ECF-100HR3-10-0469
Revision 1

Identification of Contaminants of Potential Concern for Groundwater Risk Assessment at the 100-HR-3 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

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Richland, Washington 99352

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Project: 100 Areas and 300 Area Remedial Investigation/Feasibility Study Reports

Date: November 16, 2012

Calculation Title & Description: Identification of Contaminants of Potential Concern for Groundwater Risk Assessment at the 100-HR-3 Groundwater Operable Unit

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Checker: Donna Morgans	**Basis of Qualification:** Education & Experience
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Draft A	COPC language updates based on decisional draft comments. Flow charts updated for accuracy and clarity. Incorporated revised nitrate EPC for 100-H Source exposure area.	10/7/2011	All
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Terms

ARAR	applicable or relevant and appropriate requirements
AWQC	Aquatic Water Quality Standards
BRA	Baseline Risk Assessment
COPC	contaminant of potential concern
DOE	U.S. Department of Energy
ECF	environmental calculation file
EPA	Environmental Protection Agency
EPC	Exposure Point Concentration
EQL	Estimated Quantitation Limit
FS	Feasibility Study
HEIS	Hanford Environmental Information System
MCL	Maximum Contaminant Level
MCLG	Maximum Residual Disinfectant Levels
MDL	Method Detection Limit
OU	operable unit
RI/FS	Remedial Investigation/Feasibility Study
SDWA	Safe Drinking Water Act
SAP	Sampling and Analysis Plan
WAC	Washington Administrative Code

1 Purpose

This environmental calculation describes the identification of contaminants of potential concern (COPCs) for groundwater risk assessment at the 100-HR-3 Groundwater Operable Unit (OU). This evaluation supports DOE/RL-2010-95, *Remedial Investigation/Feasibility Study for the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units*.

This environmental calculation includes a description of the 100-HR-3 OU COPC identification process, and the COPC results.

2 Background

Groundwater COPCs are potentially site-related analytes that are detected in groundwater at levels that represent a potential threat to human health or the environment and that have analytical data of sufficient quality for use in a quantitative baseline risk assessment. COPCs are selected based on a multi-step screening process. COPCs that pose a potentially unacceptable risk are carried forward to be addressed by the feasibility study (FS).

1. In general, COPCs with exposure point concentrations above an action level [see Section 3.3 for a complete list of chemical-specific applicable or relevant and appropriate requirements (ARARs)] were retained as COPCs.
2. Exceptions to this general rule are made for analytes that have exposure point concentrations that *are not* above their action level (which are calculated for the OU as a whole), but exist locally at concentrations above the action level (i.e., are localized contaminants that represent a potential threat to human health or the environment).

A preliminary COPC evaluation was conducted in 2008 to support DOE/RL-2008-46-ADD1 Rev. 0, *Integrated 100 Area Remedial Investigation/Feasibility Study Work Plan, Addendum 1: 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units*, and DOE/RL-2009-40, Rev. 0, *Sampling and Analysis Plan for the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units Remedial Investigation/ Feasibility Study*. The work plan effort evaluated groundwater analytical data collected over a 16-year period (1992 to 2008) and resulted in the identification of a list of historic COPCs that are reported in DOE/RL-2009-40, Table 1-2. The historic COPCs identified in DOE/RL-2009-40 for the 100-HR-3 Groundwater OU are also listed in Table 2-1, below.

The groundwater data used in this calculation were collected specifically to address the data needs identified in DOE/RL-2008-46-ADD1. The groundwater data set also addresses the chemical, spatial, and temporal uncertainties associated with the previous groundwater risk results.

This calculation focuses on

1. Validating and updating the results of the DOE/RL-2008-46-ADD1 COPC evaluation, using more recent and comprehensive groundwater analytical data, and
2. Evaluating the groundwater analytical data collected in accordance with DOE/RL-2009-40 to identify those analytes that qualify as COPCs.

This calculation uses a rigorous screening methodology that incorporates action levels derived from a comprehensive set of chemical-specific ARARs. COPCs are identified separately for each of three exposure areas that compose the 100-HR-3 OU:

1. 100-D Source exposure area
2. 100-H Source exposure area
3. Horn exposure area (groundwater that has moved from the 100-D area toward the river)

Table 2-1. List of Historic Contaminants of Potential Concern in the 100-HR-3 Groundwater Operable Unit [a]

Contaminants of Potential Concern		
Metals		
Antimony	Arsenic	Beryllium
Cadmium	Chromium	Cobalt
Copper	Hexavalent Chromium	Lead
Manganese	Mercury	Nickel
Selenium	Silver	Thallium
Uranium	Vanadium	Zinc
Volatile Organic Compounds		
1,1-Dichloroethene	Benzene	Carbon tetrachloride
Chloroform	Trichloroethene	Vinyl chloride
Radiological		
Strontium-90	Technetium-99	Tritium
Anions		
Fluoride	Nitrate (as N)	Nitrite (as N)
Sulfate		

Notes:

a. DOE/RL-2009-40, Rev. 0, Table 1-2

3 Methodology

The COPC identification methodology is a sequence of three steps:

1. Extract (from the Hanford Environmental Information System [HEIS]) and process the 100-HR-3 OU-specific analytical data set.
2. Evaluate the data set to select analytes that qualify for the groundwater risk assessment.
3. Evaluate the analytes for each of the three exposure areas, to identify analytes that qualify as COPCs.

The COPCs will be carried forward into the supplemental groundwater risk evaluation, which will be conducted as part of the remedial investigation/feasibility study (RI/FS).

3.1 Verification of Data Set Completeness

A list of the analytical methods used is gathered from the dataset and compared against the methods specified in the sampling and analysis plan (DOE/RL-2009-40). The following steps are taken to verify that the data set is complete and contains only those records that will be used in the COPC identification process:

- Identify any records associated with an analytical method not called out in the SAP.
- Identify any records associated with an analytical method not equivalent to a method identified in the SAP.
- Identify each well, and independently verify that all results are reported in the data set, identifying any wells for which sample results are missing.

3.2 Analytical Data Processing

The data set obtained from HEIS included the following types of information:

- Analytical results from both unfiltered and filtered samples
- Data qualification and data validation flags, including rejected results
- Results for a given analyte reported by more than one analytical method
- Parent, field duplicate, and field split sample results

The analytical data were processed to eliminate unusable results and thus identify one set of results per sampling location and date of sample collection. The data processing steps and the numbers of records associated with each step are presented in Figure 3-1. Descriptions of the data processing steps follow.

3.2.1 Unfiltered Sample Results

Only analytical results from unfiltered samples are used in identifying COPCs; results from filtered samples are excluded. Unfiltered sample results represent total concentrations of the analytes, while filtered sample results represent only dissolved concentrations. Use of filtered sampling results might lead to underestimation of chemical and radiological concentrations (e.g., in water from an unfiltered tap).

The publication, EPA/540/1-89/002, *Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A)*, addresses this issue in providing guidance on estimating exposure concentrations in groundwater:

> "While filtration of ground-water samples provides useful information for understanding chemical transport within an aquifer, the use of filtered samples for estimating exposure is very controversial, because these data may underestimate chemical concentrations in water from an unfiltered tap. Therefore, data from unfiltered samples should be used to estimate exposure concentrations."

3.2.2 Laboratory and Data Validation Flags

Analytical data are received from the laboratory with data qualification flags. Validation qualifiers are assigned during the data validation process. The following rules determine how flagged and/or qualified sample results are used in identifying COPCs.

- Sample results flagged with a "U" qualifier or combination of qualifiers that include a "U," such as a "UJ," are considered nondetected results.

- Sample results without a "U" qualifier are considered detected concentrations, including results with no qualifier or with a "J" qualifier.
- Sample results that are rejected and flagged with an "R" qualifier are not used in identifying COPCs.

3.2.3 Analytes Reported by Numerous Analytical Methods

Often analytes are reported by more than one analytical method, resulting in multiple results for the same analyte from the same location. When analytes are reported by more than one analytical method, the data are processed to select the method that provides the most reliable results. For example, the gamma spectroscopy method provides concentration results for the uranium isotopes; however, uranium concentrations reported by a uranium-isotope-specific method are preferred.

3.2.4 Field Duplicate and Field Split Results

Field quality control samples (field duplicates and field splits) are collected in the field and analyzed by the laboratory as unique samples. The parent sample and quality control samples are collected from the same location (i.e., monitoring well) on the same date, resulting in more than one sample per location/date. The following criteria are used to reduce multiple sample results for an individual location/date to a single result:

- If two or more detections exist, the maximum concentration is used.
- If at least one detection and one or more nondetected results exist, the detected concentration is used.
- If only (two or more) nondetected results exist, the lowest detection limit is used.

3.3 Identify Action Levels

Action levels are derived from available sources of chemical-specific ARARs and default exposure assumptions. All sources of chemical-specific ARARs for each of the 113 analytes reported in the HEIS database for the 100-HR-3 OU are identified in Table 3-1.

For the COPC identification process, the action level is the lowest of the available values for protection of human health and aquatic receptors.

3.3.1 ARAR-Based Remediation Goals

The sources of the chemical-specific ARARs from federal regulations are:

- 40 CFR 141 National Primary Drinking Water Regulations, MCLs, secondary MCLs, and non-zero MCLGs established under the *Safe Drinking Water Act of 1974* (SDWA)
- National Recommended Water Quality Criteria, aquatic water quality criteria (AWQC) established under Section 304 of the *Clean Water Act of 1977*
- 40 CFR 131 water quality standards for states not complying with Section 303 of the *Clean Water Act of 1977*

The sources of the chemical-specific ARARs from Washington State regulations are:

- WAC 173-340-720, "Groundwater 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"

Derivation of State of Washington groundwater cleanup levels is provided in a separate calculation brief (ECF-100NPL-10-0462, *Calculation of Standard Method B Groundwater Cleanup Levels for Potable Groundwater for the 100 Areas and 300 Area Remedial Investigation/Feasibility Study Reports*). Derivation of State of Washington surface water cleanup levels is provided in a separate calculation brief (ECF-100NPL-10-0463, *Calculation of Standard Method B Surface Water Cleanup Levels for the 100 Areas and 300 Area Remedial Investigation/Feasibility Study Reports*).

3.4 Groundwater COPC Identification Process: Part 1

After extracting and processing the 100-HR-3 OU groundwater analytical data set from HEIS, a multi-step screening process was used to identify COPCs. The COPC identification process steps, and the numbers of records and numbers of analytes associated with each step, are depicted in Figure 3-2. The steps are:

- Apply exclusion criteria.
- Identify nondetected analytes.
- Identify analytes with maximum detected concentrations less than their respective action levels.
- Identify analytes with maximum detected concentrations greater than their respective action levels.

3.4.1 Apply Exclusion Criteria

The first step in the groundwater COPC identification process is to apply certain exclusion criteria. Analytes that met one or more of the exclusion criteria were eliminated as COPCs. Analytes that did not meet any of the exclusion criteria were carried forward into the next step. The exclusion criteria are:

- Naturally occurring radionuclides associated with background radiation
- Radionuclides that have half-lives of less than 3 years and are not significant daughter products
- Essential nutrients (minerals)
- Analytes without known toxicity information

3.4.2 Identify Nondetected Analytes

The next step in the groundwater COPC identification process was to identify nondetected analytes. Chemicals and radionuclides that have been analyzed for, but not detected in any sample (collected from appropriate locations with adequate detection limits), were eliminated as COPCs. All analytes detected at least once were carried forward to the next step.

3.4.3 Identify Analytes with Maximum Detected Concentrations Less Than Action Levels

This step identifies analytes with maximum concentrations less than action levels. In this initial screening, the maximum concentration of each analyte detected in groundwater was compared to its action level, to identify analytes not likely to contribute significantly to overall risk. If the maximum detected concentration of an analyte was less than its action level, the analyte was eliminated as a COPC, unless the uncertainty analysis indicated otherwise.

Uncertainty Analysis. An additional evaluation was performed on those analytes that were detected at concentrations that were near but did not exceed their respective action level (i.e., the maximum detected concentration was at least greater than one-tenth the action level, or one order of magnitude). This evaluation also included the additional analytes identified as historic COPCs in DOE/RL-2009-40, Table 1-2 (See Table 2-1).

The purpose of this evaluation is to determine if there is a potential for underestimating cumulative effects when the concentrations of analytes are only slightly less than their action levels. Additionally, method detection limits (MDLs) associated with these analytes were evaluated, to determine if the limits are adequate for confirming presence or absence of the analytes near their respective action levels.

3.4.4 Identify Analytes with Maximum Detected Concentrations Greater Than Action Levels

This step identifies analytes with maximum concentrations greater than their respective action levels. Such analytes are likely to contribute to overall risk. If the maximum detected concentration of an analyte is greater than its action level, the analyte is carried forward for EPC calculation, unless the uncertainty analysis indicates otherwise.

Uncertainty Analysis. An additional evaluation was performed to distinguish two types of analytes that were detected infrequently:

- Analytes detected once, or a very few times, with high concentrations that are not consistent with the remainder of the dataset (are not reproducible). Such results can lead to overestimation of actual groundwater concentrations. Analytes with limited, non-reproducible results are not retained.
- Analytes that were detected infrequently overall, but more frequently at one or more locations, and that are associated with a significant local trend or may be associated with a continuing vadose source. Such results indicate a potential risk, and these analytes are retained.

3.5 Groundwater COPC Identification Process: Part 2

After identifying the set of analytes with maximum concentrations greater than action levels for the 100-HR-3 OU, a multi-step screening process is applied to the analytical dataset to further evaluate the analytes that will be carried forward for evaluation in the 100-HR-3 OU RI/FS. The preceding steps of the process were carried out on an OU-wide basis; the next steps are carried out separately for each of the three 100-HR-3 OU exposure areas.

Groundwater COPCs are identified by comparing 90th percentile values to their respective action levels. The sequential steps in the COPC identification process are:

- Identify the monitoring wells in each exposure area.
- Identify nondetected COPCs in each exposure area.
- Perform statistical calculations to estimate 90th percentile values for the analytes detected in each exposure area.
- Identify analytes with 90th percentile values less than their respective action levels in each exposure area.
- Identify analytes with 90th percentile values greater than their respective action levels in each exposure area.

- Perform analyte-specific evaluations.

A flow-chart depicting the COPC identification process and the number of analytes associated with each process step is provided in Figure 3-3. The steps in the sequence are described below.

3.5.1 Identify Monitoring Wells in Each Exposure Area

The first step in the COPC identification process is to identify the monitoring wells that are located within each exposure are: the 100-D Source exposure area, the 100-H Source exposure area, and the Horn exposure area.

3.5.2 Identify Nondetected Analytes in Each Exposure Area

An analyte may have been detected in only one or two of the exposure areas and been carried forward on that basis. The next step is to identify analytes that have not been detected in each exposure area. This step is performed in the same manner as described in Section 3.4.2. The analytes that have not been detected in any of the groundwater samples from an exposure area are eliminated as COPCs for that exposure area.

3.5.3 Calculate 90th Percentile Values for Each Analyte and Exposure Area

Groundwater COPCs are identified by comparing statistical exposure point concentration (EPC) estimates (i.e., 90th percentile values) to action levels for each detected analyte and exposure area. EPCs are estimated as the 90th percentile value for each analyte. The 90th percentile value for each analyte is calculated, separately for each exposure area, from the existing groundwater data set. In the 90th percentile calculations, the MDL is used as the "detected" concentration for nondetect samples. A description of the methodology used to calculate the 90th percentile values is provided in ECF-100HR3-10-0473, *Calculation of Exposure Point Concentrations for the 100-HR-3 Groundwater Operable Unit*.

3.5.4 Identify Analytes with 90th Percentile Values Less Than Action Levels in Each Exposure Area

Groundwater analytes with 90th percentile values less than their respective action levels are identified for each exposure area. The 90th percentile values are compared to the lowest chemical-specific ARARs for protection of human health and aquatic receptors.

3.5.4.1 Analyte-Specific Evaluation

An analyte-specific evaluation step is conducted when the 90th percentile value for an analyte is less than its action level, but individual sample results indicate concentrations greater than the action level. A flow-chart depicting this analyte-specific evaluation is provided in Figure 3-4. This step is performed to confirm that the analyte has not been inappropriately eliminated as a COPC, and takes into consideration specific attributes of the groundwater contamination plume, as described below.

- Is the analyte co-located with one or more COPCs, with some sample concentrations above its action level?
- Is the analyte associated with a significant local trend or continuing vadose source?
- Is the analyte associated with a discrete local exposure point, with some concentrations above its action level?

3.5.5 Identify Analytes with 90th Percentile Values Greater Than Action Levels in Each Exposure Area

Groundwater analytes with 90th percentile values greater than their respective action levels are identified for each exposure area. The 90th percentile values are compared to the lowest chemical-specific ARARs for protection of human health and aquatic receptors.

3.5.5.1 Analyte-Specific Evaluation

An analyte-specific evaluation is performed on analytes with 90th percentile values greater than their respective action levels. A flow-chart depicting this analyte-specific evaluation is provided in Figure 3-5. This step is performed to confirm that the 90th percentile value has not inappropriately identified a COPC, and takes into consideration the effects that data quality, naturally occurring levels of metals, and action level selection have on COPC identification.

- Is the analyte at or below background levels and thus a naturally occurring substance?
- Is the ARAR-based action level (Table 3-1) only a secondary MCL that is not enforceable?

4 Assumptions and Inputs

4.1 Groundwater Data Set Used for COPC Identification

The groundwater data set used for COPC identification consists of sampling and analysis data collected from 52 monitoring wells within the 100-HR-3 OU. All are either monitoring wells or compliance wells. A list of the wells used in this evaluation is provided in Table 4-1. Figure 4-1 shows the location of each well.

The sampling and analysis data were collected over an 8-month period between October 7, 2009 and June 11, 2010. Three sampling events were used to capture the effects that temporal fluctuations of river stage have on groundwater conditions. Samples collected from mid-May to mid-June 2010 represent aquifer conditions when the river stage is at its highest elevation. Samples collected from early October 2009 to early November 2009 represent aquifer conditions when the river is at its lowest elevation. Samples collected from mid-March to mid-April 2010 represent aquifer conditions when the river is transitioning from high to low river stage. A total of 27,354 records were obtained from HEIS, and a total of 113 analytes were included in the data set prior to analytical data processing. After analytical data processing (as described in Section 3.2), the final data set used for the COPC identification process contained a total of 16,201 records, with 113 analytes included in the data set.

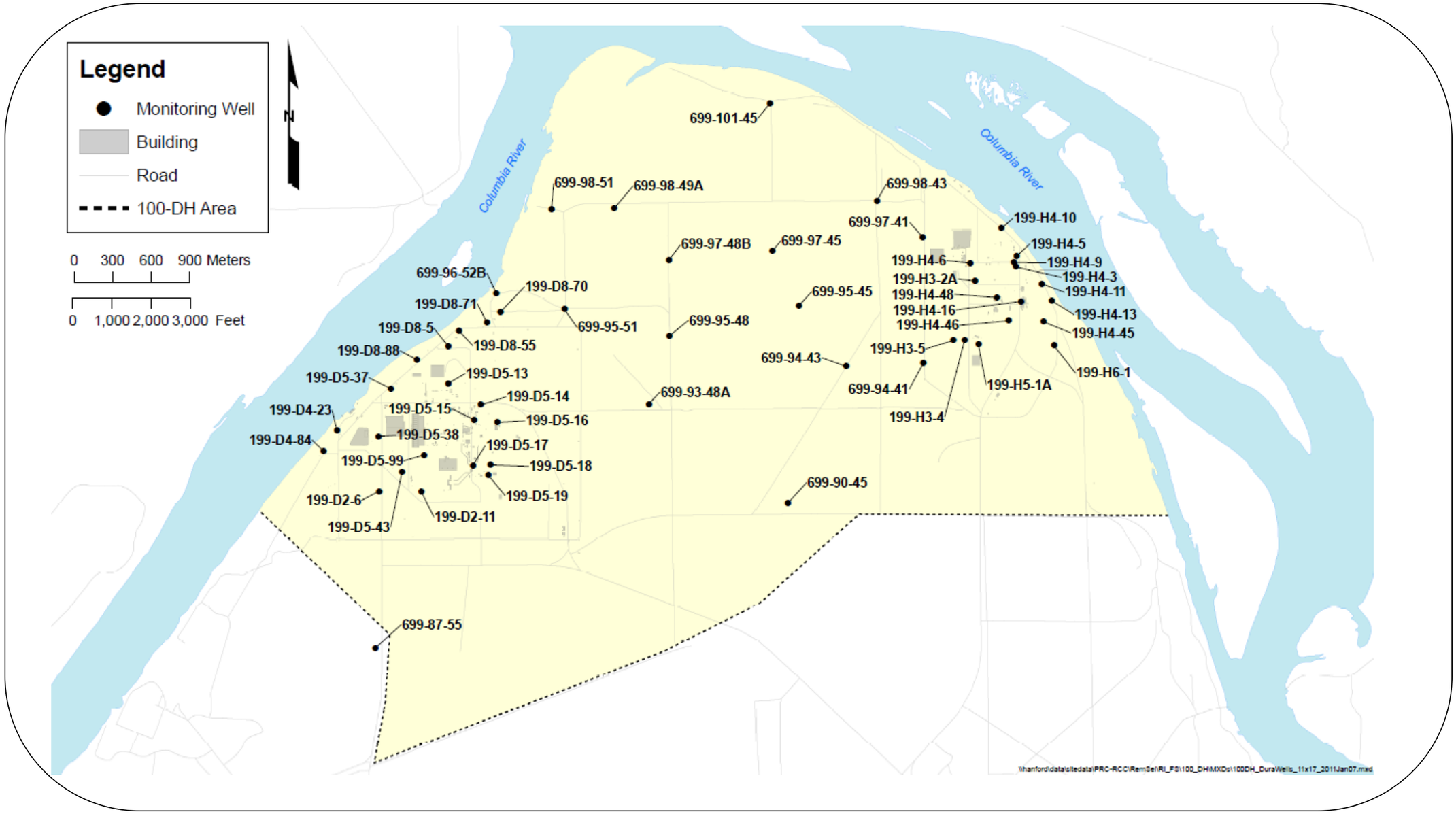

Figure 4-1. Groundwater Monitoring Wells for the 100-HR-3 Groundwater Operable Unit

5 Software Applications

Software used for this analysis includes HEIS, Microsoft Access[1] database software, and Microsoft Excel[2]. HEIS is a central repository for storing and maintaining access to environmental data collected for the Hanford Site. Microsoft Access is used to query and sort the data downloaded from HEIS. Microsoft Excel is used to present the groundwater data and other information in spreadsheets.

