be ≤20.

B3.5.1 Laboratory Contamination

Hanford Site laboratory contracts require that laboratory method blanks be analyzed with each batch of up to 20 samples, or at least 5 percent. A total of 1,769 lab blanks were reported with the lab QC associated with the 200-BP-5 Groundwater OU depth discrete sampling data set assessed in this appendix. This represents approximately 28 percent of the total number of sample results.

Of the 1,769 method blanks, 2 individual analytes displayed an unacceptable positive result, indicating potential laboratory contamination. A total of 29 method blank results are associated with these 2 analytes. Of these results, 2 (or 0.1 percent) displayed an unacceptable positive result indicating potential laboratory contamination. Table B-10 lists the total number of laboratory blanks analyzed by analyte class. Table B-11 shows the distribution of the potential laboratory contamination, by analyte, in the positive blanks, as well as the total number of blanks collected for each of the analytes. Of the two analytes, cobalt-60 is a COPC.

Table B-10. Total Method Blank Results by Analyte Class

Analyte Class	Results
Radiochemistry	208
SVOCs	637
VOCs	475
Total	**1,769**

Table B-11. Summary of Method Blank Samples

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
Bromomethane	Anions	14	1	7.1
Cobalt-60	Anions	15	1	6.6
Totals		**1,769**	**2**	**0.1**

Note: Shading denotes those analytes that were identified as COPCs in DOE/RL-2007-18, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-5 Groundwater Operable Unit*, Appendix A.

* The field blank limit is 2 times the MDL, IDL, or MDA.

B3.5.2 Accuracy

Three types of QC are used to assess accuracy. The laboratory control sample (LCS) is used to assess the performance of the laboratory with respect to the method and the accuracy of the laboratory preparation and analysis processes. The MSs are used to assess the accuracy of the published method on the sample matrix and evaluate matrix effects that may bias the data. Surrogates are organic compounds that are similar in chemical composition to the analytes of interest and spiked into QC samples prior to sample preparation and analysis. Surrogate recoveries are used to evaluate matrix interference on a sample-specific basis.

B3.5.3 Laboratory Control Samples

There were 1,087 LCSs results reported for the 200-BP-5 Groundwater OU depth discrete sampling data set.

Of the 1,087 LCS results, 7 analytes exceeded the acceptance criteria in Table B-9. A total of 65 LCS results are associated with these 7 analytes. Of these results, 7 (or 0.6 percent) exceeded QC requirements for the LCS percent recovery to be within the minimum and maximum laboratory control limits.

Table B-12 lists the total number of LCSs analyzed by analyte class. Table B-13 shows the distribution of the analytes that exceeded these limits, as well as the total number of samples collected for each of the seven analytes. Of the exceedences, two of the constituents were COPCs (antimony and neptunium-237) identified in the RI/FS Work Plan (DOE/RL-2007-18, Appendix A).

Table B-12. Total Laboratory Control Sample Results by Class

Analyte Class	Results
Anions	215
General Chemistry	70
Metals	230
Radiochemistry	176
SVOCs	291
VOCs	105
Total	**1,087**

Table B-13. Laboratory Control Sample Results Exceeding Quality Control Criteria

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
1,2,4-Trichlorobenzene	SVOC	10	1	10
1,4-Dichlorobenzene	SVOC	10	1	10
Antimony	Metals	12	1	8.3
Hexachloroethane	SVOC	9	1	11.1
Neptunium-237	Radiochemistry	14	2	14.2
3,3'-Dichlorobenzidine	SVOC	10	1	10
Totals		**1,087**	**7**	**0.6**

Note: Shading denotes those analytes that were identified as COPCs in DOE/RL-2007-18, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-5 Groundwater Operable Unit*, Appendix A.

* LCS percent recovery must be between the laboratory provided minimum control limit and maximum control limit.

B3.5.4 Laboratory Spike Recovery

Laboratory spike recovery is also used as a measure of laboratory accuracy. For the 200-BP-5 Groundwater OU depth discrete sampling data set assessed in this appendix, there were 613 individual spiked sample results. The laboratory spikes are listed by class in Table B-14.

Of the 613 MS results, 13 individual analytes exceeded the minimum and/or maximum control limits set up by the laboratory. A total of 117 MS results are associated with these 13 analytes. Of these results, 33 (or 5.3 percent) exceeded the minimum and/or maximum control limits set up by the laboratory. Table B-15 shows the distribution of analytes in these spike recovery failures. Of the exceedances, only sodium is a COPC identified in the RI/FS Work Plan (DOE/RL-2007-18, Appendix A).

