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Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

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19-AMRP-0024

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Ms. Alexandra K. Smith, Program Manager
Nuclear Waste Program
Washington State Department of Ecology
3100 Port of Benton Boulevard
Richland, Washington 99354

Dear Ms. Smith:

SUBMITTAL OF INFORMATION TO SUPPORT CLEAN CLOSURE AND REMOVAL OF 1301-N AND 1325-N DANGEROUS WASTE MANANAGEMENT UNITS FROM THE HANFORD FACILITY DANGEROUS WASTE PERMIT

References:

1239453 (1) Ecology ltr. to M.W. Cline, RL from N. M. Menard, "Re: Path Forward to Complete Closure of the 1324-N, 1324-NA, 1301-N, and 1325-N Dangerous Waste Management Units (DWMU) from the Hanford Facility Resource Conservation and Recovery Act Permit, Dangerous Waste Permit, Revision 8C (Site-wide Permit)," 16-NWP-122, dtd. July 15, 2016.

1228828 (2) RL ltr. to J. A. Hedges, Ecology, from S. L. Charboneau, "Certification of Closure of the 1301-N/116-N-1 Liquid Waste Disposal Facility," 15-AMRP-0088, dtd. February 24, 2015.

0084189 (3) RL ltr. to M. Wilson, Ecology, from K. A. Klein, "Certification of Closure for the 1325-N Liquid Waste Disposal Facility," 05-AMRC-0214, dtd. April 19, 2005.

In reference to the Washington State Department of Ecology's (Ecology) letter (16-NWP-122) dated July 15, 2016, the U.S. Department of Energy Richland Operations Office (RL) is transmitting the white paper for the 1301-N and 1325-N Dangerous Waste Management Units.

This transmittal includes the following attachment:

- 1301-N and 1325-N Dangerous Waste Management Units; 100-N Area White Paper, CHPRC-03882, Revision 0.

The white paper presents the additional data collected from the remedial investigation wells in deep zone soils at 1301-N and 1325-N Liquid Waste Disposal Facilities (LWDFs). It also presents groundwater monitoring data from the investigation wells. RL believes that this

information, in addition to information already provided for certification of closure for these two DWMUs (15-AMRP-0088 and 05-AMRC-0214), confirms that clean closure of the 1301-N and 1325-N LWDFs is complete.

RL requests that Ecology accepts the closure certification for these DWMUs and completes closure actions. This will allow clean closure and removal of the DWMUs from the Hanford Facility Resource Conservation and Recovery Act (RCRA) Permit, Dangerous Waste Portion for the Treatment, Storage, and Disposal of Dangerous Waste, Revision 8C.

If you have any questions please contact me, or your staff may contact Bill Hamel, Assistant Manager for the River and Plateau, on (509) 373-9971.

Sincerely,

Joel R. Freeman for
Doug S. Shoop
Manager

AMRP:DBC

Attachment

cc w/attach:
D. B. Bartus, EPA
J. Bell, NPT
R. Buck, Wanapum
L. Contreras, YN
L. J. Cusack, CHPRC
S. L. Dahl-Crumpler, Ecology
D. R. Einan, EPA
M. T. Gillespie, CHPRC
M. N. Jaraysi, CHPRC
M. Johnson, CTUIR
D. Rowland, YN
N. M. Menard, Ecology
D. G. Singleton, CHPRC
Administrative Record, (TSD: D-1-2)
Ecology NWP Library
Environmental Portal
HF Operating Record (J. K. Perry, MSA)

CHPRC-03882
Revision 0

1301-N and 1325-N Dangerous Waste Management Units

100-N Area White Paper

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

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

CH2MHILL
Plateau Remediation Company

P.O. Box 1600
Richland, Washington 99352

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CHPRC-03882
Revision 0

1301-N and 1325-N Dangerous Waste Management Units

100-N Area White Paper

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A. K. Lee
CH2M HILL Plateau Remediation Company

K. M. Singleton
CH2M HILL Plateau Remediation Company

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

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

CH2MHILL
Plateau Remediation Company
P.O. Box 1600
Richland, Washington 99352

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Terms

COC	contaminant of concern
COPC	contaminant of potential concern
CVP	cleanup verification package
DWMU	dangerous waste management unit
Ecology	Washington State Department of Ecology
ERDF	Environmental Restoration Disposal Facility
LWDF	liquid waste disposal facility
RCRA	*Resource Conservation and Recovery Act of 1980*
RD/RAWP	remedial design/remedial action work plan
ROD	Record of Decision

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1 Introduction

The 1301-N and 1325-N Liquid Waste Disposal Facilities (LWDFs) are dangerous waste management units (DWMUs) located within the Hanford Site 100-N Area near Richland, Washington.
The U.S. Department of Energy has completed coordinated response actions at the two facilities in accordance with DOE/RL-96-39, *100-NR-1 Treatment, Storage, and Disposal Units Corrective Measures Study/Closure Plan* (hereinafter referred to as the corrective measures study [CMS]/closure plan); and EPA/ROD/R/10-00/120, *Interim Remedial Action Record of Decision for the 100-NR-1 Operable Unit, Hanford Site, Benton County, Washington*, and amendments. DOE/RL-2000-16, *Remedial Design Report/Remedial Action Work Plan for the 100-NR-1 Treatment, Storage, and Disposal Units* (hereinafter referred to as the remedial design report/remedial action work plan [100-NR-1 RD/RAWP]), was prepared to describe the design and implementation of the remedial actions required by the 100-NR-1 OU interim action Record of Decision (ROD) and the corrective measures study/closure plan. Closure certifications have been submitted for each of these units.

A *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* remedial investigation/feasibility study was conducted to prepare the final Record of Decision (ROD) for the 100-NR-1 Source and 100-NR-2 Groundwater Operable Units. DOE/RL-2012-15, Draft A, *Remedial Investigation/Feasibility Study for the 100-NR-1 and 100-NR-2 Operable Units*, issued in June 2013, includes the results of data collected from boreholes located in the 1301-N and 1325-N DWMUs. Revision 0 of the remedial investigation/feasibility study is currently being prepared.

In 16-NWP-122, "Path Forward to Complete Closure of the 1324-N, 1324-NA, 1301-N and 1325-N Dangerous Waste Management Units (DWMU) from the *Hanford Facility Resource Conservation and Recovery Act Permit, Dangerous Waste Permit, Revision 8C* (Site-wide Permit)," dated July 15, 2016, the Washington State Department of Ecology (Ecology) stated that the additional data collected from the remedial investigation wells at 1301-N and 1325-N LWDFs provide information on hexavalent chromium in deep zone soils. The results indicated that these two DWMUs could be clean closed. Ecology proposed that a Class 2 Permit modification be submitted to modify the closure plan to describe the additional work that was conducted as part of the remedial investigation.

This document presents the additional metals characterization information collected from the 1301-N and 1325-N remedial investigation wells to support that clean closure has been met for these units and would support removal of the units from WA7890008967, *Hanford Facility Resource Conservation and Recovery Act (RCRA) Permit, Dangerous Waste Portion for the Treatment, Storage, and Disposal of Dangerous Waste*, Revision 8C.

2 Site Background

DWMU 1301-N is a combination of a large crib, a trench, and associated pipelines that received radiologically and chemically contaminated water from N Reactor. The effluent (average flow rate of 5,680 L/min [1,500 gal/min]) contained activation and fission products, as well as small quantities of corrosive liquids and laboratory chemicals. The crib began operating in 1963, and the trench was added in 1965 to enhance percolation capacity. The 1301-N unit was in use until 1985.

DWMU 1325-N is a large crib and trench system constructed between 1983 and 1985 to replace the 1301-N Crib and Trench. It received radiologically and chemically contaminated water from N Reactor late in the reactor's operational campaign. The facility was located approximately twice the distance from the river as 1301-N. The 1325-N unit was in use until 1991.

3 1301-N Closure Activities

Cleanup and closure of 1301-N was performed as a coordinated response action in accordance with the 100-NR-1 OU interim action ROD (EPA/ROD/R/10-00/120); the CMS/closure plan (DOE/RL-96-39); and EPA/ROD/R10-99/112, *Interim Remedial Action Record of Decision for the 100-NR-1 and 100-NR-2 Operable Units, Hanford Site, Benton County, Washington*. It included remediation of the crib and trench (waste site 116-N-1) and associated pipeline (waste sites 100-N-63:1 and 100-N-63:2). Remediation of the crib and trench began in April 2002 and was completed in October 2005. Remedial action at the site achieved the interim action ROD remedial action objectives and remedial action goals for soils (CVP-2006-00004, *Cleanup Verification Package for the Soil Column of the 116-N-1 Crib and Trench*). The acceptability of unrestricted direct exposure to deep zone soils (i.e., below 4.6 m [15 ft]) was demonstrated for nonradionuclide contaminants of concern (COCs) but was not demonstrated for radionuclides; therefore, institutional controls are required to prevent uncontrolled drilling or excavation into the deep zone. Institutional controls to prevent irrigation are also required due to residual radiological contamination in the deep zone. Regulatory approval of the cleanup for interim closure is documented in WSRF 2006-018, *Waste Site Reclassification Form*, Operable Unit 100-NR-1, Waste Site ID 116-N-1.