6 Calculation

Groundwater COPCs for the 100-HR-3 groundwater OU are identified using the methodology presented in Section 3 and the groundwater data set described in Section 4. Results for each step of the COPC identification process are summarized in the text and tables in Section 7.

The methodology used to calculate 90th percentile values and the results are provided in ECF-100HR3-10-0473.

7 Results/Conclusions

7.1 Groundwater COPC Identification Process: Part 1

This section summarizes the results of the COPC identification process.

7.1.1 Apply Exclusion Criteria

The following subsections summarize the results of the exclusion criteria screening step. A total of 22 analytes met the exclusion criteria; they are listed in Table 7-1. Sampling dates, minimum and maximum detected concentrations, minimum and maximum MDLs, and the bases for their exclusion are also provided in Table 7-1.

7.1.1.1 Background Radiation

One naturally occurring radionuclide associated with background radiation (potassium-40) was measured in groundwater from the 100-HR-3 groundwater OU and was eliminated as a COPC.

7.1.1.2 Radionuclides with Half-lives of Less than 3 Years

Radioisotopes with half-lives less than or equal to 3 years are eliminated from further consideration, because only a small fraction of their original activity remains after 30 years of decay. A total of four radioisotopes met this exclusion criterion (antimony-125, beryllium-7, cesium-134, and ruthenium-106) and were eliminated from further consideration as COPCs. These radioisotopes were reported with non-detectable concentrations. Additionally, these isotopes are not significant daughter products associated with a decay chain.

7.1.1.3 Essential Nutrients

Essential nutrients are those analytes considered essential for human nutrition. The essential nutrients calcium, magnesium, potassium, and sodium were detected in the groundwater in the 100-HR-3 OU, but are excluded from further consideration as COPCs.

1 Access is a trademark of Microsoft Corporation, Redmond, Washington.
2 Excel is a trademark of Microsoft Corporation, Redmond, Washington.

7.1.1.4 Analytes without Action Levels or Toxicity Values

Analytes without promulgated chemical-specific ARARs were identified in Table 3-1. Because of the lack of promulgated standards (see Table 3-1), these analytes were not evaluated herein as this environmental calculation focuses on comparing detected concentrations against action levels. However, the overall contribution of these analytes (and all other detections) were evaluated in the EPA Tap Water scenario (ECF-100HR3-10-0478, *Tap Water Risk Assessment for the 100-HR-3 Groundwater Operable Unit*) using all available toxicity information. For example, chloromethane does not have promulgated standards, but toxicity information is published and was used to evaluate the risks for these contaminants. For some analytes without an action level, there is also no available toxicological information that could be considered in assessing any risks they may present. Thirteen analytes were eliminated from further consideration as COPCs because they do not have an action level and they do not have available toxicological information. The eliminated analytes are listed in Table 7-1.

The MCL for gross beta is 4 mrem/yr annual dose and is used to indicate the presence of a group of beta-emitters. Although there is an MCL for gross beta, gross beta is reported by the laboratory in units of activity (pCi/L) and would require a conversion from activity to an annual dose rate (mrem/yr). Beta-emitting radioisotopes such as strontium-90 and technetium-99 are detected and compared to their isotope specific standard, which is based on a 4 mrem/yr annual dose. This type of comparison is considered more protective than the overall standard for gross beta. For the purpose of this environmental calculation, gross beta is used to confirm the presence of beta-emitters.

7.1.2 Identify Nondetected Analytes

A total of 42 analytes were not detected in the 100-HR-3 OU groundwater samples. They are listed in Table 7-2, each with sampling dates, minimum and maximum MDLs, the action level, the basis of the action level, and the level of exceedance. The action levels in this table are the lowest chemical-specific ARARs available for protection of human and aquatic receptors (Table 3-1). The level of exceedance in Table 7-2 is used to identify analytes with MDLs that did not meet the action level. The level of exceedance is calculated by dividing the minimum MDL by the action level.

Table 7-3 lists historic COPCs in DOE/RL-2009-40 not identified as groundwater COPCs for the 100-HR-3 groundwater OU, because they were not detected.

Table 7-3. Summary of Historic COPCs from DOE/RL-2009-40 Not Identified as Groundwater COPCs for the 100-HR-3 Groundwater Operable Unit

COPC	Reason for Inclusion in the SAP (DOE/RL-2009-40)	Reason for Exclusion as COPC
1,1-Dichloroethene	Not detected in data set; all MDLs greater than action level	Not detected in data set; all MDLs less than the EQL listed in DOE/RL-2009-40 [a].
Benzene	Maximum detected concentration greater than action level and MDLs greater than action level	Not detected in data set all MDLs less than the EQL listed in DOE/RL-2009-40 [a].
Vinyl chloride	All MDLs greater than action level	Not detected in data set; all MDLs greater than action level but less than the EQL listed in DOE/RL-2009-40 [a].

a. When action level is less than the MDL reported in DOE/RL-2009-40, the action level defaults to the EQL.

1,1-Dichloroethene was identified as an historic COPC in DOE/RL-2009-40, because all MDLs were greater than the action level (at that time) of 0.057 µg/L. 1,1-Dichloroethene was not detected in any of

the current 100-HR-3 groundwater OU samples. All MDLs for 1,1-dichloroethene ranged between 0.051 and 1 µg/L. When the action level is less than the MDL reported in DOE/RL-2009-40, the action level defaults to the estimated quantitation limit (EQL). The EQL of 2 µg/L reported in DOE/RL-2009-40 and 105 of 156 MDLs are greater than the action level of 0.057 µg/L. All MDLs are less than the EQL listed in DOE/RL-2009-40.

Benzene was identified as an historic COPC in DOE/RL-2009-40 because it was detected in two samples at concentrations greater than the action level, and because MDLs were greater than the action level (at that time) of 0.8 µg/L. Benzene was not detected in any of the current 100-HR-3 groundwater OU samples. All MDLs for benzene ranged between 0.045 and 1 µg/L. When the action level is less than the MDL reported in DOE/RL-2009-40, the action level defaults to the EQL. The EQL of 1.5 µg/L reported in DOE/RL-2009-40 and 52 of 156 MDLs are greater than the action level of 0.8 µg/L. All MDLs are less than the EQL listed in DOE/RL-2009-40.

Vinyl chloride was identified as an historic COPC in DOE/RL-2009-40, because all MDLs were greater than the action level (at that time) of 0.025 µg/L. Vinyl chloride was not detected in any of the current 100-HR-3 groundwater samples. All MDLs for vinyl chloride ranged between 0.032 and 1 µg/L. When the action level is less than the MDL reported in DOE/RL-2009-40, the action level defaults to the EQL. The EQL of 5 µg/L reported in DOE/RL-2009-40 and all MDLs are greater than the action level of 0.025 µg/L. All MDLs are less than the EQL listed in DOE/RL-2009-40.

7.1.2.1 Uncertainty Analysis

Five analytes were not detected and were reported with all MDLs greater than their respective action levels. This indicates that the analytical method selected is unable to detect the analyte at or below the action level. With the exception of vinyl chloride, the 5 analytes that are not detected are VOCs that are not known or suspected to be associated with releases at the 100-DR-1, 100-DR-2, 100-HR-1, or 100-HR-2 source OUs.

7.1.3 Identify Analytes with Maximum Detected Concentrations Less than Action Levels

Twenty-eight analytes were detected at least once and had maximum detected concentrations less than their respective action levels. A list of these analytes is presented in Table 7-4. Table 7-4 also provides sampling dates, minimum and maximum MDLs, minimum and maximum detected concentrations, the action levels, and the bases of the action levels.

Table 7-5 lists the historic COPCs from DOE/RL-2009-40 that are not identified as groundwater COPCs for the 100-HR-3 groundwater OU, because their maximum concentrations are not greater than their respective action levels.

Table 7-5. Summary of Historic COPCs from DOE/RL-2009-40 Not Identified as Groundwater COPCs for the 100-HR-3 Groundwater OU

COPC	Reason for Inclusion in the SAP (DOE/RL-2009-40)	Reason for Exclusion as COPC
Antimony	Maximum detected concentration greater than action level.	All detects and MDLs less than action level.
Beryllium	Some MDLs greater than action level.	All detects and MDLs less than action level.
Cadmium	Maximum detected concentration greater than action level.	All detects and MDLs less than action level.

Table 7-5. Summary of Historic COPCs from DOE/RL-2009-40 Not Identified as Groundwater COPCs for the 100-HR-3 Groundwater OU

COPC	Reason for Inclusion in the SAP (DOE/RL-2009-40)	Reason for Exclusion as COPC
Copper	Maximum detected concentration and some MDLs greater than action level.	All detects and MDLs less than action level.
Fluoride	Maximum detected concentration and some MDLs greater than action level.	All detects and MDLs less than action level.
Lead	Maximum detected concentration and some MDLs greater than action level.	All detects and MDLs less than action level.
Nickel	Maximum detected concentration greater than action level.	All detects and MDLs less than action level.
Nitrite	Maximum detected concentration greater than action level.	All detects and MDLs less than action level.
Silver	Maximum detected concentration and some MDLs greater than action level.	All detects and MDLs less than action level.
Technetium-99	Maximum detected concentration greater than action level.	All detects and MDLs less than action level.
Trichloroethene	Most MDLs greater than action level.	All detects less than action level; all MDLs greater than action level but less than the EQL listed in DOE/RL-2009-40 [a].
Tritium	Maximum detected concentration and some MDLs greater than action level.	All detects and MDLs less than the action level.
Uranium	Maximum detected concentration and some MDLs greater than action level.	All detects less than action level.
Vanadium	Some MDLs greater than action level.	All detects and MDLs less than action level.

a. When action level is less than the MDL reported in DOE/RL-2009-40, the action level defaults to the EQL.

Antimony was detected in 13 of 156 water samples (8.3 percent frequency). Antimony concentrations ranged from 0.61 to 1.0 µg/L, all below the action level of 5.6 µg/L. In addition, all MDLs are below the action level. Results of this evaluation indicate that antimony concentrations are consistently below the action level and that elimination of this analyte would not likely lead to underestimation of cumulative effects.

Beryllium was detected in 5 of 156 water samples (3.2 percent frequency). Beryllium concentrations ranged from 0.10 to 0.31 µg/L, all below the action level of 4 µg/L. In addition, all MDLs are below the action level. Results of this evaluation indicate that beryllium concentrations are consistently below the action level and that elimination of this analyte would not likely lead to underestimation of cumulative health effects.

Cadmium was detected in 2 of 156 water samples (1.3 percent frequency). Cadmium concentrations ranged from 0.11 to 0.22 µg/L, all below the action level of 0.25 µg/L. In addition, all MDLs are below the action level. Results of this evaluation indicate that cadmium concentrations are consistently below the action level and that elimination of this analyte would not likely lead to underestimation of cumulative health effects.

Copper was detected in 105 of 156 water samples (67 percent frequency). Copper concentrations ranged from 0.10 to 6.6 µg/L, all below the action level of 9 µg/L. In addition, all MDLs are below the action level. Results of this evaluation indicate that copper concentrations are consistently below the action level and that elimination of this analyte would not likely lead to underestimation of cumulative health effects.

Fluoride was detected in 63 of 156 water samples (40 percent frequency). Fluoride concentrations ranged from 60 to 343 µg/L, all below the action level of 960 µg/L. In addition, all MDLs are below the action level. Results of this evaluation indicate that fluoride concentrations are consistently below the action level and that elimination of this analyte would not likely lead to underestimation of cumulative health effects.

Nitrite was detected in 10 of 156 water samples (6.4 percent frequency). Nitrite concentrations ranged from 1,140 to 2,270 µg/L, all below the action level of 3,300 µg/L. In addition, all MDLs are below the action level. Results of this evaluation indicate that nitrite concentrations are consistently below the action level and that elimination of this analyte would not likely lead to underestimation of cumulative health effects.

Lead was detected in 23 of 156 water samples (15 percent frequency). Lead concentrations ranged from 0.20 to 0.71 µg/L, all below the action level of 2.1 µg/L. In addition, all MDLs are below the action level. Results of this evaluation indicate that lead concentrations are consistently below the action level and that elimination of this analyte would not likely lead to underestimation of cumulative health effects.

Nickel was detected in 33 of 156 water samples (21 percent frequency). Nickel concentrations ranged from 2.4 to 39 µg/L, all below the action level of 52 µg/L. In addition, all MDLs are below the action level. Results of this evaluation indicate that nickel concentrations are consistently below the action level and that elimination of this analyte would not likely lead to underestimation of cumulative health effects.

Silver was detected in 6 of 156 water samples (3.9 percent frequency). Silver concentrations ranged from 0.13 to 1.0 µg/L, all below the action level of 2.6 µg/L. In addition, all MDLs are below the action level. Results of this evaluation indicate that silver concentrations are consistently below the action level and that elimination of this analyte would not likely lead to underestimation of cumulative health effects.

Technetium-99 was detected in 8 of 155 water samples (5.2 percent frequency). Technetium-99 concentrations ranged from 7.9 to 35 pCi/L, all below the action level of 900 pCi/L. In addition, all MDLs are below the action level. Results of this evaluation indicate that nickel concentrations are consistently below the action level and that elimination of this analyte would not likely lead to underestimation of cumulative health effects.

Trichloroethene was detected in 3 of 156 water samples (1.9 percent frequency). Trichloroethene concentrations ranged from 0.26 to 0.33 µg/L, all below the action level of 0.49 µg/L. MDLs for trichloroethene ranged between 0.21 and 1 µg/L. When the action level is less than the MDL reported in DOE/RL-2009-40, the action level defaults to the EQL. The EQL of 1 µg/L reported in DOE/RL-2009-40 and 55 of 156 MDLs are greater than the action level of 0.49 µg/L. All MDLs are less than the EQL listed in DOE/RL-2009-40. Results of this evaluation indicate that trichloroethene concentrations are consistently below the action level and that elimination of this analyte would not likely lead to underestimation of cumulative health effects.

Tritium was detected in 142 of 156 water samples (91 percent frequency). Tritium concentrations ranged from 180 to 12,000 pCi/L, all below the action level of 20,000 pCi/L. In addition, all MDLs are consistently below the action level. Results of this evaluation indicate that tritium concentrations are consistently below the action level and that elimination of this analyte would not likely lead to underestimation of cumulative health effects.

Uranium was detected in all water samples (100 percent frequency). Uranium concentrations ranged from 0.29 to 13 µg/L, all below the action level of 30 µg/L. Results of this evaluation indicate that uranium concentrations are consistently below the action level and that elimination of this analyte would not likely lead to underestimation of cumulative health effects.

Vanadium was detected in 66 of 156 water samples (42 percent frequency). Vanadium concentrations ranged from 5.4 to 33 µg/L, all below the action level of 80 µg/L. In addition, all MDLs are below the action level. Results of this evaluation indicate that vanadium concentrations are consistently below the action level and that elimination of this analyte would not likely lead to underestimation of cumulative health effects.

7.1.3.1 Uncertainty Analysis

The analytes detected at concentrations that are near but do not exceed their respective action levels (i.e., with maximum detected concentrations greater than one-tenth of their respective action level, or one order of magnitude) are antimony, barium, bromoform, cadmium, chloride, copper, fluoride, gross alpha, lead, molybdenum, nickel, silver, trichloroethene, tritium, uranium, and vanadium. Among these, antimony, cadmium, copper, fluoride, lead, nickel, silver, technetium-99, trichloroethene, tritium, uranium, and vanadium were identified as historic COPCs in DOE/RL-2009-40 and are evaluated above.

Barium, bromoform, chloride, gross alpha[3], and molybdenum were not identified as historic COPCs in DOE/RL-2009-40, but are considered below to determine if any have concentrations that are only slightly less than their action levels and if there is thus a potential for underestimating cumulative effects by their elimination as COPCs. MDLs associated with these analytes are also evaluated, to determine if the limits are adequate for confirming presence or absence of the analytes near their respective action levels. None of these five analytes was retained as a COPC.

Barium was detected in all water samples (100 percent frequency). Barium concentrations ranged from 25 to 133 µg/L, all well below the action level of 1,000 µg/L. Results of this evaluation indicate that barium concentrations are consistently well below the action level and that elimination of this analyte would not likely lead to underestimation of cumulative health effects.

Bromoform was detected in 1 of 156 samples analyzed (0.64 percent frequency). Bromoform was detected at well 199-H4-5, at a concentration of 0.58 µg/L, which is well below the action level of 4.3 µg/L. All MDLs are consistently below the action level. Results of this evaluation indicate that bromoform concentrations are consistently well below the action level and that elimination of this analyte would not likely lead to underestimation of cumulative health effects.

Chloride was detected in all water samples analyzed (100 percent frequency). Chloride concentrations ranged from 3,960 to 44,900 µg/L, all well below the action level of 230,000 µg/L. Results of this

[3] Gross alpha was identified as an additional analyte in Table 1-2 of DOE/RL-2009-40.

evaluation indicate that chloride concentrations are consistently well below the action level and that elimination of this analyte would not likely lead to underestimation of cumulative health effects.

Gross alpha was detected in 34 of 156 samples analyzed (22 percent frequency). Gross alpha concentrations range from 2.0 to 7.9 pCi/L, all below the action level of 15 pCi/L. The highest concentration is only slightly greater than half of the action level. In addition, all MDLs are below the action level. Results of this evaluation indicate that gross alpha concentrations are consistently below the action level and that elimination of this analyte would not likely lead to underestimation of cumulative health effects.

Molybdenum was detected in 115 of 156 samples analyzed (74 percent frequency). Molybdenum concentrations ranged from 0.56 to 12 µg/L, all well below the action level of 80 µg/L. In addition, all MDLs are below the action level. Results of this evaluation indicate that molybdenum concentrations are consistently well below the action level and that elimination of this analyte would not likely lead to underestimation of cumulative health effects.

7.1.4 Identify Analytes with Maximum Detected Concentrations Greater than Action levels

Twenty-one analytes were detected at least once, with maximum detected concentrations greater than their respective action levels. Fourteen of these 21 analytes were identified as historic COPCs in DOE/RL-2009-40.

Table 7-6 provides a summary of the 21 analytes, providing for each, sampling dates, minimum and maximum MDLs, minimum and maximum detected concentrations, the action level, and the basis of the action level.

Table 7-7 lists the 14 historic COPCs from DOE/RL-2009-40 that are carried forward for EPC calculation for the 100-HR-3 groundwater OU, because their maximum concentrations are greater than their respective action levels.

Table 7-7. Summary of Historic COPCs from DOE/RL-2009-40 Carried Forward for EPC Calculation

Arsenic	Carbon tetrachloride	Chloroform	Chromium (total)
Cobalt	Hexavalent Chromium	Manganese	Mercury
Nitrate	Selenium	Strontium-90	Sulfate
Thallium	Zinc		

In addition to the 14 analytes listed on Table 7-7, 1,2-dichloroethane, aluminum, bromodichloromethane, iron, lithium, methylene chloride, and tetrachloroethene are also carried forward for EPC calculation, because their maximum concentrations are greater than their respective action levels.

7.2 Groundwater COPC Identification Process: Part 2

This section summarizes the COPC identification process.