Table B-14. Total Laboratory Spikes by Class

Analyte Class	Results
Anions	58
General Chemistry	6
Metals	169
Radiochemistry	32
SVOCs	256
VOCs	92
Total	**613**

Table B-15. Laboratory Matrix Spike Results Outside of Quality Control Criteria

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits
1,2,4-Trichlorobenzene	SVOC	8	2	25
1,4-Dichlorobenzene	SVOC	10	5	50
2-Nitroaniline	SVOC	8	6	75
3,3'-Dichlorobenzidine	SVOC	10	8	80
4-Chloroaniline	SVOC	4	2	50
4-Nitrophenol	SVOC	9	1	11
Calcium	Metals	7	1	14.2
Hexachloroethane	SVOC	8	2	25
Nitrogen in Nitrate	Anions	11	1	9
Phenol	SVOC	8	1	12.5
Sodium	Metals	11	2	18.2
Sulfate	Anions	12	1	8.3
Uranium	Metals	11	1	9
Totals		**613**	**33**	**5.3**

Table B-15. Laboratory Matrix Spike Results Outside of Quality Control Criteria

Analyte	Class	Total Collected	Total Results Out of Limits*	Percent Out of Limits

Note: Shading denotes those analytes that were identified as COPCs in DOE/RL-2007-18, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-5 Groundwater Operable Unit*, Appendix A.

* Lab spikes where the sample result is ≤4 times the spiking concentration are evaluated by comparing the percent recovery with the minimum and maximum control limits provided by the laboratory. In addition, where the sample result is ≤4 times the spiking concentration, the MS/MSD RPD must be ≤20.

B3.5.5 Laboratory Surrogates

Finally, as part of volatile and semivolatile organic analyses, a compound that is not likely to be contained in an environmental sample (a surrogate) is injected into each sample as a measure of overall method performance on that specific sample. The 200-BP-5 Groundwater OU depth discrete sampling data set assessed in this appendix contained 228 surrogate results. Of these, 9 (or approximately 3.9 percent) were outside of the laboratory-specified acceptability criteria. Table B-16 lists the surrogates analyzed by analyte class. Table B-17 shows the distribution of analytes in these surrogate failures.

Table B-16. Total Laboratory Surrogates by Class

Analyte Class	Total Surrogates
SVOCs	162
VOCs	66
Total	**228**

Table B-17. Laboratory Surrogates Exceeding Quality Control Criteria

Analyte	Compound Class	Total Collected	Total Results Out of Limits	Percent Out of Limits
2,4,6-Tribromophenol	SVOC	27	1	3.7
Phenol-d5	SVOC	27	6	22.2
Terphenyl-d14 (7CI)	SVOC	26	2	7.6
Totals		**228**	**9**	**3.9**

B4 Data Usability

Data from each category of information are summarized in the following sections. These categories include QC review from the following:

- Five percent of the data collected (selected for formal independent third party validation)
- Summary of all field QC
- Summary of all laboratory QC
- Summary of the detection limit evaluation

Analytical results associated with samples B1TTV1, B1TTV2, B1TTV3, B1TTV4, and B1TVL1 from Well 299-E33-340 were not considered representative due to the addition of drilling fluid prior to sample collection and completion of limited purging. As such, the data associated with these samples are not considered useable for regulatory decision making.

B4.1 Formal Validation

No major deficiencies were identified in the validated volatile organic, semivolatile organic, herbicide and pesticide, dioxins and furans, inorganic, or radiochemical data.

Minor deficiencies were identified by the validation process, which resulted in the application of "J" or "UJ" flags. These flagged sample results are summarized by analyte class in Tables A-1 through A-7 in Appendix A of this report. All flags identified during the validation process have been applied or corrected in HEIS.

Data users should pay attention to applied flags within HEIS and review the laboratory QC for sample results, which are specifically relied upon, particularly for those parameters for which some validated data were found to be rejectable.

B4.2 Summary of Field Quality Control Data

Field QC consisted of field blanks and field duplicates. Performance overall was excellent as summarized in Table B-18.

Table B-18. Summary of Field Quality Control Results for the 200-BP-5 Groundwater Operable Unit Data Set

Field QC Element	Total Number of Field QC Values in the Data Set	Number of Field QC Values Outside of Acceptance Criteria	Percent of Field QC Values Meeting Acceptance Criteria
Field Duplicates	176 pairs	0 pairs	100

B4.3 Summary of Laboratory Quality Control Data

Laboratory QC includes lab blanks, duplicates, LCSs, MSs, and surrogates. Overall, the laboratory performance was very good, as summarized in Table B-19.

Table B-19. Summary of Laboratory Quality Control for the 200-BP-5 Groundwater Operable Unit Depth Discrete Sampling Data Set

Laboratory QC Element	Total Number of Laboratory QC Values in the Data Set	Number of Laboratory QC Values Outside of Acceptance Criteria	Percent of Laboratory QC Meeting Acceptance Criteria
Laboratory Blanks	1,769	2	99.9
Laboratory Control Sample	1,087	7	99.4
Matrix Spike Recovery	613	33	94.7
Surrogates	228	9	96.1

Although the laboratory performance was excellent overall, some isolated data batches exhibited problems. The appropriate qualifiers have been added in the HEIS database. Data users that rely on single data results should ensure that they understand the qualifiers identified in HEIS and confirm that laboratory batch data associated with the specific result are also good.