The certification of closure for 1301-N required by WAC 173-303-610(6), "Dangerous Waste Regulations," "Closure and Post-Closure," was submitted to Ecology on February 26, 2015, and provided the owner/operator and co-operator certifications, which included those for the 1301-N Crib and Trench and piping, deferred pipeline segments (100-N-63:2), backfill and revegetation, and recorded notice in deed.

The certification of closure and certification of recording and notice in deed, required by the *Resource Conservation and Recovery Act of 1976* (RCRA) to close the site, are documented in 15-AMRP-0088, "Certification of Closure of the 1301-N/116-N-1 Liquid Waste Disposal Facility"; and 15-AMRP-0129, "Transmittal of the 1301-N Surface Impoundment Certification of Recording and Notice in Deed."

4 1325-N Closure Activities

As with the 1301-N DWMU, cleanup and closure of 1325-N (designated waste site 116-N-3 with associated pipeline waste site 100-N-63:1) was performed as a coordinated response action in accordance with the CMS/closure plan (DOE/RL-96-39) and the 100-NR-1 RD/RAWP (DOE/RL-2000-16). Cleanup for 1325-N began in July 2000 and was completed in December 2001. Remedial action at the site achieved the remedial action objectives and remedial action goals in the interim action ROD for soils (CVP-2002-00002, *Cleanup Verification Package/Clean Closure Report for the Soil Column of the 116-N-3 Trench and 100-N-63:1 Pipeline*). Acceptability of unrestricted access to deep zone soils (below 4.6 m [15 ft]) was demonstrated for nonradionuclide COCs but was not demonstrated for radionuclides; therefore, institutional controls are required to prevent uncontrolled drilling or excavation.

Regulatory approval of the cleanup efforts for interim closure is documented on WSRF 2002-055, *Waste Site Reclassification Form*, Operable Unit 100-NR-1, Waste Site ID 100-N-3 Trench, Crib, and 100-N-63:1 Pipeline. The certification of closure (05-AMRC--214, "Certification of Closure for the 1325-N Liquid Waste Disposal Facility") and certification of recording the notice in deed (05-AMRC-246, "Transmittal of the 1325-N Liquid Waste Disposal Facility Survey Plat") required by RCRA were submitted to Ecology on April 19 and April 25, 2005, respectively.

The independent qualified registered professional engineer report submitted with the certification of closure (05-AMRC-0214) describes the RCRA closure activities performed in accordance with the CMS/closure plan (DOE/RL-96-39) and the RDR/RAWP (DOE/RL-2000-16). The activities in the independent qualified registered professional engineer report are summarized below:

- **Removal of structures:** Crib, trench, and piping structures; fencing fabric and pipe material from 100-N-63:1 (associated pipelines of 1325-N); wire cables; and concrete panels were removed during site remediation. Contaminated materials were size reduced and disposed at the Environmental Restoration Disposal Facility (ERDF). Uncontaminated fence posts were placed it the crib as fill, and uncontaminated concrete panels from the clear side of the trench (broken into rubble) were placed in the trench as fill, which was an activity approved by Ecology.

- **Evaluation of soil data:** A soil investigation conducted at the site in accordance with the CMS/closure plan (DOE/RL-96-39) indicated that the site required soil remediation. In accordance with the CMS/closure plan, a sampling and analysis plan was developed for the site. As described in the closeout verification package (CVP) (CVP-2002-00002), analysis and further evaluation of the contaminants indicated that the closure plan performance standards were met through remediation.

- **Waste management:** Demolition debris removed from 1325-N included solid wastes in the crib and trench, demolished concrete and wire cables, and pipe material. This debris was disposed as contaminated waste at ERDF.

- **Site restoration:** Project personnel confirmed by email that the backfill of the site is complete, which was verified by a site walkdown. Backfill consisted of grading the site to match the adjacent existing grade. Revegetation of the site will be completed in the future.

- **Cleanup verification package:** Tables 4, 5 and 6 of the CVP (CVP-2002-00002) show that the sample results demonstrate closure performance standards, and applicable cleanup levels have been met.

Cleanup verification sampling was conducted in accordance with DOE/RL-2000-07, *Sampling and Analysis Plan for the 100-NR-1 Treatment, Storage, and Disposal Units During Remediation and Closeout*. The COCs identified in the 100-NR-1 OU interim ROD (EPA/ROD/R-10-00/120) were modified in accordance with the data quality objective process (BHI-01293, *Data Quality Objectives Summary Report for the 100-NR-1 Treatment, Storage, and Disposal Units*).

Additional soil sampling and analysis (i.e., in-process) was conducted prior to cleanup verification sampling during site remediation. Arsenic, barium, chromium, lead and selenium were common contaminants of potential concern (COPCs) in the in-process data set. Consistent with implementing the observational approach of characterizing during excavation/remediation, these metals were screened out and were not included in the final cleanup verification data set. The final nonradiological COCs identified for verification sampling were nitrate and mercury. Ecology approval of the approach and verification data set is provided on WSRF 2002-055. Cleanup verification sampling indicated that the cleanup performance standards were met for nitrate and mercury (CVP-2002-00002). Additional soil sampling (split samples) was also performed by Ecology. To date, the split samples have not been provided to the project.

5 1301-N and 1325-N Remedial Investigation

Remedial investigation drilled three boreholes to assess groundwater protection beneath remediated waste sites at the 1301-N Crib and Trench and the 1325-N Crib. Wells 199-N-186 and 199-N-187 were drilled at 1301-N, and well 199-N-188 was drilled at 1325-N. Four characterization boreholes (199-N-182, 199-N-183, 199-N-184, and 199-N-185) were also drilled downgradient of 1301-N to assess the nature and extent of contamination in the unconfined aquifer above cleanup standards.

Table 1 lists the contaminants potentially impacting groundwater from 1301-N and 1325-N identified in the CMS/closure plan (DOE/RL-96-39). Other COPCs identified by Ecology to support the assessment of groundwater protection beneath the remediated waste sites include arsenic, barium, lead, selenium, and silver. Cleanup levels for the COPCs identified in DOE/RL-2005-93, *Remedial Design Report/Remedial Action Work Plan for the 100-N Area* (hereinafter referred to as the 100-N Area RD/RAWP), that are applicable to the soils for the 116-N-1[1] Crib and Trench and 116-N-3[2] Crib and Trench are presented in Table 2. Table 3 identifies the drinking water criteria for the metals. The 90th percentile background concentrations for the metals developed for the Hanford Site (DOE/RL-92-24, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*; and DOE/RL-96-61, *Hanford Site Background: Part 3, Groundwater Background*) are included in Tables 2 and 3.

Seven characterization boreholes were completed as monitoring wells. Figure 1 shows the locations of wells installed during the remedial investigation. With the exception of well 199-N-182 (i.e., vadose zone samples were not collected), the wells were drilled across the unsaturated thickness of the vadose zone to provide contaminant source data. Well 199-N-182 was drilled next to well 199-N-184 to monitor the lower and upper portions of the unconfined aquifer, respectively. Therefore, samples were only collected in the unsaturated vadose zone thickness from the well 199-N-184 boring. After the source investigation was completed, groundwater well construction and monitoring was initiated. Analytical results for the COPCs identified in Table 2 from the borehole soil samples are presented in the following sections and are compared to the cleanup levels for direct contact and protection of groundwater and surface water (i.e., the Columbia River).

Table 1. List of Contaminants at 116-N-1/116-N-3 Subsurface Soils

116-N-1	116-N-3
Cadmium	Cadmium
Chromium	Lead
Lead	Mercury
Mercury	

Source: DOE/RL-96-39, *100-NR-1 Treatment, Storage, and Disposal Units Corrective Measures Study/Closure Plan*, Table 2-9.

[1] Waste site 116-N-1 is the crib and trench portion of the 1301-N TSD unit.

[2] Waste site 116-N-3 is the crib and trench portion of the 1325-N TSD unit.

Table 2. Interim Action Soil Cleanup Levels

TSD Unit	Contaminant	90th Percentile Background (mg/kg)*	Direct Exposure (mg/kg)	Groundwater Protection (mg/kg)	Columbia River Protection (mg/kg)
1301-N and 1325-N	Arsenic	6.47	6.5	6.5	6.5
1301-N and 1325-N	Barium	132	16,000	200	400
1301-N and 1325-N	Cadmium	0.563	13.9	0.81	0.81
1301-N	Hexavalent chromium	—	2.1	4.8	2
1301-N and 1325-N	Lead	10.2	353	10.2	10.2
1301-N and 1325-N	Mercury	0.013	24	0.33	0.33
1301-N and 1325-N	Selenium	0.78	400	5	1
1301-N and 1325-N	Silver	0.167	400	8	0.73

Source: DOE/RL-2005-93, *Remedial Design Report/Remedial Action Work Plan for the 100-N Area*, Table 2-1.