7.2.1 Identify Monitoring Wells in Each Exposure Area

The first step in the groundwater COPC identification process is to identify monitoring wells separately for each exposure area. Of the 52 monitoring wells identified for the 100-HR-3 groundwater OU, 20

monitoring wells are located in the 100-D Source exposure area, 13 monitoring wells are located in the 100-H Source exposure area, and 19 monitoring wells are located in the Horn exposure area (see Table 4-1).

7.2.2 Identify Nondetected Analytes in Each Exposure Area

The next step in the screening process is to identify analytes that have not been detected in each respective exposure area. This step is performed in the same manner as described in Section 7.1.3. Analytes that have not been detected in any of the groundwater samples from an exposure area are eliminated as groundwater COPCs for that exposure area.

The following analytes were eliminated as COPCs in the 100-D Source exposure area:

- 1,2-dichloromethane and mercury

The following analytes were eliminated as COPCs in the 100-H Source exposure area:

- 1,2-dichloroethane, bromodichloromethane, and tetrachloroethene

The following analytes were eliminated as COPCs in the Horn exposure area:

- bromodichloromethane, mercury, and thallium

All analytes detected at least once in an exposure area are carried forward to the next step of the process for that exposure area.

7.2.3 Calculate 90th Percentile Values for Each Analyte and Exposure Area

Groundwater COPCs are identified by comparing calculated EPC estimates (i.e., 90th percentile values) to action levels for each detected analyte in an exposure area. The 90th percentile value is used as an estimate of the exposure point concentration. The 90th percentile value is calculated for each analyte from the groundwater data set. In the calculations, the MDL is taken as the "detected" concentration for nondetect samples. Documentation of the calculations is provided in a separate environmental calculation (ECF-100HR3-10-0473). Results of the calculations are summarized in Tables 7-8, 7-9, and 7-10 for the 100-D Source, 100-H Source, and Horn exposure areas, respectively.

7.2.4 Identify Analtyes with 90th Percentile Values Less than the Action Levels in Each Exposure Area

The 90th percentile values are compared to the lowest available chemical-specific ARARs for protection of human health and aquatic receptors (i.e., action levels). Analytes with 90th percentile values less than their respective action levels are listed in Table 7-11, and are discussed for each exposure area in the analyte-specific evaluation below.

Table 7-11. Summary of Analytes with 90th Percentile Values Less than Action Levels

100-D Source Exposure Area		
Aluminum	Cobalt	Iron
Lithium	Manganese	Methylene chloride
Selenium	Strontium-90	Sulfate
Thallium	Zinc	
100-H Source Exposure Area		
Aluminum	Chloroform	Chromium
Cobalt	Lithium	Manganese
Methylene chloride	Nitrate	Selenium
Sulfate	Thallium	Zinc

Table 7-11. Summary of Analytes with 90th Percentile Values Less than Action Levels

Horn Exposure Area		
Chloroform	Cobalt	Lithium
Manganese	Methylene chloride	Nitrate
Selenium	Strontium-90	Sulfate
Zinc		

7.2.4.1 Analyte-Specific Evaluation

An analyte-specific evaluation step is conducted when the 90th percentile value for an analyte is less than its action level, but one or more individual sample results are greater than the action level. This step is performed to confirm that the analyte has not been inappropriately eliminated and takes into consideration specific attributes of the groundwater contamination plume, as described below.

- Is the analyte co-located with one or more COPCs, with some sample concentrations above its action level?
- Is the analyte associated with a significant local trend?
- Is the analyte associated with a discrete local exposure point, with some concentrations above its action level?

100-D Source Exposure Area

Eleven analytes have been detected at least once in groundwater in the 100-D Source exposure area and have 90th percentile values less than their respective action levels (Table 7-8). Of these 11, only sulfate and zinc are retained as COPCs for the 100-D Source exposure area.

Aluminum's 90th percentile value is 24 µg/L, which is below the action level of 50 µg/L. Aluminum was detected in 19 of 60 samples (32 percent frequency). All detected concentrations and MDLs are less than the action level. The results of this evaluation suggest that aluminum is not associated with a local trend or local exposure point; therefore, the 90th percentile value is considered a reasonable estimate of groundwater concentrations.

Cobalt's 90th percentile value is 1.3 µg/L, which is below the action level of 2.6 µg/L. Cobalt was detected in 23 of 60 samples (38 percent frequency). Cobalt was detected at concentrations greater than the action level in two monitoring wells: monitoring well 199-D4-84, with concentrations ranging between 2.1 and 2.8 µg/L; and monitoring well 199-D4-23, with concentrations ranging between 2.8 and 3.0 µg/L. Cobalt is analyzed by EPA Method 200.8, along with several other metals. For the 100-HR-3 OU samples, all cobalt results are flagged with a "D" qualifier, indicating that the analyte was reported at a secondary dilution factor; the primary preparation of the sample required dilution, either to bring one or more analytes within the calibration range or to minimize interference. Elevated concentrations of chromium are reported at both wells, indicating that the reason for the secondary dilution was to bring chromium concentrations into the calibration range of the instrument. Additionally, one cobalt result was flagged with a "C" qualifier, indicating that cobalt was detected in both the sample and the associated QC blank. Cobalt is not identified as a COPC because (1) observed concentrations above the action level do not appear to be associated with a trend, (2) all sample analyses required dilution, and (3) cobalt concentrations from laboratory contamination are above the action level. Therefore, the 90th percentile value for cobalt is considered a reasonable estimate of groundwater concentrations.

Iron's 90th percentile value is 106 µg/L, which is below the action level of 300 µg/L. Iron was detected in 39 of 60 samples (65 percent frequency). All detected concentrations and MDLs are less than the action

level. The results of this evaluation suggest that iron is not associated with a local trend or local exposure point; therefore, the 90th percentile is considered a reasonable estimate of groundwater concentrations.

Lithium's 90th percentile value is 21 µg/L, which is below the action level of 32 µg/L. Lithium was detected in 42 of 47 samples (89 percent frequency). Lithium was detected at concentrations greater than the action level in two monitoring wells: monitoring well 199-D4-84, at a concentration of 55 µg/L; and monitoring well 199-D8-71, at a concentration of 133 µg/L. Lithium was detected at monitoring well 199-D4-84, at concentrations ranging from 14 µg/L during the high river stage to 55 µg/L during the transitional phase. Lithium was detected at well 199-D8-71 at concentrations ranging from nondetect during the low river stage, to the highest value of 133 µg/L during the transition phase. The lithium concentration of 133 µg/L at well 199-D8-71 was flagged with a "BD", which indicates the analyte was detected at a value less than the contract required detection limit, but greater than or equal to the instrument detection limit (i.e. it is an estimated concentration), and that the analyte was reported at a secondary dilution factor. Lithium is not identified as a COPC because the observed concentrations do not appear to be associated with a local trend or local exposure point; therefore, the 90th percentile value for lithium is considered a reasonable estimate of groundwater concentrations.

Manganese's 90th percentile value is 4 µg/L, which is below the action level of 50 µg/L. Manganese was detected in three of 60 samples (5 percent frequency). All detected concentrations and MDLs are less than the action level. The results of this evaluation suggest that manganese is not associated with a local trend or local exposure point; therefore, the 90th percentile value for manganese is considered a reasonable estimate of groundwater concentrations.

Methylene chloride's 90th percentile value is 1 µg/L, which is below the action level of 4.6 µg/L. Methylene chloride was detected in six of 60 samples (10 percent frequency). All detected concentrations and MDLs are less than the action level. The results of this evaluation suggest that methylene chloride is not associated with a local trend or local exposure point; therefore, the 90th percentile value for methylene chloride is considered a reasonable estimate of groundwater concentrations.

Selenium's 90th percentile value is 4.4 µg/L, which is below the action level of 5 µg/L. Selenium was detected in 56 of 60 samples (93 percent frequency). Selenium was detected at concentrations greater than the action level in three monitoring wells: monitoring well 199-D8-88, with concentrations ranging between 6.0 and 6.5 µg/L; monitoring well 199-D8-5 at a concentration of 5.4 µg/L; and monitoring well 199-D8-70, at a concentration of 5.3 µg/L. Selenium is analyzed by EPA Method 200.8 in addition to several other metals. Four of the selenium results are flagged with a "D "qualifier, which indicates the analyte was reported at a secondary dilution factor; the primary preparation of the sample required dilution, either to bring one or more analytes within the calibration range or to minimize interference. Elevated concentrations of chromium are reported at all three wells, indicating that the reason for the secondary dilution was to bring chromium concentrations into the calibration range of the instrument. Two of the five selenium results were also flagged with a "C" qualifier, which indicates that selenium was detected in both the samples and the associated QC blanks. Selenium is not identified as a COPC because (1) observed concentrations do not appear to be associated with a local trend; (2) analysis required dilution to bring elevated chromium concentrations into the linear range of the instrument; and (3) selenium concentrations from laboratory contamination are above the action level. Therefore, the 90th percentile value for selenium is considered a reasonable estimate of groundwater concentrations.

Strontium-90's 90th percentile value is 0.67 pCi/L, which is below the action level of 8 pCi/L. Strontium-90 was detected in three of 60 samples (5 percent frequency). All detected concentrations and MDLs are less than the action level. The results of this evaluation suggest that strontium-90 is not associated with a

local trend or local exposure point; therefore, the 90th percentile value is considered a reasonable estimate of groundwater concentrations.

Sulfate's 90th percentile value is 161,500 µg/L, which is below the action level of 250,000 µg/L. Sulfate was detected in all samples (100 percent frequency). Sulfate was detected above the action level in monitoring well 199-D4-84, at concentrations ranging from 408,000 µg/L to 438,000 µg/L. However, the elevated sulfate concentrations in 199-D4-84 are due to past injections of sodium dithionite solution at the redox system. Sulfate is identified as a COPC because it is co-located with chromium and hexavalent chromium.

Thallium's 90th percentile value is 0.1 µg/L, which is below the action level of 0.24 µg/L. Thallium was detected in four of 60 samples (6.7 percent frequency). Thallium was detected at the action level in monitoring well 199-D8-5, at a concentration of 0.24 µg/L, and was detected above the action level in monitoring well 199-D8-71, at a concentration of 1 µg/L. In well 199-D8-5, thallium was detected at concentrations ranging from nondetect during the low and transitional river stages, to 0.24 µg/L during the high river stage. The thallium concentration of 0.24 µg/L was flagged with a "BD", indicating that the analyte was detected at a value less than the contract required detection limit, but greater than or equal to the instrument detection limit (i.e. it is an estimated concentration); and the analyte was reported at a secondary dilution factor. In well 199-D8-71, thallium was detected at concentrations ranging from nondetect during the low river stage to 1.0 µg/L during the transitional phase. The results of this evaluation indicate that thallium is not associated with a local trend or a local exposure point; therefore, the 90th percentile is considered a reasonable estimate of groundwater concentration.

Zinc's 90th percentile value is 34 µg/L, which is below the action level of 91 µg/L. Zinc was detected in 18 of 60 samples (30 percent frequency). However, zinc was detected in all three sampling events in monitoring well 199-D4-84, at concentrations ranging from 228 µg/L to 260 µg/L. Thus, zinc is associated with a long-term trend at a local exposure point. Zinc is identified as a COPC because it is co-located with chromium and hexavalent chromium.

100-H Source Exposure Area

Twelve analytes have been detected at least once in groundwater in the 100-H Source exposure area and have 90th percentile values less than their respective action levels (Table 7-9). All 12 are eliminated as COPCs for the 100-H Source exposure area.

Aluminum's 90th percentile value is 41 µg/L, which is below the action level of 50 µg/L. Aluminum was detected in 13 of 39 samples (33 percent frequency). With the exception of three results, all aluminum concentrations and MDLs are less than the action level. However, aluminum was detected in all three sampling rounds in monitoring well 199-H4-9, at concentrations ranging from 118 to 188 µg/L. The results of this evaluation indicate that aluminum is associated with a local trend or a local exposure point. However, the action level for aluminum is based on a secondary MCL. The secondary MCL for aluminum is a range of concentrations between 50 and 200 µg/L; the concentrations at monitoring well 199-H4-9 are within this range. Aluminum affects aesthetic qualities relating to public acceptance of drinking water. These regulations are not federally enforceable, but are intended as guidelines for the states. For these reasons, aluminum is not identified as a COPC.

Chloroform's 90th percentile value is 1.4 µg/L, which is equal to the action level of 1.4 µg/L. Chloroform was detected in 31 of 39 samples (79 percent frequency). With the exception of three results, all chloroform concentrations are less than the action level. Chloroform was detected in monitoring wells 199-H4-5 and 199-H4-11 at concentrations greater than the action level. In monitoring well 199-H4-5, chloroform was detected at concentrations ranging from 1.3 µg/L during the transitional river stage to 1.7

µg/L during the low river stage. In monitoring well 199-H4-11, chloroform was detected at concentrations ranging from nondetect during the low river stage to 1.5 µg/L during the high river stage. The results of this evaluation indicate that chloroform is not associated with a local trend or a local exposure point; therefore, the 90th percentile value is considered a reasonable estimate of groundwater concentrations.

Chromium's 90th percentile value is 31 µg/L, which is below the action level of 65 µg/L. Chromium was detected in all samples (100 percent frequency). All detected concentrations are less than the action level. The results of this evaluation indicate that chromium is not associated with a local trend or local exposure point; therefore, the 90th percentile value is considered a reasonable estimate of groundwater concentrations.

Cobalt's 90th percentile value is 0.43 µg/L, which is below the action level of 2.6 µg/L. Cobalt was detected in 16 of 39 samples (41 percent frequency). All detected concentrations and MDLs are less than the action level. The results of this evaluation indicate that cobalt is not associated with a local trend or local exposure point; therefore, the 90th percentile value is considered a reasonable estimate of groundwater concentrations.

Lithium's 90th percentile value is 14 µg/L, which is below the action level of 32 µg/L. Lithium was detected in 27 of 39 samples (84 percent frequency). All detected concentrations and MDLs are less than the action level. The results of this evaluation indicate that lithium is not associated with a local trend or local exposure point; therefore, the 90th percentile value is considered a reasonable estimate of groundwater concentrations.

Manganese's 90th percentile value is 35 µg/L, which is below the action level of 50 µg/L. Manganese was detected in eight of 39 samples (21 percent frequency). With the exception of two results, all manganese concentrations are less than the action level. In monitoring well 199-H4-6, manganese was detected at a concentration of 90 µg/L during the low river stage, at a concentration of 120 µg/L during the transitional river stage, and at less than the action level during the high river stage. Additionally, the action level for manganese is based on a secondary MCL. The results of this evaluation indicate that manganese is not associated with a local trend or local exposure point; therefore, the 90th percentile value is considered a reasonable estimate of groundwater concentrations.

Methylene chloride's 90th percentile value is 1.0 µg/L, which is below the action level of 4.6 µg/L. Methylene chloride was detected in five of 39 samples (13 percent frequency). However, all methylene chloride results were flagged with a "B", indicating the analyte was detected in both the sample and in the associated QC blank. The results of this evaluation indicate that methylene chloride is a result of laboratory contamination and is not site related. The 90th percentile value is considered an overestimation of methylene chloride concentrations in groundwater.

Nitrate's 90th percentile value is 39,800 µg/L, which is below the action level of 45,000 µg/L. Nitrate was detected in all samples in the 100-H Source exposure area, with concentrations ranging from 16,700 µg/L to 46,900 µg/L. With one exception, all nitrate concentrations are less than the action level. Nitrate was detected in monitoring well 199-H4-46 at a concentration of 46,900 µg/L during the low river stage; the remaining results were less than the action level. The results of this evaluation indicate that nitrate is not associated with a local trend or local exposure point; therefore, the 90th percentile value is considered a reasonable estimate of groundwater concentrations.

Selenium's 90th percentile value is 2.7 µg/L, which is below the action level of 5 µg/L. Selenium was detected in 38 of 39 samples (97 percent frequency). All detected concentrations and MDLs are less than the action level. The results of this evaluation indicate that selenium is not associated with a local trend

or local exposure point; therefore, the 90th percentile value is considered a reasonable estimate of groundwater concentrations.

Sulfate's 90th percentile value is 79,700 µg/L, which is below the action level of 250,000 µg/L. Sulfate was detected in all samples (100 percent frequency). All detected concentrations are less than the action level. The results of this evaluation indicate that sulfate is not associated with a local trend or local exposure point; therefore the 90th percentile value is considered a reasonable estimate of groundwater concentrations.

Thallium's 90th percentile value is 0.1 µg/L, which is below the action level of 0.24 µg/L. Thallium was detected in two of 39 samples (5 percent frequency), with concentrations of 0.1 µg/L and 0.28 µg/L. With the exception of one result, all thallium results and MDLs were less than the action level. In monitoring well 199-H3-2A, thallium was detected just above the action level, at a concentration of 0.28 µg/L, during the low river stage and was not detected during the transitional or high river stages. The results of this evaluation indicate than thallium is not associated with a local trend or a local exposure point; therefore, the 90th percentile value is considered a reasonable estimate of groundwater concentrations.

Zinc's 90th percentile value is 16 µg/L, which is below the action level of 91 µg/L. Zinc was detected in 9 of 39 samples (23 percent frequency). All detected concentrations and MDLs are less than the action level. The results of this evaluation indicate that zinc is not associated with a local trend or local exposure point; therefore, the 90th percentile value is considered a reasonable estimate of groundwater concentrations.

Horn Exposure Area

Ten analytes have been detected at least once in groundwater in the Horn exposure area and have 90th percentile values less than their respective action levels (Table 7-10). All 10 are eliminated as COPCs for the Horn exposure area.

Chloroform's 90th percentile value is 1 µg/L, which is below the action level of 1.4 µg/L. Chloroform was detected in 32 of 57 samples (56 percent frequency). All detected concentrations and MDLs are less than the action level. The results of this evaluation indicate that chloroform is not associated with a local trend or local exposure point; therefore, the 90th percentile value is considered a reasonable estimate of groundwater concentrations.

Cobalt's 90th percentile value is 0.1 µg/L, which is below the action level of 2.6 µg/L. Cobalt was detected in five of 57 samples (52 percent frequency). All detected concentrations and MDLs are less than the action level. The results of this evaluation indicate that cobalt is not associated with a local trend or local exposure point; therefore, the 90th percentile value is considered a reasonable estimate of groundwater concentrations.

Lithium's 90th percentile value is 12 µg/L, which is below the action level of 32 µg/L. Lithium was detected in 33 of 43 samples (77 percent frequency). All detected concentrations and MDLs are less than the action level. The results of this evaluation indicate that lithium is not associated with a local trend or local exposure point; therefore, the 90th percentile value is considered a reasonable estimate of groundwater concentrations.

Manganese's 90th percentile value is 11 µg/L, which is below the action level of 50 µg/L. Manganese was detected in 13 of 57 samples analyzed (23 percent frequency), with concentrations ranging from 0.6 µg/L to 122 µg/L. With the exception of one well, all manganese results and MDLs were less than the

action level. In monitoring well 699-90-45, manganese was detected at concentrations ranging between 108 and 122 µg/L. The presence of manganese is suspected to be associated with the well casing; this is supported by the presence of elevated iron concentrations at this well. Additionally, the action level for manganese is based on the secondary MCL. The results of this evaluation indicate that manganese is not associated with a local trend or local exposure point; therefore, the 90th percentile value is considered a reasonable estimate of groundwater concentrations.

Methylene chloride's 90th percentile value is 1.0 µg/L, which is below the action level of 4.6 µg/L. Methylene chloride was detected in seven of 57 samples (13 percent frequency). All methylene chloride results were flagged with a "B", indicating the analyte was detected in both the sample and in the associated QC blank. The results of this evaluation indicate that methylene chloride results are a result of laboratory contamination, and not site related. The 90th percentile value is considered an overestimation of methylene chloride concentrations in groundwater.

Nitrate's 90th percentile value is 29,550 µg/L, which is below the action level of 45,000 µg/L. Nitrate was detected in all samples (100 percent frequency). All detected concentrations are less than the action level. The results of this evaluation indicate that sulfate is not associated with a local trend or a local exposure point; therefore, the 90th percentile value is considered a reasonable estimate of groundwater concentrations.

Selenium's 90th percentile value is 3.2 µg/L, which is below the action level of 5.0 µg/L. Selenium was detected in 56 of 57 samples (98 percent frequency), with concentrations ranging from 0.6 to 7.1 µg/L. With the exception of one result, all selenium concentrations are less than the action level. In monitoring well 699-95-51, selenium was detected above the action level, at a concentration of 7.1 µg/L, during the low river stage; it was detected at concentrations less than the action level during the transitional and high river stages. The results of this evaluation indicate than selenium is not associated with a local trend or a local exposure point; therefore, the 90th percentile value is considered a reasonable estimate of groundwater concentrations.