B4.4 Detection Limits

Using nondetect data to demonstrate performance to a specific threshold requires the laboratory reporting limit to be less than the threshold. Several constituents, including some analytes that were identified as COPCs in the RI/FS Work Plan (DOE/RL-2007-18, Appendix A), exhibit large percentages of nondetected values where the reporting limit exceeds the identified regulatory threshold. Positive detected results can be compared with the threshold to evaluate whether or not the constituent exceeds the limit. However, nondetected results are only useful for comparison to regulatory action levels if the reporting limit is below the applicable action limit. The following findings are associated with the detection limit comparison:

- Data for 16 constituents had 100 percent nondetected values and 100 percent of the reporting limits greater than the applicable regulatory action limit (Table B-5). None of these are 200-BP-5 Groundwater OU RI/FS constituents, but they were reported as method-based analytes. Data users must look carefully at data detection limits relative to action limits when using these data.
- An additional 31 constituents displayed a large percentage (25 percent or more) of detection limits that exceeded regulatory action limits (Table B-6). These data must be considered carefully when using the data set for regulatory decision making, particularly when using the data to demonstrate achievement of a remediation goal. Data users must look carefully at data detection limits relative to action limits when using these data.

Of the 47 constituents listed in Table B-5 (constituents with 100 percent nondetected values and 100 percent results greater than the action limit) and Table B-6 (constituents with 25 percent or more results that exceed action limits), only arsenic, cadmium, and pentachlorophenol are analytes that were identified as COPCs in the RI/FS Work Plan (DOE/RL-2007-18, Appendix A).

B4.5 Conclusion

The conclusion of this assessment is that the 200-BP-5 Groundwater OU depth discrete sample data are of the right type, quality, and quantity for direct regulatory use (e.g., in the BRA) as part of the RI/FS process. Detection limits, precision, accuracy, and data completeness were analyzed to determine if any analytical data should be rejected as a result of QA or QC deficiencies. Other than those results that were noted as questionable or unusable, the analytical data were found to be acceptable for the intended use noted in this appendix.

B5 References

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601, et seq. Available at: http://uscode.house.gov/download/pls/42C103.txt.

DOE/RL-2006-55, 2010, *Sampling and Analysis Plan for FY 2006 200-BP-5 Groundwater Operable Unit Remedial Investigation/Feasibility Study*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2007-18, 2008, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-5 Groundwater Operable Unit*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=0901220536.

DOE/RL-2008-41, 2008, *Sampling and Analysis Plan for the Liquid Effluent Retention Facility (LERF) Replacement RCRA Wells*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=0808180154.

EPA/240/B-06/003, 2006, *Data Quality Assessment: Statistical Methods for Practitioners*, EPA QA/G-9S, Office of Environmental Information, U.S. Environmental Protection Agency, Washington, D.C. Available at: http://www.epa.gov/quality/qs-docs/g9s-final.pdf.

HNF-20433, 2004, *Data Validation Procedure for Chemical Analyses*, Rev. 0, Fluor Hanford, Inc., Richland, Washington.

HNF-20434, 2004, *Data Validation Procedure for Radiochemical Analyses*, Rev. 0, Fluor Hanford, Inc., Richland, Washington.

PNNL-19129, 2010, *Discrete Sampling Test Plan for the 200-BP-5 Operable Unit*, Pacific Northwest National Laboratory, Richland, Washington. Available at: http://www.osti.gov/bridge/product.biblio.jsp?osti_id=973414.

Resource Conservation and Recovery Act of 1976, 42 USC 6901, et seq. Available at: http://epw.senate.gov/rcra.pdf.

SGW-44067, 2009, *Sampling and Analysis Plan for Waste Management Area C Assessment Groundwater Monitoring Well Installation*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington.

Distribution

	MS	Quantity
U.S. Department of Energy, Richland Operations Office		
DOE Public Reading Room	H2-53	1
CH2M HILL Plateau Remediation Company		Electronic
R.E. Day	H8-15	1
V.J. Rohay	H8-15	1
G.S. Thomas	R3-50	1
C.D. Wittreich	H8-15	1
Fluor Federal Services, Inc.		Electronic
C.T. Narquis	R3-50	1
D.L. Morgans	H8-51	11
Lockheed Martin Enterprise Records and Information Management		
Administrative Record	H6-08	1
Document Clearance	H6-08	1
Pacific Northwest National Laboratory		
Hanford Technical Library	P8-55	1
Freestone Environmental Services, Inc.		
Freestone Library	B2-63	1