*The 90th percentile background is from DOE/RL-92-24, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes.*

TSD = treatment, storage, and disposal

Table 3. Drinking Water Criteria for Identified Metals

Contaminant	90th Percentile Background (µg/L)*	Standard (µg/L)	Basis for Standard
Arsenic	7.9	0.058	40 CFR 141 – federal MCL
Barium	105	2000	40 CFR 141 – federal MCL
Cadmium	0.92	5	40 CFR 141 – federal MCL
Hexavalent chromium	—	48	WAC 173-340-720(4)(b)(iii)(A) and (B)
Lead	0.92	15	40 CFR 141 – federal MCL
Mercury	0.003	2	40 CFR 141 – federal MCL
Selenium	11	50	40 CFR 141 – federal MCL
Silver	5.3	80	WAC 173-340-720(4)(b)(iii)(A) and (B)

References:

40 CFR 141, "National Primary Drinking Water Regulations."

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

*The 90th percentile background is from DOE/RL-96-61, *Hanford Site Background: Part 3, Groundwater Background.*

MCL = maximum contaminant level

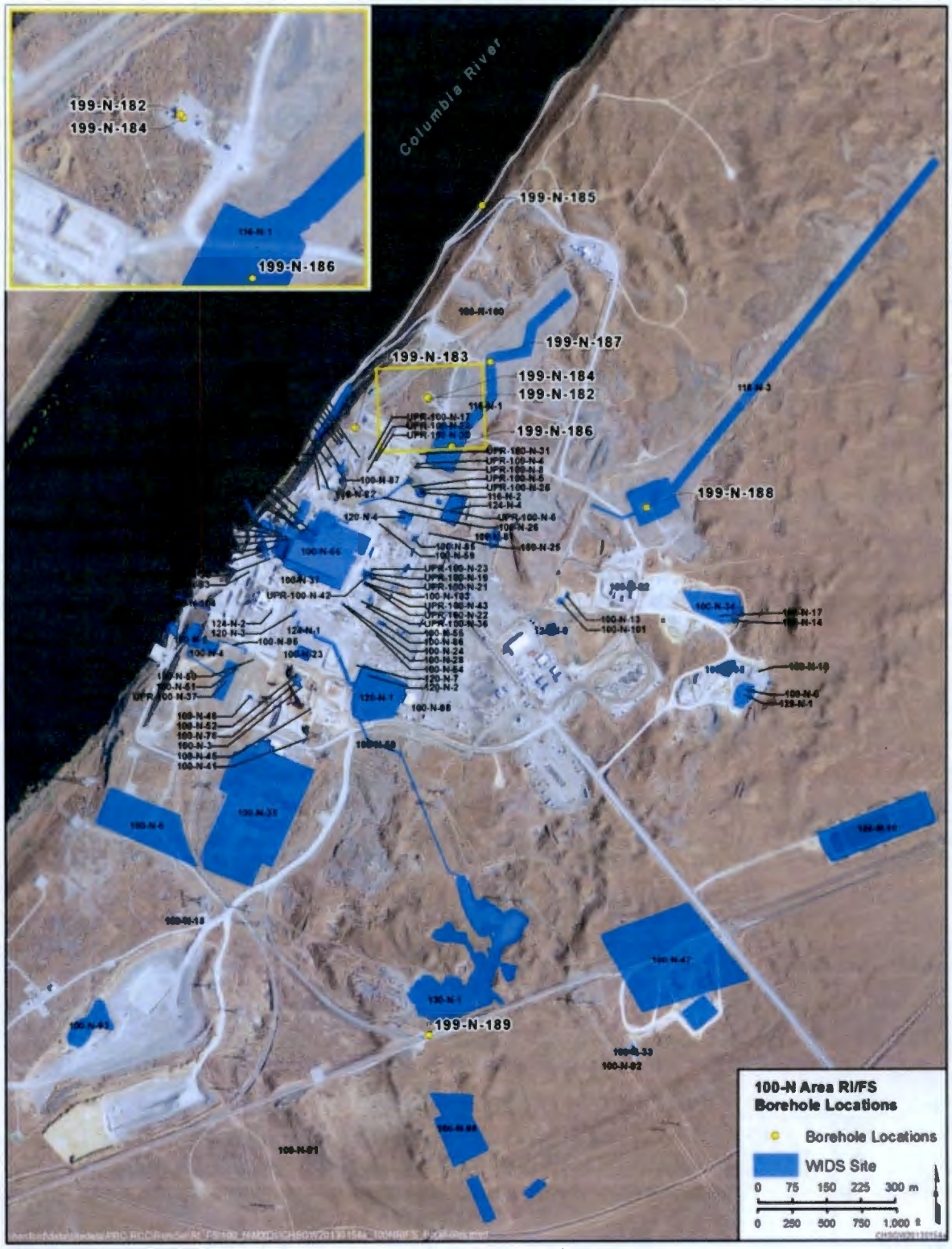

Figure 1. Remedial Investigation Well Location Map

5.1 1301-N Borehole Results (Wells 199-N-186 and 199-N-187)

The reported concentrations for the metals in soil samples collected while drilling wells 199-N-186 and 199-N-187 in 1301-N (listed in Table 2) are provided in Tables 4 and 5, respectively. Of the 664 soil sample results reported for the two boreholes, 379 results (57%) were below detection. All detected concentrations were below the clean closure performance standards listed in Table 2. Groundwater sample data collected from wells 199-N-186 and 199-N-187 for the Table 3 metals are presented in Tables 6 and 7, respectively.

Wells 199-N-186 and 199-N-187 have been sampled since 2011. Of the 952 groundwater sample results, 559 results (59%) were below detection. The detected concentrations for the RCRA metals were below the 90th percentile Hanford Site background or drinking water criteria listed in Table 3.

Table 4. Concentration of Metals from 1301-N Characterization Borehole 199-N-186 Soil Samples

Sample Interval (m bgs)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Hexavalent Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
6.035 – 6.797	1.3	50.7	0.258	0.49 (B)	1.54	0.026	0.259 (U)	0.173 (U)
7.681 – 8.443	1.85	59.9	0.232	0.3 (B)	2.18	0.014 (B)	0.305 (U)	0.203 (U)
9.053 – 9.815	1.89	61.6	0.152 (B)	0.53 (U)	1.85	0.026 (U)	0.269 (U)	0.179 (U)
10.06 – 10.82	0.724 (B)	26.7	0.11 (U)	0.11 (U)	1.65	0.054 (U)	0.33 (U)	0.11 (U)
10.7 – 11.46	1.44	52.9	0.142 (B)	0.52 (U)	1.95	0.026 (U)	0.271 (U)	0.181 (U)
12.25 – 13.01	1.16	45.6	0.126 (B)	0.52 (U)	1.67	0.026 (U)	0.307 (U)	0.205 (U)
13.78 – 14.54	1.66	68.5	0.139 (B)	0.52 (U)	2.06	0.026 (U)	0.302 (U)	0.201 (U)
15.24 – 16	2.37	56	0.123 (B)	0.52 (U)	2.86	0.029 (U)	0.309 (U)	0.206 (U)
16.82 – 17.59	2.31	50.3	0.149 (B)	0.54 (U)	3.3	0.024 (U)	0.251 (U)	0.167 (U)
16.82 – 17.59	2.53	52.9	0.158 (B)	0.54 (U)	3.29	0.03 (U)	0.256 (U)	0.17 (U)
18.35 – 19.11	2.3	60.6	0.112 (B)	0.51 (U)	2.14	0.026 (U)	0.264 (U)	0.176 (U)
19.05 – 19.81	1.65	47.7	0.099 (B)	0.52 (U)	3	0.024 (U)	0.254 (U)	0.169 (U)
19.05 – 19.81	1.86 (B)	39.7	0.286 (U)	0.52 (U)	2.24 (B)	—	4.77 (U)	0.477 (U)
19.05 – 19.81	2.12 (B)	51.9	0.227 (U)	0.52 (U)	2.5	—	3.79 (U)	0.379 (U)
19.05 – 19.81	4.56	43.3	0.297 (U)	0.52 (U)	2.18 (B)	—	4.96 (U)	0.496 (U)
19.05 – 19.81	1.86 (B)	59.8	0.215 (U)	0.52 (U)	2.23	—	3.58 (U)	0.358 (U)
19.05 – 19.81	0.15 (U)	0.013 (B)	0.015 (U)	0.02 (U)	0.15 (U)	—	0.25 (U)	0.025 (U)
19.05 – 19.81	0.15 (U)	0.025 (U)	0.015 (U)	0.02 (U)	0.15 (U)	—	0.25 (U)	0.025 (U)
19.05 – 19.81	0.03 (U)	0.01	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
19.05 – 19.81	0.03 (U)	0.007	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
19.9 – 20.67	1.91	64.6	0.109 (B)	0.51 (U)	2.67	0.031 (U)	0.237 (U)	0.158 (U)
20.57 – 21.34	1.49	81.5	0.111 (B)	0.52 (U)	2.87	0.021 (B)	0.283 (U)	0.189 (U)
20.57 – 21.34	1.94 (B)	82.1	0.305 (U)	0.52 (U)	3.22	—	5.08 (U)	0.508 (U)
20.57 – 21.34	1.99 (B)	85.9	0.263 (U)	0.23 (B)	3.73	—	4.39 (U)	0.439 (U)

Table 4. Concentration of Metals from 1301-N Characterization Borehole 199-N-186 Soil Samples