Strontium-90's 90th percentile value is 0.9 pCi/L, which is below the action level of 8 pCi/L. Strontium-90 was detected in four of 57 samples (7 percent frequency). All detected concentrations and MDLs are less than the action level. The results of this evaluation indicate that strontium-90 is not associated with a trend or a local exposure point; therefore, the 90th percentile value is considered a reasonable estimate of groundwater concentrations.

Sulfate's 90th percentile value is 78,350 µg/L, which is below the action level of 250,000 µg/L. Sulfate was detected in all samples (100 percent frequency). All detected concentrations are less than the action level. The results of this evaluation indicate that sulfate is not associated with a local trend or a local exposure point; therefore, the 90th percentile value is considered a reasonable estimate of groundwater concentrations.

Zinc's 90th percentile value is 12 µg/L, which is below the action level of 91 µg/L. Zinc was detected in nine of 57 samples (16 percent frequency). All detected concentrations and MDLs are less than the action level. The results of this evaluation indicate that zinc is not associated with a local trend or a local exposure point; therefore, the 90th percentile value is considered a reasonable estimate of groundwater concentrations.

Conclusion from Analyte-Specific Evaluation

Table 7-12 provides a summary of the historic COPCs identified in DOE/RL-2009-40 that were eliminated as COPCs for the 100-HR-3 groundwater OU.

Table 7-12. Summary of Historic COPCs from DOE/RL-2009-40 Not Identified as Groundwater COPCs for the 100-HR-3 Groundwater Operable Unit

COPC	Reason for Inclusion in the SAP (DOE/RL-2009-40)	Exposure Area	Reason for Exclusion as COPC
Chloroform	Max concentration and MDLs greater than action level.	100-H Source	90th percentile value equal to the action level and MDLs less than action level.
		Horn	All detected concentrations and MDLs less than action level.
Chromium	Maximum concentration greater than action level.	100-H Source	All detected concentrations less than action level.
Cobalt	Max concentration and MDLs greater than action level.	100-D Source	90th percentile value less than action level; anomalous results.
		100-H Source	All detected concentrations and MDLs less than action level.
		Horn	All detected concentrations and MDLs less than action level.
Manganese	Maximum concentration greater than action level.	100-D Source	All detected concentrations and MDLs less than action level; secondary MCL.
		100-H Source	90th percentile value less than action level; secondary MCL.
		Horn	90th percentile value less than action level; secondary MCL.
Nitrate	Maximum concentration greater than action level.	100-H Source	90th percentile value less than action level.
		Horn	90th percentile value less than action level.
Selenium	Max concentration and MDLs greater than action level.	100-D Source	90th percentile value less than action level; anomalous results.
		100-H Source	All detected concentrations and MDLs less than action level.
		Horn	90th percentile value less than action level.
Strontium-90	Maximum concentration greater than action level.	100-D Source	All detected concentrations and MDLs less than action level.
		Horn	All detected concentrations and MDLs less than action level.

Table 7-12. Summary of Historic COPCs from DOE/RL-2009-40 Not Identified as Groundwater COPCs for the 100-HR-3 Groundwater Operable Unit

COPC	Reason for Inclusion in the SAP (DOE/RL-2009-40)	Exposure Area	Reason for Exclusion as COPC
Sulfate	Maximum concentration greater than action level.	100-H Source	All detected concentrations and MDLs less than action level.
		Horn	All detected concentration and MDLs less than action level.
Thallium	Max concentration and MDLs greater than action level.	100-D Source	90th percentile value less than action level; anomalous results.
		100-H Source	90th percentile value less than action level.
Zinc	Maximum concentration greater than action level.	100-H Source	All detected concentrations and MDLs less than action level.
		Horn	All detected concentrations and MDLs less than action level.

7.2.5 Identify Analytes with 90th Percentile Values Greater than Action Levels in Each Exposure Area

Groundwater analytes with 90th percentile values greater than action levels are discussed below for each of the three exposure areas. A summary is provided in Table 7-13.

Table 7-13. Summary of Analytes with 90th Percentile Values Greater than Action Levels

100-D Source Exposure Area		
Arsenic	Bromodichloromethane	Carbon tetrachloride
Chloroform	Chromium	Hexavalent chromium
Nitrate	Tetrachloroethene	
100-H Source Exposure Area		
Arsenic	Carbon tetrachloride	Hexavalent chromium
Iron	Mercury	
Strontium-90		
Horn Exposure Area		
1,2-Dichloroethane	Aluminum	Arsenic
Carbon tetrachloride	Chromium	Hexavalent chromium
Iron	Tetrachloroethene	

7.2.5.1 Analyte-Specific Evaluation

An analyte-specific evaluation is performed on the analytes that have 90th percentile values greater than the action level. This evaluation considers the effects of data quality, naturally occurring levels of metals, long-term trends, and action levels on the identification of COPCs.

100-D Source Exposure Area

Eight analytes have been detected at least once in groundwater in the 100-D Source exposure area and have 90th percentile values greater than their respective action levels (Table 7-8). Of these eight, chloroform, chromium, hexavalent chromium, and nitrate are retained as COPCs for the 100-D Source exposure area and are discussed in Section 7.3.

Arsenic's 90th percentile value is 2.6 µg/L, which is greater than the action level of 0.018 µg/L. Arsenic was detected in 56 of 60 samples analyzed, with concentrations ranging between 0.61 µg/L and 2.9 µg/L. Thus, all detected concentrations of arsenic are above the action level. In DOE/RL-96-61, *Hanford site Background: Part 3, Groundwater Background*, background concentrations have been established for filtered (dissolved) concentrations of water constituents. Minimum, maximum, and 90th percentile (filtered) background concentrations of arsenic are 0.5, 8.8, and 7.85 µg/L, respectively. All arsenic concentrations are below the 90th percentile (filtered) background concentration and are considered to be naturally occurring; therefore, arsenic is not identified as a COPC.

Bromodichloromethane's 90th percentile value is 1.0 µg/L, which is greater than the action level of 0.27 µg/L. When the action level is less than the MDL reported in DOE/RL-2009-40, the action level defaults to the EQL. The EQL of 5.0 µg/L reported in DOE/RL-2009-40 and all MDLs are greater than the action level of 0.27 µg/L. MDLs ranged between 0.082 and 1 µg/L. The 90th percentile value for bromodichloromethane is less than the EQL. Bromodichloromethane was detected in two of 60 samples analyzed (3.3 percent frequency), with concentrations of 0.67 and 0.68 µg/L. In monitoring well 199-D8-88, bromodichloromethane was detected at a concentration of 0.67 µg/L during the high river stage and was not detected during the low or transitional stages. In monitoring well 199-D4-84, bromodichloromethane was detected at a concentration of 0.68 µg/L during the high river stage and was not detected the low or transitional stages. Bromodichloromethane was not identified as an historic COPC in DOE/RL-2009-40. The results of this evaluation indicate that the 90th percentile value for bromodichloromethane is less than the EQL reported in DOE/RL-2009-40; therefore, bromodichloromethane is not identified as a COPC.

Carbon tetrachloride's 90th percentile value is 1.0 µg/L, which is greater than the action level of 0.23 µg/L. When the action level is less than the MDL reported in DOE/RL-2009-40, the action level defaults to the EQL. The EQL of 1.0 µg/L reported in DOE/RL-2009-40 and 18 of 58 MDLs are greater than the action level of 0.23 µg/L. MDLs ranged between 0.063 and 1 µg/L. The 90th percentile value for carbon tetrachloride is less than (equal to) the EQL. Carbon tetrachloride was detected in two of 60 samples analyzed (3.3 percent frequency), with concentrations of 2.6 and 2.7 µg/L. In monitoring well 199-D2-6, carbon tetrachloride was detected at a concentration of 2.6 µg/L during the low river stage and was not detected during the high or transitional stages. In monitoring well 199-D5-18, carbon tetrachloride was detected at a concentration of 2.7 µg/L during the low river stage and was not detected during the high or transitional stages. The results of this evaluation indicate that the 90th percentile value for carbon tetrachloride is less than (equal to) the EQL reported in DOE/RL-2009-40; therefore, carbon tetrachloride is not identified as a COPC.

Tetrachloroethene's 90th percentile value is 1 µg/L, which is greater than the action level of 0.081 µg/L. When the action level is less than the MDL reported in DOE/RL-2009-40, the action level defaults to the EQL. The EQL of 5.0 µg/L reported in DOE/RL-2009-40 and all MDLs are greater than the action level of 0.081 µg/L. MDLs ranged between 0.088 and 1 µg/L. The 90th percentile value for tetrachloroethene is less than the EQL. Tetrachloroethene was detected in one of 60 samples (1.6 percent frequency). In monitoring well 199-D5-38, tetrachloroethene was detected at a concentration of 0.14 µg/L during the low river stage and was not detected during the transitional or high stages. The single tetrachloroethene result is flagged with a "J", indicating the result is an estimated concentration below the MDL. Tetrachloroethene was not identified as an historic COPC in DOE/RL-2009-40. The results of this evaluation indicate that the 90th percentile value for tetrachloroethene is less than the EQL reported in DOE/RL-2009-40; therefore, tetrachloroethene is not identified as a COPC.

100-H Source Exposure Area

Six analytes have been detected at least once in groundwater in the 100-H Source exposure area and have 90th percentile values greater than their respective action levels (Table 7-9). Of these six, hexavalent chromium and strontium-90 are retained as COPCs for the 100-H Source exposure area and are discussed in Section 7.3.

Arsenic's 90th percentile value is 3.3 µg/L, which is greater than the action level of 0.018 µg/L. Arsenic was detected in all 39 samples, with concentrations ranging between 1.4 µg/L and 3.7 µg/L. In DOE/RL-96-61, background concentrations have been established for filtered (dissolved) concentrations of water constituents. Minimum, maximum, and 90th percentile (filtered) background concentrations of arsenic are 0.5, 8.8, and 7.85 µg/L, respectively. All arsenic concentrations are below the 90th percentile (filtered) background concentration and are considered to be naturally occurring; therefore, arsenic is not identified as a COPC.

Carbon tetrachloride's 90th percentile value is 1 µg/L, which is greater than the action level of 0.23 µg/L. When the action level is less than the MDL reported in DOE/RL-2009-40, the action level defaults to the EQL. The EQL of 1.0 µg/L reported in DOE/RL-2009-40 and 12 of 37 MDLs are greater than the action level of 0.23 µg/L. MDLs ranged between 0.063 and 1 µg/L. The 90th percentile value for carbon tetrachloride is less than (equal to) the EQL. Carbon tetrachloride was detected in two of 39 samples analyzed (5.1 percent frequency). In monitoring well 199-H4-10, carbon tetrachloride was detected at a concentration of 0.088 µg/L during the low river stage and was not detected during the transitional or high stages. In monitoring well 199-H4-11, carbon tetrachloride was detected at a concentration of 2 µg/L during the low river stage and was not detected during the transitional or high stages. The results of this evaluation indicate that the 90th percentile value for carbon tetrachloride is less than (equal to) the EQL reported in DOE/RL-2009-40; therefore, carbon tetrachloride is not identified as a COPC.

Iron's 90th percentile value is 444 µg/L, which is greater than the action level of 300 µg/L. Iron was detected in 29 of 39 samples analyzed (74 percent frequency), with concentrations ranging from 17 and 7,840 µg/L. In DOE/RL-96-61, background concentrations have been established for filtered (dissolved) concentrations of water constituents. Minimum, maximum, and 90th percentile (filtered) background concentrations of iron are 6, 7,225, and 570 µg/L, respectively. All but two of the iron concentrations are below the 90th percentile (filtered) background concentration and are considered to be naturally occurring; therefore iron is not identified as a COPC.

Mercury's 90th percentile value is 0.1 µg/L, which is greater than the action level of 0.012 µg/L. When the action level is less than the MDL reported in DOE/RL-2009-40, the action level defaults to the EQL. The EQL of 0.5 µg/L reported in DOE/RL-2009-40 and all MDLs are greater than the action level of 0.012 µg/L. MDLs ranged between 0.05 and 0.1 µg/L. Mercury was detected in one of 39 samples (2.6 percent frequency). In monitoring well 199-H3-2A, mercury was detected at a concentration of 0.11 µg/L during the low river stage and was not detected during the transitional or high stages. The single detection was flagged with a "BD" qualifier, indicating that the analyte was detected at a value less than the contract required detection limit, but greater than or equal to the instrument detection limit (i.e. it is an estimated concentration); and the analyte was reported at a secondary dilution factor. The results of this evaluation indicate that the 90th percentile value for mercury is less than the EQL reported in DOE/RL-2009-40; therefore, mercury is not identified as a COPC.

Horn Exposure Area

Eight analytes have been detected at least once in groundwater in the Horn exposure area and have 90th percentile values greater than their respective action levels (Table 7-10). Of these eight, carbon

tetrachloride, chromium, and hexavalent chromium are retained as COPCs for the Horn exposure area and are discussed in Section 7.3.

1,2-Dichloroethane's 90th percentile value is 1 µg/L, which is greater than the action level of 0.38 µg/L. When the action level is less than the MDL reported in DOE/RL-2009-40, the action level defaults to the EQL. The EQL of 5.0 µg/L reported in DOE/RL-2009-40 and 19 of 56 MDLs are greater than the action level of 0.38 µg/L. All MDLs ranged between 0.1 and 1 µg/L. 1,2-Dichloroethane was detected in one of 57 samples analyzed (1.8 percent frequency). In monitoring well 199-H3-5, 1,2-dichloroethane was detected at a concentration of 0.67 µg/L during the high river stage and was not detected during the low or transitional stages. 1,2-Dichloroethane was not identified as an historic COPC in DOE/RL-2009-40. The results of this evaluation indicate that the 90th percentile for 1,2-dichloroethane is less than the EQL reported in DOE/RL-2009-40; therefore 1,2-dichloroethane is not identified as a COPC.

Aluminum's 90th percentile value is 54 µg/L, which is greater than the action level of 50 µg/L. Aluminum was detected in 33 of 57 samples analyzed (58 percent frequency), with concentrations ranging from 5.4 to 150 µg/L. The secondary MCL is the basis for the action level in this evaluation. The secondary MCL for aluminum is based on a range of concentrations between 50 and 200 µg/L; the 90th percentile value is within this range of concentrations. Aluminum affects aesthetic qualities relating to public acceptance of drinking water. These regulations are not federally enforceable, but are intended as guidelines for the states. For these reasons, aluminum is not identified as a COPC.

Arsenic's 90th percentile value is 5.5 µg/L which is greater than the action level of 0.018 µg/L. Arsenic was detected in 52 of 57 samples analyzed (91 percent frequency) with concentrations ranging between 0.61 µg/L and 7.5 µg/L. In DOE/RL-96-61, background concentrations have been established for filtered (dissolved) concentrations of water constituents. Minimum, maximum, and 90th percentile (filtered) background concentrations of arsenic are 0.5, 8.8, and 7.85 µg/L, respectively. All arsenic concentrations are below the 90th percentile (filtered) background concentration and are considered to be naturally occurring; therefore, arsenic is not identified as a COPC.

Iron's 90th percentile value is 422 µg/L, which is greater than the action level of 300 µg/L. Iron was detected in 42 of 57 samples analyzed (74 percent frequency), with concentrations ranging from 18 and 2,490 µg/L. In DOE/RL-96-61, background concentrations have been established for filtered (dissolved) concentrations of water constituents. Minimum, maximum, and 90th percentile (filtered) background concentrations of iron are 6.0, 7,225, and 570 µg/L, respectively. All but four total iron concentrations are below the 90th percentile (filtered) background concentration and are considered to be naturally occurring; therefore, iron is not identified as a COPC.

Tetrachloroethene's 90th percentile value is 1 µg/L, which is greater than the action level of 0.081 µg/L. When the action level is less than the MDL reported in DOE/RL-2009-40, the action level defaults to the EQL. The EQL of 5.0 µg/L reported in DOE/RL-2009-40 and all MDLs are greater than the action level of 0.081 µg/L. MDLs ranged between 0.088 and 1 µg/L. Tetrachloroethene was detected in seven of 57 samples analyzed (12 percent frequency), with concentrations ranging from 0.093 and 0.43 µg/L. Five of the seven tetrachloroethene results were flagged with a "B", indicating that the analyte was detected in both the sample and in the associated QC blank. The remaining two tetrachloroethene results were detected at monitoring well 699-87-55, at concentrations of 0.36 and 0.43 µg/L, during the high and transitional river stages. These two tetrachloroethene results are flagged with a "J", indicating that the results are estimated concentrations below the MDL. Tetrachloroethene was not identified as an historic COPC in DOE/RL-2009-40. The results of this evaluation indicate that the 90th percentile value for tetrachloroethene is less than the EQL reported in DOE/RL-2009-40; therefore, tetrachloroethene is not identified as a COPC.

Conclusions from Analyte-Specific Evaluation

Table 7-14 lists the analytes that are excluded as COPCs for the 100-HR-3 groundwater OU.

Table 7-14. Summary of Analytes Excluded as Groundwater COPCs for the 100-HR-3 Groundwater OU

COPC	Reason for Inclusion in the SAP (DOE/RL-2009-40)	Exposure Area	Reason for Exclusion as COPC
Arsenic	Maximum concentration and MDLs greater than action level.	100-D Source	Naturally occurring
		100-H Source	Naturally occurring
		Horn	Naturally occurring
Carbon tetrachloride	Maximum concentration and MDLs greater than action level.	100-D Source	90th percentile less than EQL listed in DOE/RL-2009-40 [a]
		100-H Source	90th percentile less than EQL listed in DOE/RL-2009-40 [a]
Mercury	Maximum concentration and MDLs greater than action level.	100-H Source	Single detection; 90th percentile less than EQL listed in DOE/RL-2009-40 [a]

a. When action level is less than the MDL reported in DOE/RL-2009-40, the action level defaults to the EQL.

7.3 Summary of Groundwater COPCs

Fifty-two monitoring wells were determined to be spatially representative of the groundwater conditions at the 100-HR-3 groundwater OU. Thirty-one historic COPCs were identified in DOE/RL-2009-40. The monitoring wells were analyzed for the 31 COPCs, using a method based analytical approach. Three sampling events were used to capture the effects that temporal fluctuations in river stage have on groundwater conditions. Samples collected from mid-May to mid-June 2010 represent aquifer conditions when the river stage is at its highest elevation. Samples collected from early-October 2009 to early-November 2009 represent aquifer conditions when the river is at its lowest elevation. Samples collected from mid-March to mid-April 2010 represent aquifer conditions when the river is transitioning from high to low river stage.

The COPCs are the contaminants most likely to contribute to overall risk.

1. In general, analytes with exposure point concentrations[4] above an action level [see Section 3.3 for a complete list of chemical-specific applicable or relevant and appropriate requirements (ARARs)] were retained as COPCs.
2. Exceptions to this general rule are made for analytes that have exposure point concentrations that *are not* above their action level (which are calculated for the exposure area as a whole), but exist locally at concentrations above the action level (i.e., are localized contaminants that represent a potential threat to human health or the environment).

Based on the results of the COPC identification process,

- Six analytes are identified as COPCs in the 100-D Source exposure area.

[4] Exposure point concentrations are estimated as the 90th percentile value. See ECF-100HR3-10-0473.

- Two analytes are identified as COPCs in the 100-H Source exposure area.
- Three analytes are identified as COPCs in the Horn exposure area.

A summary list is presented in Table 7-15. The monitoring wells in each exposure area that reported the COPCs at concentrations greater than their respective action levels are listed in Tables 7-16 through 7-18.

Table 7-15. Summary of Groundwater COPCs Identified for the 100-HR-3 Groundwater Operable Unit

100-D Source Exposure Area		
Metals	**VOCs**	**Non-Radioactive Anions**
Chromium	Chloroform	Nitrate
Hexavalent Chromium		Sulfate[a]
Zinc[a]		
100-H Source Exposure Area		
Metals	**Radionuclides**	
Hexavalent Chromium	Strontium-90	
Horn Exposure Area		
Metals	**VOCs**	
Chromium	Carbon Tetrachloride	
Hexavalent chromium		

a. 90th percentile value did not exceed an action level but retained as a COPC due to localized contamination.

100-D Source Exposure Area

Chloroform's 90th percentile value is 5.1 µg/L, which is greater than the action level of 1.4 µg/L. When the action level is less than the MDL reported in DOE/RL-2009-40, the action level defaults to the EQL. The EQL of 5.0 µg/L reported in DOE/RL-2009-40 is greater than the action level of 1.4 µg/L. All MDLs for chloroform were 1.0 µg/L. Chloroform was detected in 50 of 60 samples analyzed (83 percent frequency), with concentrations ranging from 0.12 to 8.3 µg/L. Chloroform was detected at concentrations greater than the action level in 11 of 20 monitoring wells in this exposure area.

Chromium's 90th percentile value is 925 µg/L, which is greater than the action level of 65 µg/L. Chromium was detected in all 60 samples analyzed, with concentrations ranging from 7.7 to 4,460 µg/L. Chromium was detected at concentrations greater than the action level in 13 of 20 monitoring wells in this exposure area.

Hexavalent chromium's 90th percentile value is 992 µg/L, which is greater than the action level of 10 µg/L. Hexavalent chromium was detected in all 60 samples analyzed, with concentrations ranging from 7.9 to 6,390 µg/L. Hexavalent chromium was detected at concentrations greater than the action level in 18 of 20 monitoring wells in this exposure area.

Nitrate's 90th percentile value is 69,500 µg/L, which is greater than the action level of 45,000 µg/L. Nitrate was detected in all 60 samples analyzed, with concentrations ranging from 10,800 to 99,200 µg/L. Nitrate was detected at concentrations greater than the action level in 9 of 20 monitoring wells in this exposure area.

Sulfate's 90th percentile value is 161,500 µg/L, which is less than the action level of 250,000 µg/L. Sulfate was detected in all 60 samples analyzed, with concentrations ranging from 24,900 to 438,000 µg/L. Sulfate was detected at concentrations greater than the action level in 1 of 20 monitoring wells in this exposure area. Elevated sulfate concentrations are present in monitoring well 199-D4-84, as a result of past injections of sodium dithionite solution at the redox system. Elevated concentrations of chromium and hexavalent chromium are also present at this monitoring well.

Zinc's 90th percentile value is 34 µg/L, which is less than the action level of 91 µg/L. Zinc was detected in three of 60 samples analyzed, with concentrations ranging from 6.4 to 260 µg/L. Zinc was detected at concentrations greater than the action level in 1 of 20 monitoring wells in this exposure area. Elevated zinc concentrations are present in monitoring well 199-D4-84, as a result of past injections of sodium dithionite solution at the redox system. Elevated concentrations of chromium and hexavalent chromium are also present at this monitoring well.

Monitoring wells with concentrations of COPCs greater than their respective action levels in the 100-D Source exposure area are provided in Tables 7-16.

100-H Source Exposure Area

Hexavalent chromium's 90th percentile value is 26 µg/L, which is greater than the action level of 10 µg/L. Hexavalent chromium was detected in 34 of 39 samples analyzed (87 percent frequency), with concentrations ranging from 2.6 to 29 µg/L. Hexavalent chromium was detected at concentrations greater than the action level in 9 of 13 monitoring wells in this exposure area.

Strontium-90's 90th percentile value is 14 pCi/L, which is greater than the action level of 8 pCi/L. Strontium-90 was detected in 12 of 39 samples analyzed (31 percent frequency), with concentrations ranging from 3.2 to 27 pCi/L. Strontium-90 was detected at concentrations greater than the action level in 3 of 13 monitoring wells in this exposure area.

Monitoring wells with concentrations of COPCs greater than their respective action levels in the 100-H Source exposure area are provided in Tables 7-17.

Horn Exposure Area

Carbon tetrachloride's 90th percentile value is 1.3 µg/L, which is greater than the action level of 0.23 µg/L. When the action level is less than the MDL reported in DOE/RL-2009-40, the action level defaults to the EQL. The EQL of 1.0 µg/L reported in DOE/RL-2009-40 and 10 of 47 MDLs are greater than the action level of 0.23 µg/L. All MDLs for carbon tetrachloride ranged between 0.063 and 1 µg/L. Carbon tetrachloride was detected in 10 of 57 samples analyzed (17 percent frequency), with concentrations ranging between 0.16 and 1.7 µg/L. Carbon tetrachloride was detected at concentrations greater than the EQL in 9 of 19 monitoring wells in this exposure area.

Chromium's 90th percentile value is 76 µg/L, which is greater than the action level of 65 µg/L. Chromium was detected in all 57 samples analyzed, with concentrations ranging from 5.6 to 88 µg/L. Chromium was detected at concentrations greater than the action level in 3 of 19 monitoring wells in this exposure area.

Hexavalent chromium's 90th percentile value is 71 µg/L, which is greater than the action level of 10 µg/L. Hexavalent chromium was detected in 50 of 57 samples analyzed (88 percent frequency), with concentrations ranging from 3.8 to 90 µg/L. Hexavalent chromium was detected at concentrations greater than the action level in 16 of 19 monitoring wells in this exposure area.

Monitoring wells with concentrations of COPCs greater than their respective action levels in the Horn exposure area are provided in Tables 7-18.

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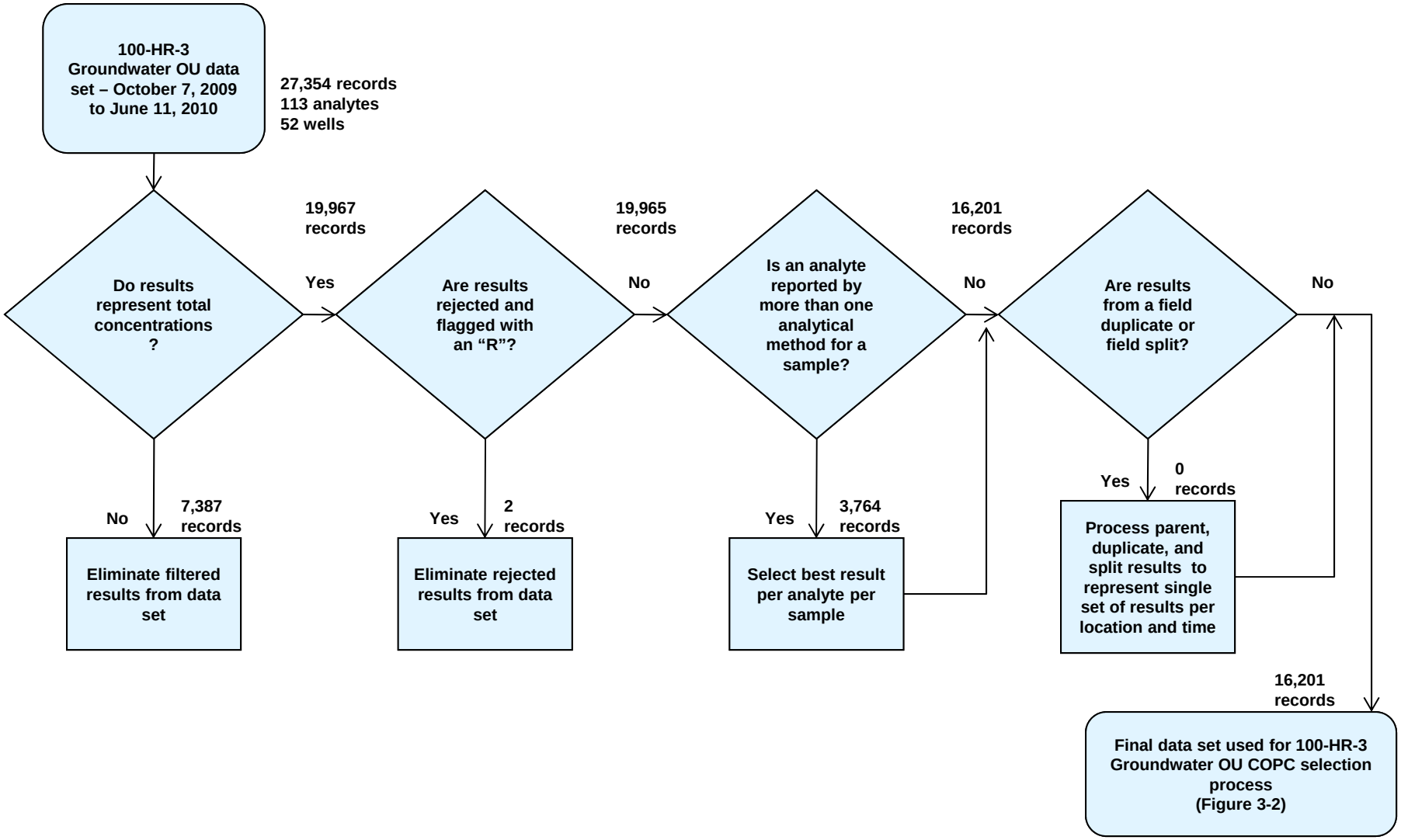

Figure 3-1. Data Processing and Reduction Steps for the 100-HR-3 Groundwater OU Data Set

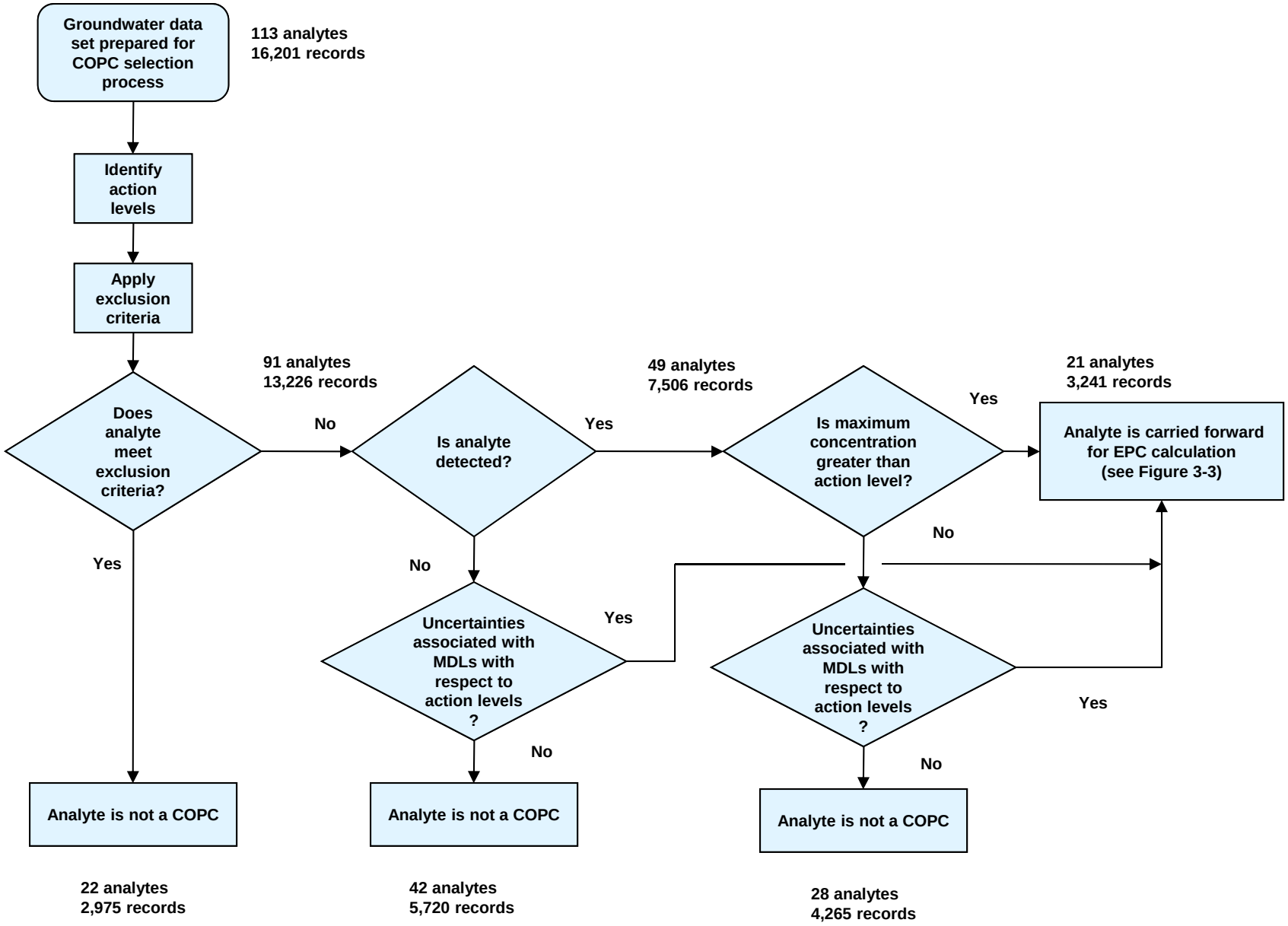

Figure 3-2. COPC Identification Process for the 100-HR-3Groundwater OU: Part 1

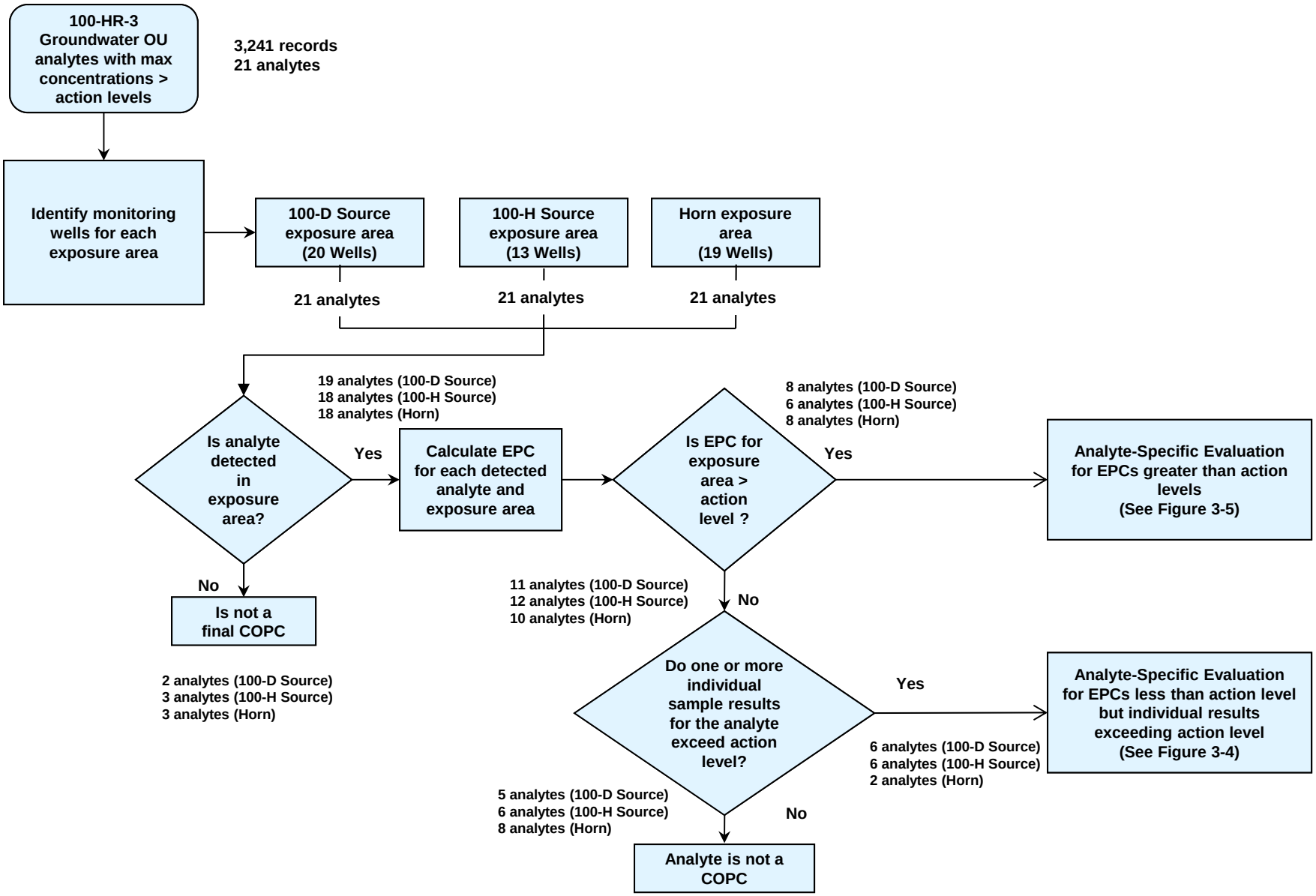

Figure 3-3. COPC Identification Process for the 100-HR-3 Groundwater OU: Part 2

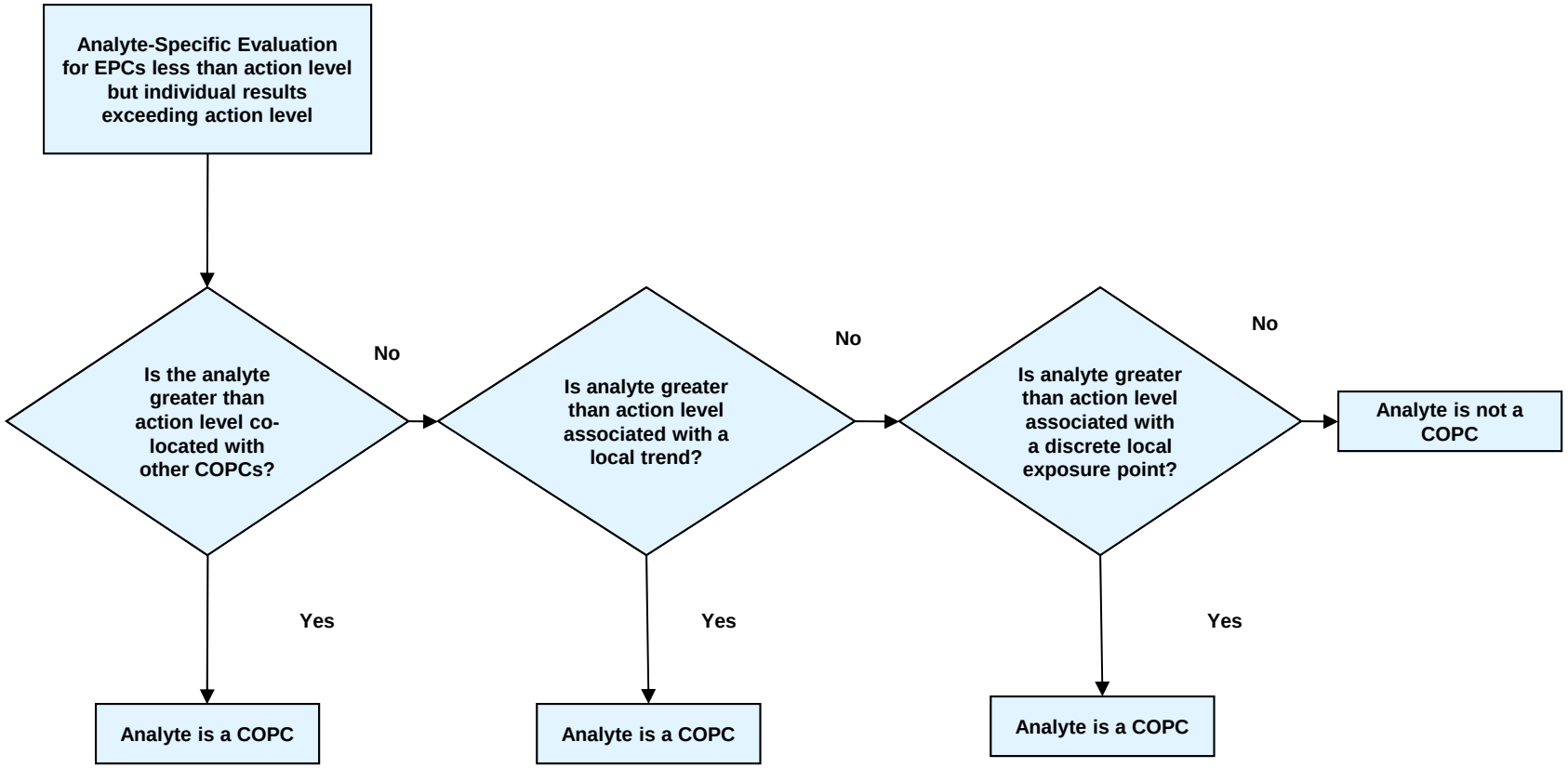

Figure 3-4. Analyte Specific Evaluation Process for Exposure Point Concentrations Less Than Action Levels

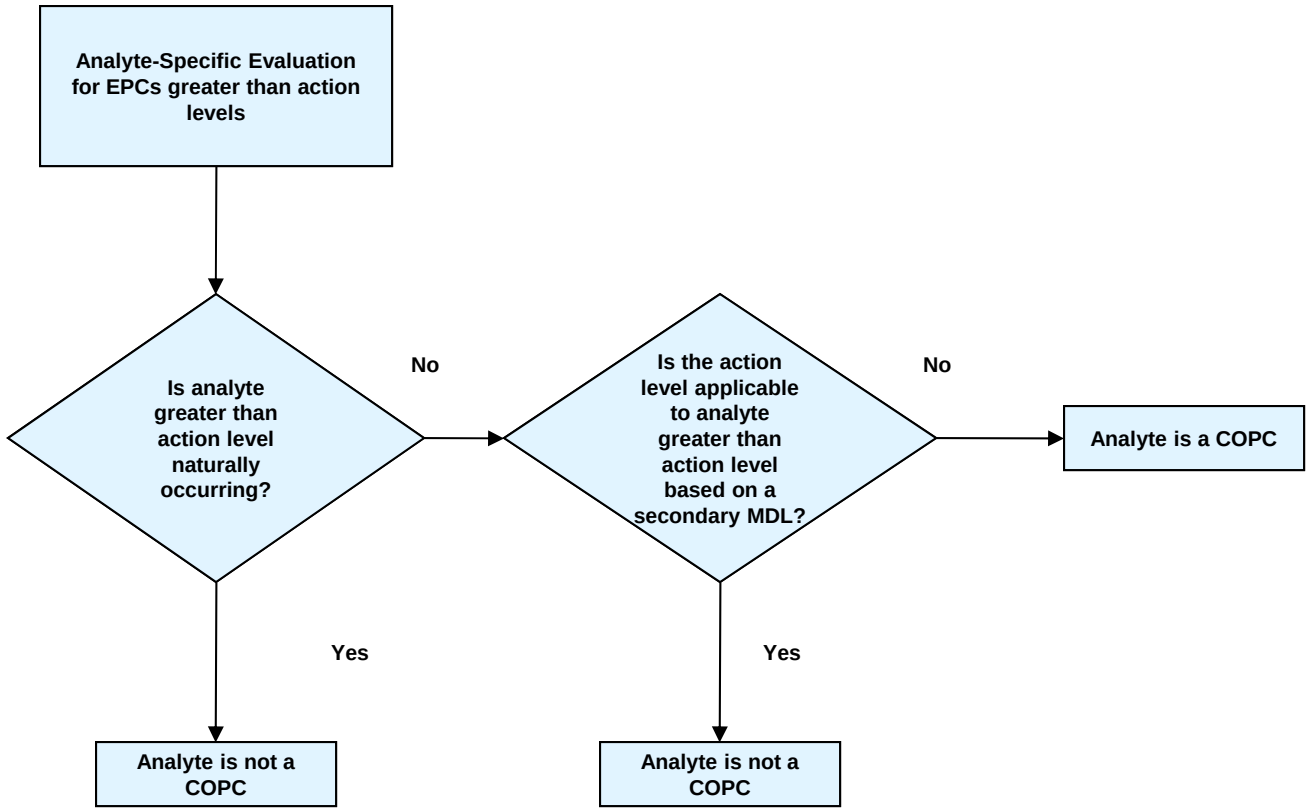

Figure 3-5. Analyte Specific Evaluation Process for Exposure Point Concentrations Greater Than Action Levels

Table 3-1. Summary of Federal and State Water Quality Criteria and Action Levels for the 100-HR-3 Groundwater Operable Unit.