Sample Interval (m bgs)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Hexavalent Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
20.57 – 21.34	1.86 (B)	87.5	0.282 (U)	0.52 (U)	2.75 (B)	—	4.71 (U)	0.471 (U)
20.57 – 21.34	1.6 (B)	88.9	0.272 (U)	0.52 (U)	3.2	—	4.54 (U)	0.454 (U)
20.57 – 21.34	0.15 (U)	0.011 (B)	0.015 (U)	0.02 (U)	0.15 (U)	—	0.25 (U)	0.025 (U)
20.57 – 21.34	0.03 (U)	0.007	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
20.57 – 21.34	0.03 (U)	0.006	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
20.57 – 21.34	0.03 (U)	0.006	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
21.34 – 22.1	1.1 (B)	99.3	0.14 (B)	0.53 (U)	3.5	0.016 (BC)	1.1 (U)	0.49 (U)
21.34 – 22.1	1.85	83.6	0.121 (B)	0.196	3.31	0.026 (U)	0.278 (U)	0.186 (U)
22.1 – 22.86	1.66 (B)	61.4	0.256 (U)	0.56 (U)	3.17	0.029 (U)	4.27 (U)	0.427 (U)
22.1 – 22.86	1.42 (B)	49.5	0.211 (U)	0.56 (U)	2.77	—	3.52 (U)	0.352 (U)
22.1 – 22.86	1.36 (B)	46.3	0.269 (U)	0.56 (U)	3.13	—	4.48 (U)	0.448 (U)
22.1 – 22.86	1.14 (B)	43.5	0.232 (U)	0.56 (U)	2.93	—	3.86 (U)	0.386 (U)
22.1 – 22.86	0.15 (U)	0.023 (B)	0.015 (U)	0.04 (U)	0.15 (U)	—	0.25 (U)	0.025 (U)
22.1 – 22.86	0.15 (U)	0.023 (B)	0.015 (U)	0.04 (U)	0.15 (U)	—	0.25 (U)	0.025 (U)
22.1 – 22.86	0.03 (U)	0.01	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
22.1 – 22.86	0.03 (U)	0.007	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
22.1 – 22.86	1.1	46.8	0.058 (B)	0.56 (U)	2.87	—	0.323 (U)	0.215 (U)

Notes: Laboratory qualifiers associated with the sample results are provided in parentheses following the reported result. Laboratory qualifiers include the following:

B = INORGANICS and WETCHEM: The analyte was detected at a value less than the contract required detection limit but greater than or equal to the instrument detection limit/method detection limit (as appropriate).

C = INORGANICS/WETCHEM: The analyte was detected in both the sample and the associated quality control blank, and the sample concentration was ≤5 times the blank concentration.

U = Analyzed for but not detected above limiting criteria.

bgs = below ground surface

Table 5. Concentration of Metals from 1301-N Characterization Borehole 199-N-187 Soil Samples

Sample Interval (m bgs)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Hexavalent Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
5.944 – 6.706	1.93	81.2	0.163 (B)	0.53 (U)	2.61	0.029 (U)	0.316 (U)	0.211 (U)
9.449 – 9.632	1.29	77	0.197	0.52 (U)	2.26	0.028 (U)	0.268 (U)	0.179 (U)
10.55 – 10.79	1.34	71.4	0.1 (B)	0.51 (U)	1.91	0.024 (U)	0.256 (U)	0.171 (U)
12.19 – 12.95	1.72	70.1	0.1 (B)	0.54 (U)	2.57	0.029 (U)	0.314 (U)	0.209 (U)
13.66 – 13.66	1.59	41.2	0.076 (B)	0.53 (U)	2.5	0.028 (U)	0.226 (U)	0.15 (U)

Table 5. Concentration of Metals from 1301-N Characterization Borehole 199-N-187 Soil Samples

Sample Interval (m bgs)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Hexavalent Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
15.24 – 16	2.17	63.9	0.108 (B)	0.51 (U)	2.94	0.024 (U)	0.237 (U)	0.158 (U)
15.24 – 16	2.04	71	0.105 (B)	0.51 (U)	3.04	0.026 (U)	0.258	0.163 (U)
16.76 – 17.37	1.23	41.1	0.178 (B)	0.52 (U)	2.15	0.025 (U)	0.282 (U)	0.188 (U)
18.44 – 19.2	2.25	42.3	0.105 (B)	0.52 (U)	3.29	0.026 (U)	0.235	0.15 (U)
18.96 – 19.72	1.71	46.3	0.116 (B)	0.52 (U)	2.87	0.027 (U)	0.269	0.171 (U)
18.96 – 19.72	1.31 (B)	32.2	0.226 (U)	0.52 (U)	1.95 (B)	—	3.77 (U)	0.377 (U)
18.96 – 19.72	2.27	50.2	0.217 (U)	0.52 (U)	3.83	—	3.61 (U)	0.361 (U)
18.96 – 19.72	2.4 (B)	53	0.26 (U)	0.52 (U)	2.74	—	4.34 (U)	0.434 (U)
18.96 – 19.72	2.39	49.4	0.2 (U)	0.52 (U)	3.18	—	3.34 (U)	0.334 (U)
18.96 – 19.72	0.15 (U)	0.025 (U)	0.015 (U)	0.04 (U)	0.15 (U)	—	0.25 (U)	0.025 (U)
18.96 – 19.72	0.03 (U)	0.005 (B)	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
18.96 – 19.72	0.03 (U)	0.004 (B)	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
18.96 – 19.72	0.03 (U)	0.008	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
19.84 – 20.6	1.92	60.1	0.13 (B)	0.51 (U)	2.69	0.026 (U)	0.199 (U)	0.132 (U)
20.42 – 21.18	2.15	76.2	0.18 (B)	0.51 (U)	3.59	0.025 (U)	0.512	0.193 (U)
20.42 – 21.18	2.46	77.1	0.239 (U)	0.51 (U)	3.1	—	3.98 (U)	0.398 (U)
20.42 – 21.18	2.76	73.7	0.273 (U)	0.51 (U)	3.56	—	4.55 (U)	0.455 (U)
20.42 – 21.18	2.24 (B)	72.2	0.235 (U)	0.51 (U)	3.08	—	3.92 (U)	0.392 (U)
20.42 – 21.18	2.23 (B)	69	0.247 (U)	0.51 (U)	3.05	—	4.11 (U)	0.411 (U)
20.42 – 21.18	0.15 (U)	0.013 (B)	0.015 (U)	0.03 (U)	0.15 (U)	—	0.25 (U)	0.025 (U)
20.42 – 21.18	0.03 (U)	0.008	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
20.42 – 21.18	0.03 (U)	0.006	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
20.42 – 21.18	0.03 (U)	0.006	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
21.31 – 22.07	1.21	63.7	0.122 (B)	0.55 (U)	2.94	0.028 (U)	0.244 (U)	0.189
21.79 – 22.56	1.23	0.011 (B)	0.015 (U)	0.02 (U)	0.15 (U)	0.03 (U)	0.288 (U)	0.192 (U)
21.79 – 22.56	0.75 (B)	60.5	0.087 (B)	0.55 (U)	2.6	—	3.62 (U)	0.362 (U)
21.79 – 22.56	1.65 (B)	44.9	0.217 (U)	0.55 (U)	1.07 (B)	—	4.3 (U)	0.43 (U)
21.79 – 22.56	1.26 (B)	48	0.258 (U)	0.55 (U)	2.99	—	4.05 (U)	0.405 (U)
21.79 – 22.56	1.39 (B)	38.6	0.243 (U)	0.55 (U)	3.87	—	5 (U)	0.5 (U)
21.79 – 22.56	0.15 (U)	51.7	0.3 (U)	0.55 (U)	2.87 (B)	—	0.25 (U)	0.025 (U)
21.79 – 22.56	0.15 (U)	0.011 (B)	0.015 (U)	0.02 (U)	0.15 (U)	—	0.25 (U)	0.025 (U)

Table 5. Concentration of Metals from 1301-N Characterization Borehole 199-N-187 Soil Samples

Sample Interval (m bgs)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Hexavalent Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
21.79 – 22.56	0.03 (U)	0.007	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
21.79 – 22.56	0.03 (U)	0.006	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)

Note: Laboratory qualifiers associated with the sample results are provided in parentheses following the reported result. Laboratory qualifiers include the following:

B = INORGANICS and WETCHEM: The analyte was detected at a value less than the contract required detection limit but greater than or equal to the instrument detection limit/method detection limit (as appropriate).

U = Analyzed for but not detected above limiting criteria.

bgs = below ground surface

Table 6. Well 199-N-186 Groundwater Sample Data for Metals

Sample Date	Arsenic (µg/L)	Barium (µg/L)	Cadmium (µg/L)	Hexavalent Chromium (µg/L)	Lead (µg/L)	Mercury (µg/L)	Selenium (µg/L)	Silver (µg/L)
8/10/2011	10 (U)	149 (D)	1 (U)	3.7 (U)	10 (U)	0.0636 (BD)	10 (U)	5 (U)
8/11/2011	1.44 (BD)	103 (D)	0.1 (UD)	2 (UN)	2.18 (D)	0.06 (UD)	1.9 (BD)	0.1 (UD)
8/16/2011	0.809 (BD)	40.3 (D)	0.1 (UD)	2 (U)	1.12 (BD)	0.06 (UD)	0.736 (BD)	0.1 (UD)
2/21/2012	0.571 (BD)	100 (D)	4 (U)	2 (U)	1.12 (D)	0.1 (UD)	2 (UD)	4 (U)
3/14/2012	1.03 (BD)	95.6 (D)	4 (U)	2 (U)	0.478 (BD)	0.1 (UD)	2 (UD)	4 (U)
5/21/2012	0.612 (BD)	94.2	4 (U)	2.8 (B)	0.1 (UD)	0.1 (UD)	2 (UD)	4 (U)
8/23/2012	0.812 (BD)	104 (D)	4 (U)	2.3 (B)	0.1 (UD)	0.1 (UD)	2 (UD)	4 (U)
11/7/2012	1.2 (U)	102 (D)	4 (U)	8 (U)	0.25 (B)	0.1 (UD)	2 (UD)	6 (U)
2/13/2013	1.19 (BD)	108 (D)	4 (U)	4.4 (B)	0.1 (UD)	0.1 (UD)	2 (UD)	4 (U)
5/6/2013	1.84 (BD)	128 (D)	4 (U)	4 (B)	0.1 (UD)	0.1 (UD)	2 (UD)	4 (U)
9/26/2013	0.502 (BD)	121 (D)	4 (U)	3.2 (B)	0.1 (UD)	0.1 (UD)	2 (UD)	4 (U)
12/6/2013	0.406 (BD)	104 (D)	0.1 (UD)	4.5 (B)	0.234 (BD)	0.1 (UD)	2 (UD)	0.1 (UD)
3/20/2014	1.7 (U)	94.7 (M)	0.11 (U)	8 (U)	0.5 (U)	0.1 (UD)	2 (UD)	0.2 (U)
6/19/2014	1.2 (U)	106	0.1 (U)	8 (U)	0.17 (U)	0.06 (U)	1.6 (U)	0.77 (U)
9/9/2014	1.2 (U)	124	0.1 (U)	8 (U)	0.19 (B)	0.06 (U)	2 (B)	0.82 (U)

Table 6. Well 199-N-186 Groundwater Sample Data for Metals

Sample Date	Arsenic (µg/L)	Barium (µg/L)	Cadmium (µg/L)	Hexavalent Chromium (µg/L)	Lead (µg/L)	Mercury (µg/L)	Selenium (µg/L)	Silver (µg/L)
11/12/2014	1.7 (U)	69.8	0.11 (U)	24.7	0.5 (U)	0.067 (U)	1.81 (B)	0.2 (U)
9/16/2015	1.7 (U)	73.2	0.11 (U)	5.3	0.5 (U)	0.067 (U)	1.5 (U)	0.2 (U)

Note: Laboratory qualifiers associated with the sample results are provided in parentheses following the reported result. Laboratory qualifiers include the following:

B = INORGANICS and WETCHEM: The analyte was detected at a value less than the contract required detection limit but greater than or equal to the instrument detection limit/method detection limit (as appropriate).

D = INORGANICS/WETCHEM: Analyte was identified in an analysis at a secondary dilution factor (i.e., dilution factor different than 1.0).

M = INORGANICS: Duplicate precision criteria not met.

U = Analyzed for but not detected above limiting criteria.

Table 7. Well 199-N-187 Groundwater Sample Data for Metals

Sample Date	Arsenic (µg/L)	Barium (µg/L)	Cadmium (µg/L)	Hexavalent Chromium (µg/L)	Lead (µg/L)	Mercury (µg/L)	Selenium (µg/L)	Silver (µg/L)
8/30/2011	10 (U)	49.9 (D)	1 (U)	7.59 (BD)	3.7 (U)	10 (U)	0.06 (UD)	10 (U)
8/31/2011	0.8 (UD)	40.4 (D)	0.1 (UD)	19.3 (D)	2 (U)	0.382 (BD)	0.06 (UD)	1.49 (BD)
9/1/2011	0.8 (UD)	29.5 (D)	0.1 (UD)	2.87 (BD)	2 (U)	1.38 (BD)	0.06 (UD)	1.29 (BD)
3/14/2012	1.1 (BD)	65.9 (D)	4 (U)	7.1 (B)	2 (U)	0.392 (BD)	0.1 (UD)	2.33 (BD)
6/14/2012	1.2 (U)	57.2	4 (U)	5 (U)	13 (U)	0.21 (B)	0.1 (UD)	2.7 (B)
8/23/2012	0.712 (BD)	51.1 (D)	4 (U)	5 (U)	2 (U)	0.1 (UD)	0.1 (UD)	2 (UD)
11/12/2012	0.706 (BD)	60 (D)	4 (U)	5 (U)	3.3 (B)	0.116 (BD)	0.1 (UD)	2.36 (BD)
2/13/2013	1.23 (BD)	66.1 (D)	4 (U)	5 (U)	4 (B)	0.1 (UD)	0.1 (UD)	2.39 (BD)
5/6/2013	1.68 (BD)	59.7 (D)	4 (U)	5 (U)	3.4 (B)	0.1 (UD)	0.1 (UD)	2.33 (BD)
9/26/2013	1.2 (U)	62.2 (D)	4 (U)	5 (U)	8 (U)	0.17 (U)	0.1 (UD)	3.5 (B)
12/17/2013	1.2 (U)	54.1 (D)	0.1 (U)	3.76 (D)	8 (U)	0.17 (U)	0.1 (UD)	3.42 (BD)
3/19/2014	0.672 (BD)	46.6 (D)	0.1 (UD)	3.31 (D)	3.9 (B)	0.1 (UD)	0.1 (UD)	2.9 (BD)
6/19/2014	1.7 (U)	53.5	0.11 (U)	2.73	8 (U)	0.5 (U)	0.067 (U)	2.63 (B)
9/9/2014	1.7 (U)	47.4	0.11 (U)	2.48	8 (U)	0.5 (U)	0.067 (U)	2.26 (B)
11/12/2014	1.2 (U)	51.7	0.1 (U)	3.9 (B)	3.4 (B)	1.7 (B)	0.06 (U)	2.8 (B)

Table 7. Well 199-N-187 Groundwater Sample Data for Metals

Sample Date	Arsenic (µg/L)	Barium (µg/L)	Cadmium (µg/L)	Hexavalent Chromium (µg/L)	Lead (µg/L)	Mercury (µg/L)	Selenium (µg/L)	Silver (µg/L)
9/17/2015	1.2 (U)	44.6	0.1 (U)	4.2 (B)	3 (B)	0.17 (U)	0.073 (BC)	3 (B)

Note: Laboratory qualifiers associated with the sample results are provided in parentheses following the reported result. Laboratory qualifiers include the following:

B = INORGANICS and WETCHEM: The analyte was detected at a value less than the contract required detection limit but greater than or equal to the instrument detection limit/method detection limit (as appropriate).

C = INORGANICS/WETCHEM: The analyte was detected in both the sample and the associated quality control blank, and the sample concentration was ≤5 times the blank concentration.

D = INORGANICS/WETCHEM: Analyte was identified in an analysis at a secondary dilution factor (i.e., dilution factor different than 1.0).

U = Analyzed for but not detected above limiting criteria.

5.2 1325-N Borehole Results (Well 199-N-188)

Table 8 lists the concentrations of metals in soil samples collected while drilling well 199-N-188 in the crib/head end of 1325-N. Of the 325 soil sample results reported, 186 samples (57%) were below detection. All detected concentrations were below the clean closure performance standards listed in Table 2.

Groundwater sample data collected from well 199-N-188 for the metals listed in Table 3 are presented in Table 9. Well 199-N-188 has been sampled since 2011. Of the 388 groundwater sample results, 209 results (54%) were below detection. The detected concentrations for the RCRA metals were below the 90th percentile Hanford Site background or drinking water criteria listed in Table 3.

The groundwater sample data from well 199-N-188 summarized in Table 9 indicate that the hexavalent chromium detected in this well appeared after the well was completed, as initial samples taken in 2011 did not indicate the presence of hexavalent chromium. Starting with samples taken in 2012, hexavalent chromium has been detected in groundwater, and the hexavalent chromium is not related to liquid disposed to the 1325-N LWDF. Groundwater from the 100-K Area (100-KR-4 OU), which is being actively treated for hexavalent chromium in groundwater, is moving into the 100-N Area.

Table 8. Concentration of Metals from 1325-N Characterization Borehole 199-N-188 Soil Samples

Sample Interval (m bgs)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Hexavalent Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
4.481 – 5.243	2.17	57.4	0.088 (B)	7.96	0.53 (U)	2.66	0.026 (U)	0.243 (U)
6.401 – 6.401	1.24	43.4	0.146 (B)	4.4	0.52 (U)	1.62	0.027 (U)	0.305
7.772 – 8.534	1.13	39.5	0.149 (B)	2.74	0.52 (U)	1.41	0.027 (U)	0.389
9.144 – 9.906	0.96	39.2	0.132 (B)	3.34	0.52 (U)	1.28	0.028 (U)	0.207 (U)
10.76 – 11.52	0.909	41.3	0.146	3.88	0.52 (U)	1.34	0.025 (U)	0.279
12.13 – 12.89	1.09	40.5	0.155	4.11	0.52 (U)	1.37	0.027 (U)	0.215 (U)
12.13 – 12.89	1.12	54.2	0.148	3.97	0.52 (U)	1.38	0.027 (U)	0.244

Table 8. Concentration of Metals from 1325-N Characterization Borehole 199-N-188 Soil Samples