				Groundwater					Surface Water								Final Value	
				40 CFR 141 National Primary Drinking Water Regulations[a]		WAC 246-290-310[b]	WAC 173-340-720[c]		Clean Water Act National Recommended Water Quality Criteria[d]			WAC 173-201A[e]	40 CFR 131 Water Quality Standards[f]			WAC 173-340-730[g]		
CAS#	Analyte Name	Alternate Analyte Name	Units	Federal MCL	Federal MCLG	State MCL	Groundwater Method A Cleanup Levels	Groundwater Method B Unrestricted Land Use	Acute Freshwater CMC	Freshwater CCC	Human Health Water + Organism	Freshwater CCC	Freshwater CMC	Freshwater CCC	Human Health Water + Organism	Surface Water Method B Unrestricted Land Use	Final Action Level	Final Action Level Basis
630-20-6	1,1,1,2-Tetrachloroethane	--	µg/L	--	--	--	--	1.7	--	--	--	--	--	--	--	6.2	1.7	WAC 173-340-720(4)(b)(iii)(A) and (B)
71-55-6	1,1,1-Trichloroethane	--	µg/L	200	200	--	--	16,000	--	--	--	--	--	--	--	925,926	200	40 CFR 141 - Federal MCL
79-34-5	1,1,2,2-Tetrachloroethane	--	µg/L	--	--	--	--	0.22	--	--	0.17	--	--	--	0.17	6.5	0.17	Clean Water Act -- Human Health Water + Organism
79-00-5	1,1,2-Trichloroethane	--	µg/L	5.0	3.0	--	--	0.77	--	--	0.59	--	--	--	0.60	25	0.59	Clean Water Act -- Human Health Water + Organism
75-34-3	1,1-Dichloroethane	--	µg/L	--	--	--	--	1,600	--	--	--	--	--	--	--	73,549	1,600	WAC 173-340-720(4)(b)(iii)(A) and (B)
75-35-4	1,1-Dichloroethene	1,1-Dichloroethylene	µg/L	7.0	7.0	--	--	400	--	--	330	--	--	--	0.057	23,148	0.057	40 CFR 131 -- Human Health Water + Organism
96-18-4	1,2,3-Trichloropropane	--	µg/L	--	--	--	--	0.0015	--	--	--	--	--	--	--	0.017	0.0015	WAC 173-340-720(4)(b)(iii)(A) and (B)
96-12-8	1,2-Dibromo-3-chloropropane	--	µg/L	0.20	--	--	--	0.055	--	--	--	--	--	--	--	0.70	0.055	WAC 173-340-720(4)(b)(iii)(A) and (B)
106-93-4	1,2-Dibromoethane	--	µg/L	0.050	--	--	--	0.022	--	--	--	--	--	--	--	0.22	0.022	WAC 173-340-720(4)(b)(iii)(A) and (B)
107-06-2	1,2-Dichloroethane	--	µg/L	5.0	--	--	--	0.48	--	--	0.38	--	--	--	0.38	59	0.38	Clean Water Act -- Human Health Water + Organism
540-59-0	1,2-Dichloroethene (Total)	1,2-Dichloroethylene Mixed Isomers	µg/L	--	--	--	--	72	--	--	--	--	--	--	--	2,102	72	WAC 173-340-720(4)(b)(iii)(A) and (B)
78-87-5	1,2-Dichloropropane	--	µg/L	5.0	--	--	--	1.2	--	--	0.50	--	--	--	--	44	0.50	Clean Water Act -- Human Health Water + Organism
106-46-7	1,4-Dichlorobenzene	--	µg/L	75	75	--	--	8.1	--	--	63	--	--	--	400	22	8.1	WAC 173-340-720(4)(b)(iii)(A) and (B)
123-91-1	1,4-Dioxane	--	µg/L	--	--	--	--	4.0	--	--	--	--	--	--	--	--	4.0	WAC 173-340-720(4)(b)(iii)(A) and (B)
71-36-3	1-Butanol	N-Butanol	µg/L	--	--	--	--	800	--	--	--	--	--	--	--	82,044	800	WAC 173-340-720(4)(b)(iii)(A) and (B)
78-93-3	2-Butanone	Methyl Ethyl Ketone	µg/L	--	--	--	--	4,800	--	--	--	--	--	--	--	492,264	4,800	WAC 173-340-720(4)(b)(iii)(A) and (B)
591-78-6	2-Hexanone	--	µg/L	--	--	--	--	80	--	--	--	--	--	--	--	3,429	80	WAC 173-340-720(4)(b)(iii)(A) and (B)
108-10-1	4-Methyl-2-pentanone	4-Methyl-2-Penatone	µg/L	--	--	--	--	640	--	--	--	--	--	--	--	61,002	640	WAC 173-340-720(4)(b)(iii)(A) and (B)
67-64-1	Acetone	--	µg/L	--	--	--	--	7,200	--	--	--	--	--	--	--	738,397	7,200	WAC 173-340-720(4)(b)(iii)(A) and (B)
75-05-8	Acetonitrile	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
107-02-8	Acrolein	--	µg/L	--	--	--	--	4.0	--	3.0	6.0	--	--	--	320	--	3.0	Clean Water Act -- Freshwater CCC
107-05-1	Allyl chloride	--	µg/L	--	--	--	--	2.1	--	--	--	--	--	--	--	62	2.1	WAC 173-340-720(4)(b)(iii)(A) and (B)
7429-90-5	Aluminum	--	µg/L	50	--	--	--	16,000	750	87	--	--	--	--	--	5,185	50	40 CFR 141 - Federal MCL
7440-36-0	Antimony	Antimony (metallic)	µg/L	6.0	6.0	6.0	--	6.4	--	--	5.6	--	--	--	14	1,037	5.6	Clean Water Act -- Human Health Water + Organism
14234-35-6	Antimony-125	--	pCi/L	300	--	--	--	--	--	--	--	--	--	--	--	--	300	40 CFR 141 - Federal MCL
7440-38-2	Arsenic	Arsenic, Inorganic	µg/L	10	--	10	--	0.058	340	150	0.018	190	360	190	0.018	0.098	0.018	Clean Water Act -- Human Health Water + Organism
7440-39-3	Barium	--	µg/L	2,000	2,000	2,000	--	3,200	--	--	1,000	--	--	--	--	129,630	1,000	Clean Water Act -- Human Health Water + Organism
71-43-2	Benzene	--	µg/L	5.0	--	--	--	0.80	--	--	2.2	--	--	--	1.2	23	0.80	WAC 173-340-720(4)(b)(iii)(A) and (B)
7440-41-7	Beryllium	Beryllium and Compounds	µg/L	4.0	4.0	4.0	--	32	--	--	--	--	--	--	--	273	4.0	40 CFR 141 - Federal MCL
13966-02-4	Beryllium-7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
7440-69-9	Bismuth	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
7440-42-8	Boron	Boron And Borates Only	µg/L	--	--	--	--	3,200	--	--	--	--	--	--	--	--	3,200	WAC 173-340-720(4)(b)(iii)(A) and (B)
24959-67-9	Bromide	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
75-27-4	Bromodichloromethane	--	µg/L	--	--	--	--	0.71	--	--	0.55	--	--	--	0.27	28	0.27	40 CFR 131 -- Human Health Water + Organism
75-25-2	Bromoform	--	µg/L	--	80	--	--	5.5	--	--	4.3	--	--	--	4.3	219	4.3	Clean Water Act -- Human Health Water + Organism
74-83-9	Bromomethane	--	µg/L	--	--	--	--	11	--	--	47	--	--	--	48	968	11	WAC 173-340-720(4)(b)(iii)(A) and (B)
7440-43-9	Cadmium	Cadmium (Water)	µg/L	5.0	5.0	5.0	--	8.0	2.0	0.25	--	0.91	3.9	1.0	--	20	0.25	Clean Water Act -- Freshwater CCC
7440-70-2	Calcium	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
75-15-0	Carbon disulfide	--	µg/L	--	--	--	--	800	--	--	--	--	--	--	--	13,295	800	WAC 173-340-720(4)(b)(iii)(A) and (B)
56-23-5	Carbon tetrachloride	--	µg/L	5.0	--	--	--	0.34	--	--	0.23	--	--	--	0.25	2.7	0.23	Clean Water Act -- Human Health Water + Organism
13967-70-9	Cesium-134	--	pCi/L	80	--	--	--	--	--	--	--	--	--	--	--	--	80	40 CFR 141 - Federal MCL
10045-97-3	Cesium-137	--	pCi/L	200	--	--	--	--	--	--	--	--	--	--	--	--	200	40 CFR 141 - Federal MCL
16887-00-6	Chloride	--	µg/L	250,000	--	250,000	--	--	860,000	230,000	--	230,000	--	--	--	--	230,000	Clean Water Act -- Freshwater CCC
108-90-7	Chlorobenzene	--	µg/L	100	100	--	--	160	--	--	130	--	--	--	680	5,034	100	40 CFR 141 - Federal MCL
75-00-3	Chloroethane	Ethylchloride	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
67-66-3	Chloroform	--	µg/L	80	--	80	--	1.4	--	--	5.7	--	--	--	5.7	56	1.4	WAC 173-340-720(4)(b)(iii)(A) and (B)
74-87-3	Chloromethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
126-99-8	Chloroprene	2-Chloro-1,3-butadiene	µg/L	--	--	--	--	160	--	--	--	--	--	--	--	2,412	160	WAC 173-340-720(4)(b)(iii)(A) and (B)
7440-47-3	Chromium	--	µg/L	100	100	100	--	24,000	570	65	--	156	550	180	--	19,444	65	Clean Water Act -- Freshwater CCC
156-59-2	cis-1,2-Dichloroethylene	--	µg/L	70	70	--	--	80	--	--	--	--	--	--	--	2,336	70	40 CFR 141 - Federal MCL
10061-01-5	cis-1,3-Dichloropropene	--	µg/L	--	--	--	--	0.44	--	--	0.34	--	--	--	--	34	0.34	Clean Water Act -- Human Health Water + Organism
7440-48-4	Cobalt	--	µg/L	--	--	--	--	4.8	--	--	--	--	--	--	--	2.6	2.6	WAC 173-340-730(3)(b)(iii)(A) and (B)
10198-40-0	Cobalt-60	--	pCi/L	100	--	--	--	--	--	--	--	--	--	--	--	--	100	40 CFR 141 - Federal MCL
7440-50-8	Copper	--	µg/L	1,300	1,300	--	--	640	13	9.0	1,300	--	17	11	--	2,881	9.0	Clean Water Act -- Freshwater CCC
124-48-1	Dibromochloromethane	--	µg/L	60	60	--	--	0.52	--	--	0.40	--	--	--	0.41	21	0.40	Clean Water Act -- Human Health Water + Organism
74-95-3	Dibromomethane	Methylene Bromide	µg/L	--	--	--	--	80	--	--	--	--	--	--	--	4,216	80	WAC 173-340-720(4)(b)(iii)(A) and (B)
75-71-8	Dichlorodifluoromethane	--	µg/L	--	--	--	--	1,600	--	--	--	--	--	--	--	84,312	1,600	WAC 173-340-720(4)(b)(iii)(A) and (B)
107-12-0	Ethyl cyanide	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
97-63-2	Ethyl methacrylate	--	µg/L	--	--	--	--	720	--	--	--	--	--	--	--	26,365	720	WAC 173-340-720(4)(b)(iii)(A) and (B)
100-41-4	Ethylbenzene	--	µg/L	700	700	--	--	4.0	--	--	530	--	--	--	3,100	16	4.0	WAC 173-340-720(4)(b)(iii)(A) and (B)
14683-23-9	Europium-152	--	pCi/L	200	--	--	--	--	--	--	--	--	--	--	--	--	200	40 CFR 141 - Federal MCL
15585-10-1	Europium-154	--	pCi/L	60	--	--	--	--	--	--	--	--	--	--	--	--	60	40 CFR 141 - Federal MCL
14391-16-3	Europium-155	--	pCi/L	600	--	--	--	--	--	--	--	--	--	--	--	--	600	40 CFR 141 - Federal MCL
16984-48-8	Fluoride	--	µg/L	4,000	4,000	4,000	--	960	--	--	--	--	--	--	--	--	960	WAC 173-340-720(4)(b)(iii)(A) and (B)
12587-46-1	Gross alpha	--	pCi/L	15	--	--	--	--	--	--	--	--	--	--	--	--	15	40 CFR 141 - Federal MCL
12587-47-2	Gross beta	--	mrem/year	4.0	--	--	--	--	--	--	--	--	--	--	--	--	4.0	40 CFR 141 - Federal MCL
18540-29-9	Hexavalent Chromium	Chromium (VI)	µg/L	--	100	--	--	48	16	11	--	10	15	10	--	486	10	40 CFR 131 -- Freshwater CCC
74-88-4	Iodomethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
7439-89-6	Iron	--	µg/L	300	--	300	--	11,200	--	1,000	300	--	--	--	--	9,074	300	40 CFR 141 - Federal MCL
78-83-1	Isobutyl alcohol	--	µg/L	--	--	--	--	2,400	--	--	--	--	--	--	--	246,132	2,400	WAC 173-340-720(4)(b)(iii)(A) and (B)
7439-92-1	Lead	Lead and Compounds	µg/L	15	--	--	15	--	65	2.5	--	2.1	65	2.5	--	--	2.1	WAC 173-201A
7439-93-2	Lithium	--	µg/L	--	--	--	--	32	--	--	--	--	--	--	--	--	32	WAC 173-340-720(4)(b)(iii)(A) and (B)
7439-95-4	Magnesium	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
7439-96-5	Manganese	Manganese (Water)	µg/L	50	--	50	--	2,240	--	--	50	--	--	--	--	907	50	40 CFR 141 - Federal MCL
7487-94-7	Mercury	Mercuric chloride	µg/L	2.0	2.0	2.0	--	4.8	1.4	0.77	--	0.012	2.1	0.012	0.14	0.78	0.012	40 CFR 131 -- Freshwater CCC
126-98-7	Methacrylonitrile	--	µg/L	--	--	--	--	0.80	--	--	--	--	--	--	--	82	0.80	WAC 173-340-720(4)(b)(iii)(A) and (B)
80-62-6	Methyl methacrylate	--	µg/L	--	--	--	--	11,200	--	--	--	--	--	--	--	960,219	11,200	WAC 173-340-720(4)(b)(iii)(A) and (B)
75-09-2	Methylene chloride	--	µg/L	5.0	--	--	--	5.8	--	--	4.6	--	--	--	4.7	960	4.6	Clean Water Act -- Human Health Water + Organism

Table 3-1. Summary of Federal and State Water Quality Criteria and Action Levels for the 100-HR-3 Groundwater Operable Unit.

				Groundwater					Surface Water								Final Value	
				40 CFR 141 National Primary Drinking Water Regulations[a]		WAC 246-290-310[b]	WAC 173-340-720[c]		Clean Water Act National Recommended Water Quality Criteria[d]			WAC 173-201A[e]	40 CFR 131 Water Quality Standards[f]			WAC 173-340-730[g]		
CAS#	Analyte Name	Alternate Analyte Name	Units	Federal MCL	Federal MCLG	State MCL	Groundwater Method A Cleanup Levels	Groundwater Method B Unrestricted Land Use	Acute Freshwater CMC	Freshwater CCC	Human Health Water + Organism	Freshwater CCC	Freshwater CMC	Freshwater CCC	Human Health Water + Organism	Surface Water Method B Unrestricted Land Use	Final Action Level	Final Action Level Basis
7439-98-7	Molybdenum	--	µg/L	--	--	--	--	80	--	--	--	--	--	--	--	1,296	80	WAC 173-340-720(4)(b)(iii)(A) and (B)
7440-02-0	Nickel	Nickel Soluble Salts	µg/L	--	100	100	--	320	470	52	610	137	1,400	160	610	1,103	52	Clean Water Act -- Freshwater CCC
14797-55-8	Nitrate	--	µg/L	45,000	45,000	45,000	--	113,600	--	--	45,000	--	--	--	--	--	45,000	40 CFR 141 - Federal MCL
14797-65-0	Nitrite	--	µg/L	3,300	3,300	3,300	--	5,280	--	--	--	--	--	--	--	--	3,300	40 CFR 141 - Federal MCL
14265-44-2	Phosphate	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
7440-09-7	Potassium	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
13966-00-2	Potassium-40	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
13967-48-1	Ruthenium-106	--	pCi/L	30	--	--	--	--	--	--	--	--	--	--	--	--	30	40 CFR 141 - Federal MCL
7782-49-2	Selenium	--	µg/L	50	50	50	--	80	--	5.0	170	5.0	20	5.0	--	2,701	5.0	Clean Water Act -- Freshwater CCC
7440-21-3	Silicon	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
7440-22-4	Silver	--	µg/L	100	--	100	--	80	3.2	--	--	2.6	3.4	--	--	25,926	2.6	WAC 173-201A
7440-23-5	Sodium	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
7440-24-6	Strontium	Strontium, Stable	µg/L	--	--	--	--	9,600	--	--	--	--	--	--	--	25,926	9,600	WAC 173-340-720(4)(b)(iii)(A) and (B)
10098-97-2	Strontium-90	--	pCi/L	8.0	--	--	--	--	--	--	--	--	--	--	--	--	8.0	40 CFR 141 - Federal MCL
100-42-5	Styrene	--	µg/L	100	100	--	--	1,600	--	--	--	--	--	--	--	38,409	100	40 CFR 141 - Federal MCL
14808-79-8	Sulfate	--	µg/L	250,000	--	250,000	--	--	--	--	--	--	--	--	--	--	250,000	40 CFR 141 - Federal MCL
14133-76-7	Technetium-99	--	pCi/L	900	--	--	--	--	--	--	--	--	--	--	--	--	900	40 CFR 141 - Federal MCL
127-18-4	Tetrachloroethene	Perchloroethylene (PCE)	µg/L	5.0	--	--	--	0.081	--	--	0.69	--	--	--	0.80	0.39	0.081	WAC 173-340-720(4)(b)(iii)(A) and (B)
109-99-9	Tetrahydrofuran	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
7440-28-0	Thallium	Thallium (Soluble Salts)	µg/L	2.0	0.50	2.0	--	--	--	--	0.24	--	--	--	1.7	--	0.24	Clean Water Act -- Human Health Water + Organism
7440-31-5	Tin	--	µg/L	--	--	--	--	9,600	--	--	--	--	--	--	--	519	519	WAC 173-340-730(3)(b)(iii)(A) and (B)
108-88-3	Toluene	--	µg/L	1,000	1,000	--	--	640	--	--	1,300	--	--	--	6,800	19,384	640	WAC 173-340-720(4)(b)(iii)(A) and (B)
156-60-5	trans-1,2-Dichloroethylene	--	µg/L	100	100	--	--	160	--	--	140	--	--	--	--	32,818	100	40 CFR 141 - Federal MCL
10061-02-6	trans-1,3-Dichloropropene	--	µg/L	--	--	--	--	0.44	--	--	0.34	--	--	--	--	34	0.34	Clean Water Act -- Human Health Water + Organism
110-57-6	trans-1,4-Dichloro-2-butene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
76-02-8	Trichloroacetyl chloride	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
79-01-6	Trichloroethene	Trichloroethylene (TCE)	µg/L	5.0	--	--	--	0.49	--	--	2.5	--	--	--	2.7	6.6	0.49	WAC 173-340-720(4)(b)(iii)(A) and (B)
75-69-4	Trichloromonofluoromethane	Trichlorofluoromethane	µg/L	--	--	--	--	2,400	--	--	--	--	--	--	--	--	2,400	WAC 173-340-720(4)(b)(iii)(A) and (B)
10028-17-8	Tritium	--	pCi/L	20,000	--	--	--	--	--	--	--	--	--	--	--	--	20,000	40 CFR 141 - Federal MCL
7440-61-1	Uranium	Uranium (Soluble Salts)	µg/L	30	--	--	--	48	--	--	--	--	--	--	--	778	30	40 CFR 141 - Federal MCL
7440-62-2	Vanadium	Vanadium and Compounds	µg/L	--	--	--	--	80	--	--	--	--	--	--	--	--	80	WAC 173-340-720(4)(b)(iii)(A) and (B)
108-05-4	Vinyl acetate	--	µg/L	--	--	--	--	8,000	--	--	--	--	--	--	--	820,441	8,000	WAC 173-340-720(4)(b)(iii)(A) and (B)
75-01-4	Vinyl chloride	--	µg/L	2.0	--	--	--	0.061	--	--	0.025	--	--	--	2.0	7.7	0.025	Clean Water Act -- Human Health Water + Organism
1330-20-7	Xylenes (total)	Xylenes (mixture)	µg/L	10,000	10,000	--	--	1,600	--	--	--	--	--	--	--	--	1,600	WAC 173-340-720(4)(b)(iii)(A) and (B)
7440-66-6	Zinc	Zinc (Metallic)	µg/L	5,000	--	5,000	--	4,800	120	120	7,400	91	110	100	--	16,548	91	WAC 173-201A