Sample Interval (m bgs)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Hexavalent Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
13.66 – 14.42	1.94	49	0.083 (B)	11.8	0.52 (U)	4.39	0.027 (U)	0.287 (U)
15.3 – 16.06	1.77	73.3	0.107 (B)	12.9	0.51 (U)	2.74	0.028 (U)	0.268 (U)
16.86 – 17.62	1.72 (B)	63.5	0.265 (U)	9.21	0.51 (U)	2.31 (B)	0.025 (U)	3.33 (U)
16.86 – 17.62	0.3 (U)	0.05 (U)	0.03 (U)	0.03 (U)	0.02 (U)	0.3 (U)	—	4.42 (U)
16.86 – 17.62	0.3 (U)	0.05 (U)	0.03 (U)	0.03 (U)	0.03 (U)	0.3 (U)	—	0.5 (U)
16.86 – 17.62	1.71	78.9	0.117 (B)	10.8	0.51 (U)	2.37	—	0.27 (U)
16.86 – 17.62	2.14 (B)	66.1	0.217 (U)	11.5	0.51 (U)	2.35	—	3.61 (U)
16.86 – 17.62	2 (B)	77.8	0.265 (U)	10.2	0.51 (U)	2.78	—	4.42 (U)
16.86 – 17.62	2.07	71.6	0.2 (U)	11.5	0.51 (U)	2.42	—	0.5 (U)
16.86 – 17.62	0.03 (U)	0.008	0.003 (U)	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)
16.86 – 17.62	0.03 (U)	0.008	0.003 (U)	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)
18.2 – 18.96	0.03 (U)	0.007	0.003 (U)	0.003 (U)	0.02 (U)	0.15 (U)	0.024 (U)	0.25 (U)
18.2 – 18.96	0.03 (U)	0.007	0.003 (U)	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)
18.2 – 18.96	0.03 (U)	0.006	0.003 (U)	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)
18.2 – 18.96	1.75	55.9	0.167	12	0.02 (U)	0.03 (U)	—	0.05 (U)
18.2 – 18.96	1.95 (B)	57.9	0.308 (U)	12.1	0.51 (U)	2.64	—	0.214 (U)
18.2 – 18.96	2.23	53.7	0.217 (U)	11.3	0.51 (U)	4.74	—	5.13 (U)
18.2 – 18.96	2.6	58.3	0.248 (U)	10.9	0.51 (U)	3.57	—	3.61 (U)
18.2 – 18.96	2.45	55.1	0.211 (U)	11.8	0.51 (U)	4.74	—	4.14 (U)
18.2 – 18.96	0.15 (U)	0.013 (B)	0.015 (U)	0.015 (U)	0.51 (U)	4.32	—	3.51 (U)
18.99 – 19.75	1.83	74.4	0.162	8.74	0.52 (U)	2.87	0.029 (U)	0.24 (U)
19.81 – 20.57	0.709 (B)	29.2	0.126 (B)	8.52	0.56 (U)	2.07	0.031 (U)	0.31 (U)
19.81 – 20.57	1.4 (B)	41.9	0.275 (U)	9.97	0.54 (U)	2.64 (B)	—	4.58 (U)
19.81 – 20.57	1.17 (B)	33.6	0.213 (U)	7.08	0.54 (U)	2.06 (B)	—	3.55 (U)
19.81 – 20.57	1.46 (B)	54.2	0.249 (U)	22.4	0.54 (U)	3.06	—	4.16 (U)
19.81 – 20.57	1.1 (B)	55.2	0.257 (U)	9.17	0.54 (U)	2.17 (B)	—	4.29 (U)
19.81 – 20.57	0.15 (U)	0.011 (B)	0.015 (U)	0.015 (U)	0.03 (U)	0.15 (U)	—	0.25 (U)
19.81 – 20.57	0.15 (U)	0.012 (B)	0.015 (U)	0.015 (U)	0.03 (U)	0.15 (U)	—	0.25 (U)
19.81 – 20.57	0.03 (U)	0.007	0.003 (U)	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)
19.81 – 20.57	0.03 (U)	0.007	0.003 (U)	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)
20.63 – 21.4	1.03	50.2	0.147 (B)	7.68	0.56 (U)	2	0.027 (U)	0.354
20.63 – 21.4	1.73 (B)	39	0.255 (U)	4.05	0.54 (U)	4.97	—	4.25 (U)
20.63 – 21.4	0.954 (B)	36.5	0.23 (U)	4.9	0.54 (U)	3.32	—	3.83 (U)

Table 8. Concentration of Metals from 1325-N Characterization Borehole 199-N-188 Soil Samples

Sample Interval (m bgs)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Hexavalent Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
20.63 – 21.4	1.16 (B)	48.9	0.281 (U)	5.67	0.54 (U)	2.99	—	4.69 (U)
20.63 – 21.4	1.55 (B)	42.4	0.244 (U)	11.6	0.54 (U)	2.83	—	4.06 (U)
20.63 – 21.4	0.15 (U)	0.025 (U)	0.015 (U)	0.015 (U)	0.02 (U)	0.15 (U)	—	0.25 (U)
20.63 – 21.4	0.03 (U)	0.008	0.003 (U)	0.001 (B)	0.02 (U)	0.03 (U)	—	0.05 (U)
20.63 – 21.4	0.03 (U)	0.006	0.003 (U)	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)
20.63 – 21.4	0.03 (U)	0.005	0.003 (U)	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)

Note: Laboratory qualifiers associated with the sample results are provided in parentheses following the reported result. Laboratory qualifiers include the following:

B = INORGANICS and WETCHEM: The analyte was detected at a value less than the contract required detection limit but greater than or equal to the instrument detection limit/method detection limit (as appropriate).

U = Analyzed for but not detected above limiting criteria.

bgs = below ground surface

Table 9. Well 199-N-188 Groundwater Sample Data for Metals

Sample Date	Arsenic (µg/L)	Barium (µg/L)	Cadmium (µg/L)	Hexavalent Chromium (µg/L)	Lead (µg/L)	Mercury (µg/L)	Selenium (µg/L)	Silver (µg/L)
9/7/2011	10 (U)	49.6 (B)	1 (U)	3.7 (U)	3.7 (U)	10 (U)	0.24	10 (U)
9/12/2011	2.8 (B)	53.1	0.1 (U)	2 (U)	2 (U)	0.88 (B)	0.062 (BN)	1.6 (U)
9/14/2011	2.7 (B)	38.5 (B)	0.1 (U)	2 (U)	2 (U)	0.62 (B)	0.06 (UN)	1.6 (U)
2/21/2012	2.21 (BD)	43.9 (D)	4 (U)	5.1	5.1	0.534 (BD)	0.1 (UD)	2 (UD)
3/20/2012	2.23 (BD)	41.3 (D)	4 (U)	8.5	8.5	0.1 (UD)	0.1 (UD)	2 (UD)
5/2/2012	2.59 (BD)	43.3 (D)	4 (U)	8.8	8.8	0.322 (BD)	0.1 (UD)	2 (UD)
8/23/2012	2.81 (BD)	37.7 (D)	4 (U)	10.4	10.4	0.1 (UD)	0.1 (UD)	2 (UD)
11/12/2012	2.18 (BD)	47.6 (D)	4 (U)	9.6	9.6	0.1 (UD)	0.1 (UD)	2 (UD)
2/13/2013	2.93 (BD)	48.5 (D)	4 (U)	10.6	10.6	0.1 (UD)	0.1 (UD)	2 (UD)
5/6/2013	3.38 (BD)	43.9 (D)	4 (U)	10.7	10.7	0.1 (UD)	0.1 (UD)	2 (UD)
9/25/2013	2.21 (BD)	41.2	4 (U)	9.8	9.8	0.1 (UD)	0.1 (UD)	2 (UD)
12/6/2013	2.32 (BD)	38.4 (D)	0.1 (UD)	9.6	9.6	0.214 (BD)	0.1 (UD)	2 (UD)
3/20/2014	2.41 (BD)	36.3 (D)	0.1 (UD)	11.1	11.1	0.1 (UD)	0.1 (UD)	2 (UD)
6/19/2014	2.9 (B)	34.8	0.14 (B)	13	13	0.2 (B)	0.06 (U)	1.6 (U)
9/29/2014	3.6 (B)	44.8	0.1 (U)	11	11	0.17 (U)	0.06 (U)	1.6 (U)
11/13/2014	3.69 (C)	35.8	0.11 (U)	11.8	11.8	0.5 (U)	0.067 (U)	1.5 (U)
9/8/2015	3.6 (B)	37	0.11 (U)	13	13	0.5 (U)	0.067 (U)	1.5 (U)

Table 9. Well 199-N-188 Groundwater Sample Data for Metals

Sample Date	Arsenic (µg/L)	Barium (µg/L)	Cadmium (µg/L)	Hexavalent Chromium (µg/L)	Lead (µg/L)	Mercury (µg/L)	Selenium (µg/L)	Silver (µg/L)
9/23/2016	3.2 (B)	55.6	0.3 (U)	—	—	0.5 (U)	—	2 (U)
9/21/2017	1.8 (B)	47.4	0.27 (U)	—	—	0.18 (U)	—	1.2 (B)

Note: Laboratory qualifiers associated with the sample results are provided in parentheses following the reported result. Laboratory qualifiers include the following:

B = INORGANICS and WETCHEM: The analyte was detected at a value less than the contract required detection limit but greater than or equal to the instrument detection limit/method detection limit (as appropriate).

C = INORGANICS/WETCHEM: The analyte was detected in both the sample and the associated quality control blank, and the sample concentration was ≤5 times the blank concentration.