Notes:
a. 40 CFR 141 National Primary Drinking Water Regulations. http://www.epa.gov/waterscience/criteria/wqctable/
b. Washington Department of Ecology, 2008, *Group A Public Water Supplies 246-290-310 WAC*, Publication No. 08-03-061
c. WAC 173-340-720(4)(b)(ii)(A) and (B), Ground water cleanup standars, Method B ground water cleanup levels, Noncarcinogens and Carcinogens
d. Clean Water Act - National Recommended Water Quality Criteria
e. WAC 173-201A, "Water Quality Standards for Surface Waters of the State of Washington," *Washington Administrative Code*, Olympia, Washington. http://apps.leg.wa.gov/wac/default.aspx?cite=173-201A
f. 40 CFR 131 Water Quality Standards, http://ecfr.gpoaccess.gov
g. WAC 173-340-730(3)(b)(iii)(A) and (B), Surface water cleanup standards, Method B surface water cleanup levels, Noncarcinogens and Carcinogens
MCL - Maximum Contaminant Limit
MCLG - Maximum Contaminant Limit Goal
CCC - Criteria Continuous Concentration
CMC - Criteria Maximum Concentration
Ecology, 2007, The Model Toxics Control Act Cleanup Regulation Chapter 173-340 WAC,Publication No. 94-06, amended 1996, Washington State Department of Ecology, Olympia, Washington.

Table 4-1. 100-HR-3 Groundwater Operable Unit Monitoring Wells by Exposure Area

Well Name			
100-D Source Exposure Area			
199-D2-11	199-D2-6	199-D4-23	199-D4-84
199-D5-13	199-D5-14	199-D5-15	199-D5-16
199-D5-17	199-D5-18	199-D5-19	199-D5-37
199-D5-38	199-D5-43	199-D5-99	199-D8-5
199-D8-55	199-D8-70	199-D8-71	199-D8-88
100-H Source Exposure Area			
199-H3-2A	199-H4-10	199-H4-11	199-H4-13
199-H4-16	199-H4-3	199-H4-45	199-H4-46
199-H4-48	199-H4-5	199-H4-6	199-H4-9
199-H6-1			
Horn Exposure Area			
199-H3-4	199-H3-5	199-H5-1A	699-101-45
699-87-55	699-90-45	699-93-48A	699-94-41
699-94-43	699-95-45	699-95-48	699-95-51
699-96-52B	699-97-41	699-97-45	699-97-48B
699-98-43	699-98-49A	699-98-51	

Table 7-1. Summary of Groundwater Analytes That Meet Exclusion Criteria
100-HR-3 Operable Unit

Analyte Name	Analyte Class	Begin Samp Date	End Samp Date	Total Samples	Total Detects	Frequency of Detection	Units	Minimum Detection Limit	Maximum Detection Limit	Minimum Detected Result	Maximum Detected Result	Basis for Exclusion
Bromide	ANION	10/7/2009	6/11/2010	117	86	73.50%	µg/L	90	450	98	320	No Action Level/ No Toxicity Values
Phosphate	ANION	10/7/2009	6/11/2010	117	3	2.56%	µg/L	429	2,150	460	1,260	No Action Level/ No Toxicity Values
Bismuth	METAL	10/7/2009	6/11/2010	122	7	5.74%	µg/L	0	23	23	38	No Action Level/ No Toxicity Values
Calcium	METAL	10/7/2009	6/11/2010	156	156	100.00%	µg/L	--	--	34,200	157,000	Essential Nutrient
Magnesium	METAL	10/7/2009	6/11/2010	156	156	100.00%	µg/L	--	--	774	39,600	Essential Nutrient
Potassium	METAL	10/7/2009	6/11/2010	156	156	100.00%	µg/L	--	--	1,870	7,190	Essential Nutrient
Silicon	METAL	10/7/2009	6/11/2010	122	122	100.00%	µg/L	--	--	7,510	22,800	No Action Level/ No Toxicity Values
Sodium	METAL	10/7/2009	6/11/2010	156	156	100.00%	µg/L	--	--	4,200	38,100	Essential Nutrient
Antimony-125	RAD	10/7/2009	6/11/2010	156	0	0.00%	pCi/L	-4.30E+00	6.5	--	--	Half-Life less than 3 years
Beryllium-7	RAD	10/7/2009	6/11/2010	156	0	0.00%	pCi/L	-3.28E+01	32	--	--	Half-Life less than 3 years
Cesium-134	RAD	10/7/2009	6/11/2010	156	0	0.00%	pCi/L	-2.81E+00	2.7	--	--	Half-Life less than 3 years
Gross beta	RAD	10/7/2009	6/11/2010	156	116	74.36%	pCi/L	0.055	6.3	3.4	58	No Action Level/ No Toxicity Values
Potassium-40	RAD	10/7/2009	6/11/2010	156	1	0.64%	pCi/L	-8.60E+01	37	58	58	Background Radiation
Ruthenium-106	RAD	10/7/2009	6/11/2010	156	0	0.00%	pCi/L	-2.79E+01	26	--	--	Half-Life less than 3 years
Acetonitrile	VOC	3/18/2010	6/11/2010	104	0	0.00%	µg/L	2.0	2.0	--	--	No Action Level/ No Toxicity Values
Chloroethane	VOC	10/7/2009	6/11/2010	156	0	0.00%	µg/L	0.085	1.0	--	--	No Action Level/ No Toxicity Values
Chloromethane	VOC	10/7/2009	6/11/2010	156	1	0.64%	µg/L	0.077	1.0	0.10	0.10	No Action Level/Toxicity Values Available
Ethyl cyanide	VOC	10/7/2009	6/11/2010	156	0	0.00%	µg/L	1.2	2.0	--	--	No Action Level/ No Toxicity Values
Iodomethane	VOC	3/18/2010	6/11/2010	104	0	0.00%	µg/L	0.092	0.092	--	--	No Action Level/ No Toxicity Values
Tetrahydrofuran	VOC	10/7/2009	6/11/2010	156	0	0.00%	µg/L	1.1	2.0	--	--	No Action Level/ No Toxicity Values
trans-1,4-Dichloro-2-butene	VOC	3/18/2010	6/11/2010	104	0	0.00%	µg/L	0.29	0.29	--	--	No Action Level/ No Toxicity Values
Trichloroacetyl chloride	VOC	10/9/2009	10/9/2009	1	1	100.00%	µg/L	--	--	1.5	1.5	No Action Level/ No Toxicity Values

Table 7-2. Summary of Groundwater Analytes That Were Not Detected
100-HR-3 Operable Unit

Analyte Name	Analyte Class	Begin Sample Date	End Sample Date	Total Samples	Total Detects	Frequency of Detection	Units	Minimum Detection Limit	Maximum Detection Limit	Action Level	Action Level Basis	Level of Exceedence
Cesium-137	RAD	10/7/2009	6/11/2010	156	0	0.00%	pCi/L	-2.15	2.96	2.00E+02	40 CFR 141 - Federal MCL	-1.08E-02
Cobalt-60	RAD	10/7/2009	6/11/2010	156	0	0.00%	pCi/L	-2.98	2.09	1.00E+02	40 CFR 141 - Federal MCL	-2.98E-02
Europium-152	RAD	10/7/2009	6/11/2010	156	0	0.00%	pCi/L	-6.76	6.52	2.00E+02	40 CFR 141 - Federal MCL	-3.38E-02
Europium-154	RAD	10/7/2009	6/11/2010	156	0	0.00%	pCi/L	-6.14	7.94	60	40 CFR 141 - Federal MCL	-1.02E-01
Europium-155	RAD	10/7/2009	6/11/2010	156	0	0.00%	pCi/L	-5.03	4.24	600	40 CFR 141 - Federal MCL	-8.38E-03
1,4-Dichlorobenzene	SVOC	10/7/2009	6/11/2010	156	0	0.00%	µg/L	0.12	1	8.1	WAC 173-340-720(4)(b)(iii)(A) and (B)	1.48E-02
1,1,1,2-Tetrachloroethane	VOC	3/18/2010	6/11/2010	104	0	0.00%	µg/L	0.09	0.09	1.7	WAC 173-340-720(4)(b)(iii)(A) and (B)	5.36E-02
1,1,1-Trichloroethane	VOC	10/7/2009	6/11/2010	156	0	0.00%	µg/L	0.067	1	200	40 CFR 141 - Federal MCL	3.35E-04
1,1,2,2-Tetrachloroethane	VOC	10/7/2009	6/11/2010	156	0	0.00%	µg/L	0.098	1	0.17	Clean Water Act -- Human Health Water + Organism	5.76E-01
1,1,2-Trichloroethane	VOC	10/7/2009	6/11/2010	156	0	0.00%	µg/L	0.063	1	0.59	Clean Water Act -- Human Health Water + Organism	1.07E-01
1,1-Dichloroethane	VOC	10/7/2009	6/11/2010	156	0	0.00%	µg/L	0.068	1	1,600	WAC 173-340-720(4)(b)(iii)(A) and (B)	4.25E-05
1,1-Dichloroethene	VOC	10/7/2009	6/11/2010	156	0	0.00%	µg/L	0.051	1	0.057	40 CFR 131 -- Human Health Water + Organism	8.95E-01
1,2,3-Trichloropropane	VOC	3/18/2010	6/11/2010	104	0	0.00%	µg/L	0.15	0.15	0.0015	WAC 173-340-720(4)(b)(iii)(A) and (B)	1.03E+02
1,2-Dibromo-3-chloropropane	VOC	3/18/2010	6/11/2010	104	0	0.00%	µg/L	0.41	0.41	0.055	WAC 173-340-720(4)(b)(iii)(A) and (B)	7.50E+00
1,2-Dibromoethane	VOC	3/18/2010	6/11/2010	104	0	0.00%	µg/L	0.13	0.13	0.022	WAC 173-340-720(4)(b)(iii)(A) and (B)	5.94E+00
1,2-Dichloroethene (Total)	VOC	10/7/2009	6/11/2010	156	0	0.00%	µg/L	0.13	1	72	WAC 173-340-720(4)(b)(iii)(A) and (B)	1.81E-03
1,2-Dichloropropane	VOC	10/7/2009	6/11/2010	156	0	0.00%	µg/L	0.097	1	0.50	Clean Water Act -- Human Health Water + Organism	1.94E-01
1,4-Dioxane	VOC	3/18/2010	6/11/2010	104	0	0.00%	µg/L	7.6	7.6	4.0	WAC 173-340-720(4)(b)(iii)(A) and (B)	1.91E+00
1-Butanol	VOC	10/7/2009	6/11/2010	156	0	0.00%	µg/L	12	100	800	WAC 173-340-720(4)(b)(iii)(A) and (B)	1.50E-02
2-Hexanone	VOC	10/7/2009	6/11/2010	156	0	0.00%	µg/L	0.22	1.0	80	WAC 173-340-720(4)(b)(iii)(A) and (B)	2.75E-03
4-Methyl-2-pentanone	VOC	10/7/2009	6/11/2010	156	0	0.00%	µg/L	0.12	1.0	640	WAC 173-340-720(4)(b)(iii)(A) and (B)	1.88E-04
Acrolein	VOC	3/18/2010	6/11/2010	104	0	0.00%	µg/L	2.8	2.8	3.0	Clean Water Act -- Freshwater CCC	9.33E-01
Allyl chloride	VOC	3/18/2010	6/11/2010	104	0	0.00%	µg/L	0.091	0.11	2.1	WAC 173-340-720(4)(b)(iii)(A) and (B)	4.38E-02
Benzene	VOC	10/7/2009	6/11/2010	156	0	0.00%	µg/L	0.045	1.0	0.80	WAC 173-340-720(4)(b)(iii)(A) and (B)	5.65E-02
Chlorobenzene	VOC	10/7/2009	6/11/2010	156	0	0.00%	µg/L	0.15	1.0	100	40 CFR 141 - Federal MCL	1.50E-03
Chloroprene	VOC	3/18/2010	6/11/2010	104	0	0.00%	µg/L	0.086	0.097	160	WAC 173-340-720(4)(b)(iii)(A) and (B)	5.38E-04
cis-1,2-Dichloroethylene	VOC	10/7/2009	6/11/2010	156	0	0.00%	µg/L	0.083	1.0	70	40 CFR 141 - Federal MCL	1.19E-03
cis-1,3-Dichloropropene	VOC	10/7/2009	6/11/2010	156	0	0.00%	µg/L	0.073	1.0	0.34	Clean Water Act -- Human Health Water + Organism	2.15E-01
Dibromochloromethane	VOC	10/7/2009	6/11/2010	156	0	0.00%	µg/L	0.057	1.0	0.40	Clean Water Act -- Human Health Water + Organism	1.43E-01
Dibromomethane	VOC	3/18/2010	6/11/2010	104	0	0.00%	µg/L	0.21	0.21	80	WAC 173-340-720(4)(b)(iii)(A) and (B)	2.63E-03
Dichlorodifluoromethane	VOC	3/18/2010	6/11/2010	104	0	0.00%	µg/L	0.070	0.084	1,600	WAC 173-340-720(4)(b)(iii)(A) and (B)	4.38E-05
Ethyl methacrylate	VOC	3/18/2010	6/11/2010	104	0	0.00%	µg/L	0.11	0.11	720	WAC 173-340-720(4)(b)(iii)(A) and (B)	1.53E-04
Ethylbenzene	VOC	10/7/2009	6/11/2010	156	0	0.00%	µg/L	0.086	1.0	4.0	WAC 173-340-720(4)(b)(iii)(A) and (B)	2.16E-02
Isobutyl alcohol	VOC	3/18/2010	6/11/2010	104	0	0.00%	µg/L	8.7	8.7	2,400	WAC 173-340-720(4)(b)(iii)(A) and (B)	3.63E-03
Methacrylonitrile	VOC	3/18/2010	6/11/2010	104	0	0.00%	µg/L	0.050	0.50	0.80	WAC 173-340-720(4)(b)(iii)(A) and (B)	6.25E-02
Methyl methacrylate	VOC	3/18/2010	6/11/2010	104	0	0.00%	µg/L	0.26	0.26	11,200	WAC 173-340-720(4)(b)(iii)(A) and (B)	2.32E-05
Styrene	VOC	10/7/2009	6/11/2010	156	0	0.00%	µg/L	0.036	1.0	100	40 CFR 141 - Federal MCL	3.60E-04
trans-1,2-Dichloroethylene	VOC	10/7/2009	6/11/2010	156	0	0.00%	µg/L	0.083	1.0	100	40 CFR 141 - Federal MCL	8.30E-04
trans-1,3-Dichloropropene	VOC	10/7/2009	6/11/2010	156	0	0.00%	µg/L	0.083	1.0	0.34	Clean Water Act -- Human Health Water + Organism	2.44E-01
Trichloromonofluoromethane	VOC	3/18/2010	6/11/2010	104	0	0.00%	µg/L	0.041	0.11	2,400	WAC 173-340-720(4)(b)(iii)(A) and (B)	1.71E-05
Vinyl acetate	VOC	3/18/2010	6/11/2010	104	0	0.00%	µg/L	0.17	0.18	8,000	WAC 173-340-720(4)(b)(iii)(A) and (B)	2.13E-05
Vinyl chloride	VOC	10/7/2009	6/11/2010	156	0	0.00%	µg/L	0.032	1.0	0.025	Clean Water Act -- Human Health Water + Organism	1.28E+00

Note:
Shading indicates analyte is listed as a groundwater contaminant of potential concern in DOE/RL-2009-40, *Sampling and Analysis Plan for the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units Remedial Investigation/Feasibility Study*.

Table 7-4. Summary of Groundwater Analytes That Do Not Exceed an Action Level
100-HR-3 Operable Unit

Analyte Name	Analyte Class	Begin Sample Date	End Sample Date	Total Samples	Total Detects	Frequency of Detection	Units	Minimum Detection Limit	Maximum Detection Limit	Minimum Detected Result	Maximum Detected Result	Action Level	Action Level Basis
Chloride	ANION	10/7/2009	6/11/2010	156	156	100.00%	µg/L	--	--	3,960	44,900	230,000	Clean Water Act -- Freshwater CCC
Fluoride	ANION	10/7/2009	6/11/2010	156	63	40.38%	µg/L	60	300	60	343	960	WAC 173-340-720(4)(b)(iii)(A) and (B)
Nitrite	ANION	10/7/2009	6/11/2010	156	10	6.41%	µg/L	9.9	591	1,140	2,270	3,300	WAC 173-340-720(4)(b)(iii)(A) and (B)
Antimony	METAL	10/7/2009	6/11/2010	156	13	8.33%	µg/L	0.30	1.1	0.61	1.0	5.6	Clean Water Act -- Human Health Water + Organism
Barium	METAL	10/7/2009	6/11/2010	156	156	100.00%	µg/L	--	--	25	133	1,000	Clean Water Act -- Human Health Water + Organism
Beryllium	METAL	10/7/2009	6/11/2010	156	5	3.21%	µg/L	0.050	0.11	0.10	0.31	4.0	40 CFR 141 - Federal MCL
Boron	METAL	10/7/2009	6/11/2010	122	44	36.07%	µg/L	19	19	9.7	102	3,200	WAC 173-340-720(4)(b)(iii)(A) and (B)
Cadmium	METAL	10/7/2009	6/11/2010	156	2	1.28%	µg/L	0.055	0.20	0.11	0.22	0.25	Clean Water Act -- Freshwater CCC
Copper	METAL	10/7/2009	6/11/2010	156	104	66.67%	µg/L	0.10	0.20	0.10	2.8	9.0	Clean Water Act -- Freshwater CCC
Lead	METAL	10/7/2009	6/11/2010	156	23	14.74%	µg/L	0.10	0.20	0.20	0.71	2.1	WAC 173-201A
Molybdenum	METAL	10/7/2009	6/11/2010	122	115	94.26%	µg/L	4.0	4.0	0.56	12	80	WAC 173-340-720(4)(b)(iii)(A) and (B)
Nickel	METAL	10/7/2009	6/11/2010	156	33	21.15%	µg/L	4.0	4.0	2.4	39	52	Clean Water Act -- Freshwater CCC
Silver	METAL	10/7/2009	6/11/2010	156	6	3.85%	µg/L	0.040	0.20	0.13	1.00	2.6	WAC 173-201A
Strontium	METAL	10/7/2009	6/11/2010	156	156	100.00%	µg/L	--	--	138	938	9,600	WAC 173-340-720(4)(b)(iii)(A) and (B)
Tin	METAL	10/7/2009	6/11/2010	122	11	9.02%	µg/L	0.050	39	0.055	43	519	WAC 173-340-730(3)(b)(iii)(A) and (B)
Uranium	METAL	10/7/2009	6/11/2010	156	156	100.00%	µg/L	--	--	0.29	13	30	40 CFR 141 - Federal MCL
Vanadium	METAL	10/7/2009	6/11/2010	156	66	42.31%	µg/L	4.1	12	5.4	33	80	WAC 173-340-720(4)(b)(iii)(A) and (B)
Gross alpha	RAD	10/7/2009	6/11/2010	156	34	21.79%	pCi/L	-2.90E+00	11	2.0	7.9	15	40 CFR 141 - Federal MCL
Technetium-99	RAD	10/7/2009	6/11/2010	155	8	5.16%	pCi/L	-1.70E+01	3.6	7.9	35	900	40 CFR 141 - Federal MCL
Tritium	RAD	10/7/2009	6/11/2010	156	142	91.03%	pCi/L	-1.30E+01	170	180	12,000	20,000	40 CFR 141 - Federal MCL
2-Butanone	VOC	10/7/2009	6/11/2010	156	1	0.64%	µg/L	0.52	1.0	10	10	4,800	WAC 173-340-720(4)(b)(iii)(A) and (B)
Acetone	VOC	10/7/2009	6/11/2010	156	2	1.28%	µg/L	0.34	1.0	0.82	6.9	7,200	WAC 173-340-720(4)(b)(iii)(A) and (B)
Bromoform	VOC	10/7/2009	6/11/2010	156	1	0.64%	µg/L	0.094	1.0	0.58	0.58	4.3	Clean Water Act -- Human Health Water + Organism
Bromomethane	VOC	10/7/2009	6/11/2010	156	1	0.64%	µg/L	0.084	1.0	0.97	0.97	11	WAC 173-340-720(4)(b)(iii)(A) and (B)
Carbon disulfide	VOC	10/7/2009	6/11/2010	156	1	0.64%	µg/L	0.050	1.0	0.076	0.076	800	WAC 173-340-720(4)(b)(iii)(A) and (B)
Toluene	VOC	10/7/2009	6/11/2010	156	3	1.92%	µg/L	0.062	1.0	0.062	0.18	640	WAC 173-340-720(4)(b)(iii)(A) and (B)
Trichloroethene	VOC	10/7/2009	6/11/2010	156	3	1.92%	µg/L	0.21	1.0	0.26	0.33	0.49	WAC 173-340-720(4)(b)(iii)(A) and (B)
Xylenes (total)	VOC	10/7/2009	6/11/2010	156	2	1.28%	µg/L	0.11	1.0	0.44	0.46	1,600	WAC 173-340-720(4)(b)(iii)(A) and (B)

Note:
Shading indicates analyte is listed as a groundwater contaminant of potential concern in DOE/RL-2009-40, *Sampling and Analysis Plan for the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units Remedial Investigation/Feasibility Study* .