D = INORGANICS/WETCHEM: Analyte was identified in an analysis at a secondary dilution factor (i.e., dilution factor different than 1.0).

N = Spike sample recovery is outside control limits.

U = Analyzed for but not detected above limiting criteria.

5.3 1301-N Downgradient Borehole Results (Wells 199-N-182 Through 199-N-185)

Tables 10 through 12 list the RCRA metals concentrations in soil samples collected while drilling wells 199-N-183 through 199-N-185, located downgradient of 1301-N. Vadose zone samples were not collected from well 199-N-182. Of the 906 soil sample results reported, 560 samples (62%) were below detection. Detected metal concentrations from boreholes 199-N-183, 199-N-184, and 199-N-185 are below the clean closure performance standards listed in Table 2. One sample result for lead from the duplicate and split samples (nine samples total) from well 199-N-185 was above the cleanup value at the 1.524 to 2.286 m (5 to 7.5 ft) sample interval. Sample results from the other eight duplicate and split samples from this sample interval were below the cleanup value or below detection. This result is considered an outlier because it is out of trend with the other spit/duplicate sample results. The mean concentration based on the nine samples collected from the interval (including the outlier result) is below background and soil concentrations protective of groundwater and the Columbia River.

Groundwater sample data collected from wells 199-N-182, 199-N-183, 199-N-184, and 199-N-185 for the metals listed in Table 3 are presented in Tables 13 through 16. The wells have been sampled since 2011. Of the 615 groundwater sample results, 382 results (62%) were below detection. The detected concentrations for the RCRA metals were all below the 90th percentile Hanford Site background or drinking water criteria listed in Table 3, except for one sample for arsenic from well 199-N-185 that had a detected value of 10.7 µg/L. This value was flagged with "B" qualifier, indicating that the value was estimated because the value was above detection but less than the practical quantification limit. The sample result for the duplicate sample for this well was also below detection.

Table 10. Concentration of Metals from 1301-N Downgradient Characterization Borehole 199-N-183 Soil Samples

Sample Interval (m bgs)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Hexavalent Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
17.68 – 18.44	1.48 (B)	63.2	0.236 (U)	0.52 (U)	3.27	0.026 (U)	3.93 (U)	0.393 (U)
17.68 – 18.44	1.92 (B)	60.2	0.289 (U)	0.52 (U)	3.14	—	4.81 (U)	0.481 (U)
17.68 – 18.44	1.52 (B)	59.6	0.26 (U)	0.52 (U)	3.18	—	0.246 (U)	0.164 (U)
17.68 – 18.44	1.69	74.3	0.072 (B)	0.52 (U)	3.23	—	4.33 (U)	0.433 (U)
17.68 – 18.44	1.67 (B)	54.9	0.283 (U)	0.52 (U)	3.04	—	4.72 (U)	0.472 (U)
17.68 – 18.44	0.15 (U)	0.021 (B)	0.015 (U)	0.02 (U)	0.15 (U)	—	0.25 (U)	0.025 (U)
17.68 – 18.44	0.03 (U)	0.015	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
17.68 – 18.44	0.15 (U)	0.015 (B)	0.015 (U)	0.02 (U)	0.15 (U)	—	0.25 (U)	0.025 (U)
17.68 – 18.44	0.03 (U)	0.01	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
19.08 – 19.84	0.931	26.1	0.037 (B)	0.52 (U)	2.36	0.025 (U)	0.223 (U)	0.149 (U)
19.08 – 19.84	0.84 (B)	27.7	0.244 (U)	0.52 (U)	9.15	—	4.06 (U)	0.406 (U)
19.08 – 19.84	0.852 (B)	33.1	0.24 (U)	0.52 (U)	6.25	—	4 (U)	0.4 (U)
19.08 – 19.84	2 (U)	29.3	0.2 (U)	0.52 (U)	3.94	—	3.33 (U)	0.333 (U)
19.08 – 19.84	2.83 (U)	27.9	0.283 (U)	0.52 (U)	6.08	—	4.72 (U)	0.472 (U)
19.08 – 19.84	0.15 (U)	0.026	0.015 (U)	0.02 (U)	0.15 (U)	—	0.25 (U)	0.025 (U)
19.08 – 19.84	0.03 (U)	0.032	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
19.08 – 19.84	0.03 (U)	0.026	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
19.08 – 19.84	0.03 (U)	0.026	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
20.79 – 21.55	0.893 (B)	43.1	0.069 (B)	0.55 (U)	2.88	0.026 (U)	0.254 (U)	0.169 (U)
20.79 – 21.55	1.08	32.7	0.055 (B)	0.55 (U)	2.08	0.027 (U)	0.325 (U)	0.217 (U)
20.79 – 21.55	3.12 (U)	38.5	0.312 (U)	0.94	2.79 (B)	—	5.2 (U)	0.52 (U)
20.79 – 21.55	0.987 (B)	57.1	0.254 (U)	0.54 (U)	2.46 (B)	—	4.23 (U)	0.423 (U)
20.79 – 21.55	1.15 (B)	50.3	0.275 (U)	0.54 (U)	2.62 (B)	—	4.58 (U)	0.458 (U)
20.79 – 21.55	1.32 (B)	75.5	0.306 (U)	0.54 (U)	2.62 (B)	—	5.1 (U)	0.51 (U)
20.79 – 21.55	0.15 (U)	0.034	0.015 (U)	0.02 (U)	0.15 (U)	—	0.25 (U)	0.032
20.79 – 21.55	0.15 (U)	0.031	0.015 (U)	0.02 (U)	0.15 (U)	—	0.25 (U)	0.016 (B)
20.79 – 21.55	0.03 (U)	0.02	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
20.79 – 21.55	0.03 (U)	0.012	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
21.52 – 22.28	1.54	49.4	0.086 (B)	0.56 (U)	3.37	0.03 (U)	0.226 (U)	0.151 (U)
21.52 – 22.28	1.15 (B)	66.6	0.289 (U)	0.23 (B)	2.8 (B)	—	4.82 (U)	0.482 (U)
21.52 – 22.28	3.11 (U)	81.4	0.127 (B)	0.27 (B)	2.84 (B)	—	5.19 (U)	0.519 (U)
21.52 – 22.28	2.49 (U)	54.5	0.249 (U)	0.54 (U)	2.71	—	4.15 (U)	0.415 (U)

Table 10. Concentration of Metals from 1301-N Downgradient Characterization Borehole 199-N-183 Soil Samples

Sample Interval (m bgs)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Hexavalent Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
21.52 – 22.28	1.05 (B)	42.6	0.265 (U)	0.54 (U)	4.79	—	4.42 (U)	0.442 (U)
21.52 – 22.28	0.15 (U)	0.032	0.015 (U)	0.02 (U)	0.15 (U)	—	0.25 (U)	0.025 (U)
21.52 – 22.28	0.03 (U)	0.018	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.003 (B)
21.52 – 22.28	0.03 (U)	0.017	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
21.52 – 22.28	0.03 (U)	0.024	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)

Note: Laboratory qualifiers associated with the sample results are provided in parentheses following the reported result. Laboratory qualifiers include the following:

B = INORGANICS and WETCHEM: The analyte was detected at a value less than the contract required detection limit but greater than or equal to the instrument detection limit/method detection limit (as appropriate).

U = Analyzed for but not detected above limiting criteria.

bgs = below ground surface

Table 11. Concentration of Metals from 1301-N Downgradient Characterization Borehole 199-N-184 Soil Samples

Sample Interval (m bgs)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Hexavalent Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
6.096 – 6.858	1.66	56.1	0.111 (B)	0.51 (U)	1.89	0.027 (U)	0.217 (U)	0.145 (U)
7.772 – 8.534	1.26	46.2	0.126 (B)	0.51 (U)	1.39	0.025 (U)	0.39	0.144 (U)
9.083 – 9.845	1.43	79.2	0.149	0.51 (U)	2.23	0.028 (U)	0.203 (U)	0.135 (U)
10.73 – 11.49	1.57	60.4	0.151 (B)	0.51 (U)	1.99	0.026 (U)	0.294 (U)	0.196 (U)
12.04 – 12.8	1.43	56.4	0.131 (B)	0.51 (U)	1.76	0.024 (U)	0.205 (U)	0.137 (U)
13.9 – 14.66	1.68	62.4	0.093 (B)	0.51 (U)	2.19	0.026 (U)	0.264 (U)	0.176 (U)
15.42 – 16.18	2.62	81.8	0.228	0.52 (U)	2.98	0.026 (U)	0.262 (U)	0.175 (U)
16.89 – 17.59	1.28	51.3	0.104 (B)	0.57 (U)	2.11	0.028 (U)	0.337 (U)	0.225 (U)
17.47 – 18.23	1.81 (B)	45.4	0.21 (U)	0.51 (U)	2.28	—	3.5 (U)	0.35 (U)
17.47 – 18.23	1.95 (B)	49.2	0.247 (U)	0.51 (U)	2.5	—	4.12 (U)	0.412 (U)
17.47 – 18.23	1.92 (B)	40.1	0.213 (U)	0.51 (U)	2.14	—	3.54 (U)	0.354 (U)
17.47 – 18.23	1.56 (B)	44.2	0.201 (U)	0.51 (U)	2.1	—	3.36 (U)	0.336 (U)
17.47 – 18.23	0.15 (U)	0.025 (U)	0.015 (U)	0.05 (U)	0.15 (U)	—	0.25 (U)	0.025 (U)
17.47 – 18.23	0.15 (U)	0.025 (U)	0.015 (U)	0.04 (U)	0.15 (U)	—	0.25 (U)	0.025 (U)
17.47 – 18.23	0.03 (U)	0.003 (B)	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
17.47 – 18.23	0.03 (U)	0.002 (B)	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
18.23 – 18.99	2.04	53.5	0.083 (B)	0.52 (U)	2.26	0.027 (U)	0.269	0.152 (U)