Table 7-6. Summary of Groundwater Analytes That Exceed an Action Level
100-HR-3 Operable Unit

Analyte Name	Analyte Class	Begin Sample Date	End Sample Date	Total Samples	Total Detects	Frequency of Detection	Units	Minimum Detection Limit	Maximum Detection Limit	Minimum Detected Result	Maximum Detected Result	Action Level	Action Level Basis
Nitrate	ANION	10/7/2009	6/11/2010	155	156	100.00%	µg/L	--	--	7,880	99,200	45,000	WAC 173-340-720(4)(b)(iii)(A) and (B)
Sulfate	ANION	10/7/2009	6/11/2010	156	156	100.00%	µg/L	--	--	24,900	438,000	250,000	40 CFR 141 - Federal MCL
Aluminum	METAL	10/7/2009	6/11/2010	156	65	41.67%	µg/L	5.0	10	5.4	188	50	40 CFR 141 - Federal MCL
Arsenic	METAL	10/7/2009	6/11/2010	156	147	94.23%	µg/L	0.40	0.80	0.61	7.5	0.018	Clean Water Act -- Human Health Water + Organism
Chromium	METAL	10/7/2009	6/11/2010	156	156	100.00%	µg/L	--	--	5.6	4,460	65	Clean Water Act -- Freshwater CCC
Cobalt	METAL	10/7/2009	6/11/2010	156	44	28.21%	µg/L	0.050	0.22	0.062	3.0	2.6	WAC 173-340-730(3)(b)(iii)(A) and (B)
Hexavalent Chromium	METAL	10/7/2009	6/11/2010	156	144	92.31%	µg/L	2.0	2.0	2.6	6,390	10	40 CFR 131 -- Freshwater CCC
Iron	METAL	10/7/2009	6/11/2010	156	110	70.51%	µg/L	18	18	17	7,840	300	40 CFR 141 - Federal MCL
Lithium	METAL	10/7/2009	6/11/2010	122	102	83.61%	µg/L	4.0	4.0	2.6	133	32	WAC 173-340-720(4)(b)(iii)(A) and (B)
Manganese	METAL	10/7/2009	6/11/2010	156	24	15.38%	µg/L	3.3	4.0	0.60	122	50	40 CFR 141 - Federal MCL
Mercury	METAL	10/7/2009	6/11/2010	156	1	0.64%	µg/L	0.050	0.10	0.11	0.11	0.012	40 CFR 131 -- Freshwater CCC
Selenium	METAL	10/7/2009	6/11/2010	156	150	96.15%	µg/L	0.60	0.60	0.38	7.1	5.0	Clean Water Act -- Freshwater CCC
Thallium	METAL	10/7/2009	6/11/2010	156	6	3.85%	µg/L	0.050	0.10	0.10	1.0	0.24	Clean Water Act -- Human Health Water + Organism
Zinc	METAL	10/7/2009	6/11/2010	156	36	23.08%	µg/L	5.2	6.0	0.90	260	91	WAC 173-201A
Strontium-90	RAD	10/7/2009	6/11/2010	156	19	12.18%	pCi/L	-1.40E+01	2.6	2.2	27	8.0	40 CFR 141 - Federal MCL
1,2-Dichloroethane	VOC	10/7/2009	6/11/2010	156	1	0.64%	µg/L	0.10	1.0	0.67	0.67	0.38	Clean Water Act -- Human Health Water + Organism
Bromodichloromethane	VOC	10/7/2009	6/11/2010	156	2	1.28%	µg/L	0.082	1.0	0.67	0.68	0.27	40 CFR 131 -- Human Health Water + Organism
Carbon tetrachloride	VOC	10/7/2009	6/11/2010	156	14	8.97%	µg/L	0.063	1.0	0.088	2.7	0.23	Clean Water Act -- Human Health Water + Organism
Chloroform	VOC	10/7/2009	6/11/2010	156	113	72.44%	µg/L	0.10	1.0	0.12	8.3	1.4	WAC 173-340-720(4)(b)(iii)(A) and (B)
Methylene chloride	VOC	10/7/2009	6/11/2010	156	18	11.54%	µg/L	0.11	1.0	0.12	11	4.6	Clean Water Act -- Human Health Water + Organism
Tetrachloroethene	VOC	10/7/2009	6/11/2010	156	8	5.13%	µg/L	0.088	1.0	0.093	0.43	0.081	WAC 173-340-720(4)(b)(iii)(A) and (B)

Note:
Shading indicates analyte is listed as a groundwater contaminant of potential concern in DOE/RL-2009-40, *Sampling and Analysis Plan for the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units Remedial Investigation/Feasibility Study.*

Table 7-8. Exposure Point Concentration Summary for the 100-D Source Exposure Area
100-HR-3 Operable Unit

Analyte Name	Analyte Class	Total Number of Samples	Number of Detects	Frequency of Detection	Units	Minimum Detection Limit	Maximum Detection Limit	Minimum Detected Result	Maximum Detected Result	90th Percentile	Action Level	Action Level Basis	90th Percentile > Action Level?	Level of Exceedence
Nitrate	ANION	60	60	100.00%	µg/L	--	--	10,800	99,200	69,500	45,000	40 CFR 141 - Federal MCL	Yes	1.54E+00
Sulfate	ANION	60	60	100.00%	µg/L	--	--	24,900	438,000	161,500	250,000	40 CFR 141 - Federal MCL	No	6.46E-01
Aluminum	METAL	60	19	31.67%	µg/L	5	10	5.9	42	24	50	40 CFR 141 - Federal MCL	No	4.87E-01
Arsenic	METAL	60	56	93.33%	µg/L	0.8	0.8	0.61	2.9	2.6	0.018	Clean Water Act -- Human Health Water + Organism	Yes	1.43E+02
Chromium	METAL	60	60	100.00%	µg/L	--	--	7.7	4,460	925	65	Clean Water Act -- Freshwater CCC	Yes	1.42E+01
Cobalt	METAL	60	23	38.33%	µg/L	0.05	0.22	0.099	3.0	1.3	2.6	WAC 173-340-730(3)(b)(iii)(A) and (B)	No	5.13E-01
Hexavalent Chromium	METAL	60	60	100.00%	µg/L	--	--	7.9	6,390	992	10	40 CFR 131 -- Freshwater CCC	Yes	9.92E+01
Iron	METAL	60	39	65.00%	µg/L	18	18	22	265	106	300	40 CFR 141 - Federal MCL	No	3.55E-01
Lithium	METAL	47	42	89.36%	µg/L	4	4	4.3	133	21	32	WAC 173-340-720(4)(b)(iii)(A) and (B)	No	6.48E-01
Manganese	METAL	60	3	5.00%	µg/L	3.3	4	5.5	47.0	4.0	50	40 CFR 141 - Federal MCL	No	8.00E-02
Selenium	METAL	60	56	93.33%	µg/L	0.6	0.6	0.38	6.5	4.4	5.0	Clean Water Act -- Freshwater CCC	No	8.76E-01
Thallium	METAL	60	4	6.67%	µg/L	0.05	0.1	0.12	1.0	0.10	0.24	Clean Water Act -- Human Health Water + Organism	No	4.17E-01
Zinc	METAL	60	18	30.00%	µg/L	5.2	6	6.4	260	34	91	WAC 173-201A	No	3.77E-01
Strontium-90	RAD	60	3	5.00%	pCi/L	-14	2.4	2.3	3.7	0.67	8.0	40 CFR 141 - Federal MCL	No	8.31E-02
Bromodichloromethane	VOC	60	2	3.33%	µg/L	0.082	1	0.67	0.68	1.0	0.27	40 CFR 131 -- Human Health Water + Organism	Yes	3.70E+00
Carbon tetrachloride	VOC	60	2	3.33%	µg/L	0.063	1	2.6	2.7	1.0	0.23	Clean Water Act -- Human Health Water + Organism	Yes	4.35E+00
Chloroform	VOC	60	50	83.33%	µg/L	1	1	0.12	8.3	5.1	1.4	WAC 173-340-720(4)(b)(iii)(A) and (B)	Yes	3.62E+00
Methylene chloride	VOC	60	6	10.00%	µg/L	0.11	1	0.16	0.27	1.0	4.6	Clean Water Act -- Human Health Water + Organism	No	2.17E-01
Tetrachloroethene	VOC	60	1	1.67%	µg/L	0.088	1	0.14	0.14	1.0	0.081	WAC 173-340-720(4)(b)(iii)(A) and (B)	Yes	1.23E+01

Table 7-9. Exposure Point Concentration Summary for the 100-H Source Exposure Area
100-HR-3 Operable Unit

Analyte Name	Analyte Class	Total Number of Samples	Number of Detects	Frequency of Detection	Units	Minimum Detection Limit	Maximum Detection Limit	Minimum Detected Result	Maximum Detected Result	90th Percentile	Action Level	Action Level Basis	90th Percentile > Action Level?	Level of Exceedence
Nitrate	ANION	38	38	100.00%	µg/L	--	--	16,700	46,900	39,800	45,000	40 CFR 141 - Federal MCL	No	8.84E-01
Sulfate	ANION	39	39	100.00%	µg/L	--	--	38,000	88,700	79,700	250,000	40 CFR 141 - Federal MCL	No	3.19E-01
Aluminum	METAL	39	13	33.33%	µg/L	10	10	6.1	188	41	50	40 CFR 141 - Federal MCL	No	8.26E-01
Arsenic	METAL	39	39	100.00%	µg/L	--	--	1.4	3.7	3.3	0.018	Clean Water Act -- Human Health Water + Organism	Yes	1.84E+02
Chromium	METAL	39	39	100.00%	µg/L	--	--	7.3	39	31	65	Clean Water Act -- Freshwater CCC	No	4.75E-01
Cobalt	METAL	39	16	41.03%	µg/L	0.050	0.10	0.062	0.90	0.43	2.6	WAC 173-340-730(3)(b)(iii)(A) and (B)	No	1.64E-01
Hexavalent Chromium	METAL	39	34	87.18%	µg/L	2.0	2.0	2.6	29	26	10	40 CFR 131 -- Freshwater CCC	Yes	2.55E+00
Iron	METAL	39	29	74.36%	µg/L	18	18	17	7,840	444	300	40 CFR 141 - Federal MCL	Yes	1.48E+00
Lithium	METAL	32	27	84.38%	µg/L	4.0	4.0	4.4	23	14	32	WAC 173-340-720(4)(b)(iii)(A) and (B)	No	4.48E-01
Manganese	METAL	39	8	20.51%	µg/L	4.0	4.0	12	120	35	50	40 CFR 141 - Federal MCL	No	7.06E-01
Mercury	METAL	39	1	2.56%	µg/L	0.050	0.10	0.11	0.11	0.10	0.012	40 CFR 131 -- Freshwater CCC	Yes	8.33E+00
Selenium	METAL	39	38	97.44%	µg/L	0.60	0.60	0.83	3.2	2.7	5.0	Clean Water Act -- Freshwater CCC	No	5.40E-01
Thallium	METAL	39	2	5.13%	µg/L	0.050	0.10	0.10	0.28	0.10	0.24	Clean Water Act -- Human Health Water + Organism	No	4.17E-01
Zinc	METAL	39	9	23.08%	µg/L	6.0	6.0	2.8	30	16	91	WAC 173-201A	No	1.76E-01
Strontium-90	RAD	39	12	30.77%	pCi/L	-7.80E+00	2.6	3.2	27	14	8.0	40 CFR 141 - Federal MCL	Yes	1.75E+00
Carbon tetrachloride	VOC	39	2	5.13%	µg/L	0.063	1.0	0.088	2.0	1.0	0.23	Clean Water Act -- Human Health Water + Organism	Yes	4.35E+00
Chloroform	VOC	39	31	79.49%	µg/L	1.0	1.0	0.55	1.7	1.4	1.4	WAC 173-340-720(4)(b)(iii)(A) and (B)	No	9.93E-01
Methylene chloride	VOC	39	5	12.82%	µg/L	0.11	1.0	0.13	11	1.0	4.6	Clean Water Act -- Human Health Water + Organism	No	2.17E-01

Table 7-10. Exposure Point Concentration Summary for the Horn Exposure Area
100-HR-3 Operable Unit

Analyte Name	Analyte Class	Total Number of Samples	Number of Detects	Frequency of Detection	Units	Minimum Detection Limit	Maximum Detection Limit	Minimum Detected Result	Maximum Detected Result	90th Percentile	Action Level	Action Level Basis	90th Percentile > Action Level?	Level of Exceedence
Nitrate	ANION	57	57	100.00%	µg/L	--	--	7,880	33,900	29,550	45,000	40 CFR 141 - Federal MCL	No	6.57E-01
Sulfate	ANION	57	57	100.00%	µg/L	--	--	30,000	97,300	78,350	250,000	40 CFR 141 - Federal MCL	No	3.13E-01
Aluminum	METAL	57	33	57.89%	µg/L	5	10	5.4	150	54	50	40 CFR 141 - Federal MCL	Yes	1.09E+00
Arsenic	METAL	57	52	91.23%	µg/L	0.4	0.8	0.6	7.5	5.5	0.018	Clean Water Act -- Human Health Water + Organism	Yes	3.05E+02
Chromium	METAL	57	57	100.00%	µg/L	--	--	6	88	76	65	Clean Water Act -- Freshwater CCC	Yes	1.18E+00
Cobalt	METAL	57	5	8.77%	µg/L	0.05	0.10	0.07	0.21	0.10	2.6	WAC 173-340-730(3)(b)(iii)(A) and (B)	No	3.86E-02
Hexavalent Chromium	METAL	57	50	87.72%	µg/L	2	2	4	90	71	10	40 CFR 131 -- Freshwater CCC	Yes	7.13E+00
Iron	METAL	57	42	73.68%	µg/L	18	18	18	2490	422	300	40 CFR 141 - Federal MCL	Yes	1.41E+00
Lithium	METAL	43	33	76.74%	µg/L	4	4	3	16	12	32	WAC 173-340-720(4)(b)(iii)(A) and (B)	No	3.83E-01
Manganese	METAL	57	13	22.81%	µg/L	4	4	1	122	11	50	40 CFR 141 - Federal MCL	No	2.28E-01
Selenium	METAL	57	56	98.25%	µg/L	0.6	0.6	0.9	7.1	3.2	5.0	Clean Water Act -- Freshwater CCC	No	6.45E-01
Zinc	METAL	57	9	15.79%	µg/L	1	6	6	46	12	91	WAC 173-201A	No	1.32E-01
Strontium-90	RAD	57	4	7.02%	pCi/L	-9.70	1.00	2.20	4.20	0.90	8.0	40 CFR 141 - Federal MCL	No	1.13E-01
1,2-Dichloroethane	VOC	57	1	1.75%	µg/L	0.1	1.0	0.7	0.7	1.0	0.38	Clean Water Act -- Human Health Water + Organism	Yes	2.63E+00
Carbon tetrachloride	VOC	57	10	17.54%	µg/L	0.1	1.0	0.2	1.7	1.3	0.23	Clean Water Act -- Human Health Water + Organism	Yes	5.65E+00
Chloroform	VOC	57	32	56.14%	µg/L	0.1	1.0	0.2	1.0	1.0	1.4	WAC 173-340-720(4)(b)(iii)(A) and (B)	No	7.09E-01
Methylene chloride	VOC	57	7	12.28%	µg/L	0.1	1.0	0.1	0.6	1.0	4.6	Clean Water Act -- Human Health Water + Organism	No	2.17E-01
Tetrachloroethene	VOC	57	7	12.28%	µg/L	0.1	1.0	0.1	0.4	1.0	0.081	WAC 173-340-720(4)(b)(iii)(A) and (B)	Yes	1.23E+01

Table 7-16. Monitoring Well Locations Reported with Concentrations of COPCs Greater Than Action Level for the 100-HR-3 Operable Unit 100-D Source Exposure Area

Final COPC	Chloroform	Chromium	Hexavalent chromium	Nitrate	Sulfate	Zinc
Action Level	1.4 µg/L	65 µg/L	10 µg/L	45,000 µg/L	250,000 µg/L	91 µg/L
199-D2-11	X					
199-D2-6			X	X		
199-D4-23			X			
199-D4-84	X	X	X		X	X
199-D5-13	X	X	X			
199-D5-14	X	X	X	X		
199-D5-15	X	X	X	X		
199-D5-16	X	X	X	X		
199-D5-17			X	X		
199-D5-18			X	X		
199-D5-19				X		
199-D5-37	X		X			
199-D5-38	X	X	X			
199-D5-43		X	X			
199-D5-99	X	X	X			
199-D8-5	X	X	X	X		
199-D8-55		X	X			
199-D8-70		X	X			
199-D8-71		X	X	X		
199-D8-88	X	X	X			

Table 7-17. Monitoring Well Locations Reported with Concentrations of COPCs Greater Than Action Level for the 100-HR-3 Operable Unit 100-H Source Exposure Area

Final COPC	Hexavalent chromium	Strontium-90
Action Level	10 µg/L	8 pCi/L
199-H3-2A	X	
199-H4-10	X	
199-H4-11	X	X
199-H4-13	X	X
199-H4-16		
199-H4-3		
199-H4-45	X	X
199-H4-46	X	
199-H4-48	X	
199-H4-5		
199-H4-6		
199-H4-9	X	
199-H6-1	X	

Table 7-18. Monitoring Well Locations Reported with Concentrations of COPCs Greater Than Action Level for the 100-HR-3 Operable Unit Horn Exposure Area

Final COPC	Carbon tetrachloride	Chromium	Hexavalent chromium
Action Level	0.23 µg/L	65 µg/L	10 µg/L
199-H3-4			X
199-H3-5		X	X
199-H5-1A			X
699-101-45			X
699-87-55			X
699-90-45			
699-93-48A			
699-94-41			X
699-94-43	X		X
699-95-45	X		X
699-95-48	X		X
699-95-51	X		X
699-96-52B	X		X
699-97-41	X	X	X
699-97-45			X
699-97-48B	X		X
699-98-43	X	X	X
699-98-49A	X		
699-98-51			X