Table 11. Concentration of Metals from 1301-N Downgradient Characterization Borehole 199-N-184 Soil Samples

Sample Interval (m bgs)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Hexavalent Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
19.02 – 19.78	1.91	120	0.108 (B)	0.52 (U)	2.75	0.026 (U)	0.304	0.181 (U)
19.02 – 19.78	1.76	79.5	0.111 (B)	0.52 (U)	2.64	0.024 (U)	0.303 (U)	0.202 (U)
19.02 – 19.78	2.37 (B)	66.7	0.247 (U)	0.52 (U)	2.5	—	4.11 (U)	0.411 (U)
19.02 – 19.78	2.24 (B)	55.8	0.25 (U)	0.52 (U)	2.41 (B)	—	4.17 (U)	0.417 (U)
19.02 – 19.78	1.34 (B)	38.6	0.216 (U)	0.52 (U)	2.46	—	3.59 (U)	0.359 (U)
19.02 – 19.78	2.16	68.6	0.216 (U)	0.52 (U)	2.44	—	3.59 (U)	0.359 (U)
19.02 – 19.78	0.15 (U)	0.025 (U)	0.015 (U)	0.08 (U)	0.15 (U)	—	0.25 (U)	0.025 (U)
19.02 – 19.78	0.15 (U)	0.025 (U)	0.015 (U)	0.07 (U)	0.15 (U)	—	0.25 (U)	0.025 (U)
19.02 – 19.78	0.03 (U)	0.003 (B)	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
19.02 – 19.78	0.03 (U)	0.003 (B)	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
19.81 – 20.48	2.33	81.2	0.111 (B)	0.52 (U)	2.93	0.026 (U)	0.217 (U)	0.145 (U)
20.57 – 21.34	2.45 (B)	71.2	0.315 (U)	0.55 (U)	3.34	0.025 (U)	5.26 (U)	0.526 (U)
20.57 – 21.34	1.97 (B)	60.3	0.273 (U)	0.55 (U)	3.47	—	4.56 (U)	0.456 (U)
20.57 – 21.34	1.7 (B)	63.8	0.219 (U)	0.55 (U)	2.73	—	3.65 (U)	0.365 (U)
20.57 – 21.34	1.79 (B)	83.3	0.265 (U)	0.55 (U)	3.37	—	4.41 (U)	0.441 (U)
20.57 – 21.34	0.15 (U)	0.025 (U)	0.015 (U)	0.05 (U)	0.15 (U)	—	0.25 (U)	0.025 (U)
20.57 – 21.34	0.15 (U)	0.047	0.015 (U)	0.05 (U)	0.15 (U)	—	0.25 (U)	0.025 (U)
20.57 – 21.34	0.03 (U)	0.009	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
20.57 – 21.34	0.03 (U)	0.005 (U)	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
20.57 – 21.34	2.01	95	0.115 (B)	0.55 (U)	3.1	—	0.232 (U)	0.155 (U)

Note: Laboratory qualifiers associated with the sample results are provided in parentheses following the reported result. Laboratory qualifiers include the following:

B = INORGANICS and WETCHEM: The analyte was detected at a value less than the contract required detection limit but greater than or equal to the instrument detection limit/method detection limit (as appropriate).

U = Analyzed for but not detected above limiting criteria.

bgs = below ground surface

Table 12. Concentration of Metals from 1301-N Downgradient Characterization Borehole 199-N-185 Soil Samples

Sample Interval (m bgs)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Hexavalent Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
0.7315 – 1.341	0.03 (U)	67.2	0.103 (B)	0.02 (U)	0.15 (U)	—	0.25 (U)	0.025 (U)
0.7315 – 1.341	4.03	65.9	0.288 (U)	0.54 (U)	5.7	—	0.305 (U)	0.203 (U)
0.7315 – 1.341	3.31	61.4	0.304 (U)	0.54 (U)	5.48	—	4.8 (U)	0.48 (U)
0.7315 – 1.341	3.38	60.4	0.278 (U)	0.54 (U)	7.56	—	5.07 (U)	0.507 (U)
0.7315 – 1.341	3.1	63.9	0.288 (U)	0.54 (U)	6.04	—	4.63 (U)	0.463 (U)
0.7315 – 1.341	3.6	0.047	0.015 (U)	0.54 (U)	6.11	—	4.8 (U)	0.48 (U)
0.7315 – 1.341	0.15 (U)	0.025 (U)	0.015 (U)	0.02 (U)	0.15 (U)	—	0.25 (U)	0.025 (U)
0.7315 – 1.341	0.15 (U)	0.025 (U)	0.015 (U)	0.02 (U)	0.15 (U)	—	0.25 (U)	0.025 (U)
0.7315 – 1.341	0.15 (U)	0.004 (B)	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
1.524 – 2.286	3.57	56.5	0.18 (B)	0.73	8.44	—	0.314 (U)	0.209 (U)
1.524 – 2.286	2.88 (B)	59.1	0.29 (U)	0.4 (B)	5.5	—	4.83 (U)	0.483 (U)
1.524 – 2.286	4.18	71.3	0.16 (B)	0.42 (B)	9.54	—	4.66 (U)	0.466 (U)
1.524 – 2.286	3.61	64.4	0.169 (B)	0.31 (B)	8.77	—	4.92 (U)	0.492 (U)
1.524 – 2.286	4.17	81	0.226 (B)	0.36 (B)	13.6*	—	4.5 (U)	0.45 (U)
1.524 – 2.286	0.15 (U)	0.034	0.015 (U)	0.02 (U)	0.15 (U)	—	0.25 (U)	0.025 (U)
1.524 – 2.286	0.03 (U)	0.018	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
1.524 – 2.286	0.03 (U)	0.016	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
1.524 – 2.286	0.03 (U)	0.011	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
2.957 – 3.566	2.22	96.6	0.075 (B)	0.54 (U)	3.06	—	0.298 (U)	0.199 (U)
2.957 – 3.566	2.37	86.7	0.084 (B)	0.54 (U)	2.77	—	0.29 (U)	0.194 (U)
2.957 – 3.566	1.91 (B)	94.6	0.256 (U)	0.54 (U)	3.13	—	4.27 (U)	0.427 (U)
2.957 – 3.566	1.79 (B)	86.8	0.248 (U)	0.26 (B)	2.95	—	4.14 (U)	0.414 (U)
2.957 – 3.566	2.01 (B)	91.5	0.264 (U)	0.54 (U)	2.85	—	4.41 (U)	0.441 (U)
2.957 – 3.566	1.96 (B)	90.9	0.31 (U)	0.54 (U)	2.94 (B)	—	5.17 (U)	0.517 (U)
2.957 – 3.566	0.15 (U)	0.021 (B)	0.015 (U)	0.02 (U)	0.15 (U)	—	0.25 (U)	0.025 (U)
2.957 – 3.566	0.03 (U)	0.011	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
2.957 – 3.566	0.03 (U)	0.005 (B)	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
2.957 – 3.566	0.03 (U)	0.006	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
3.78 – 4.542	1.41	62.5	0.08 (B)	0.56 (U)	2.73	—	0.305 (U)	0.203 (U)
3.78 – 4.542	1.9 (B)	89.6	0.255 (U)	0.55 (U)	4.31	—	4.24 (U)	0.424 (U)
3.78 – 4.542	1.87 (B)	74.3	0.085 (B)	0.55 (U)	3.09	—	4.24 (U)	0.424 (U)
3.78 – 4.542	1.93 (B)	113	0.267 (U)	0.55 (U)	3.75	—	4.45 (U)	0.445 (U)

Table 12. Concentration of Metals from 1301-N Downgradient Characterization Borehole 199-N-185 Soil Samples

Sample Interval (m bgs)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Hexavalent Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
3.78 – 4.542	1.75 (B)	82.9	0.267 (U)	0.55 (U)	3.21	—	4.45 (U)	0.445 (U)
3.78 – 4.542	0.15 (U)	0.025 (U)	0.015 (U)	0.02 (U)	0.15 (U)	—	0.25 (U)	0.025 (U)
3.78 – 4.542	0.03 (U)	0.002 (B)	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
3.78 – 4.542	0.03 (U)	0.003 (B)	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)
3.78 – 4.542	0.03 (U)	0.005 (U)	0.003 (U)	0.02 (U)	0.03 (U)	—	0.05 (U)	0.005 (U)

Note: Laboratory qualifiers associated with the sample results are provided in parentheses following the reported result. Laboratory qualifiers include the following:

B = INORGANICS and WETCHEM: The analyte was detected at a value less than the contract required detection limit but greater than or equal to the instrument detection limit/method detection limit (as appropriate).

U = Analyzed for but not detected above limiting criteria.

*This value is considered to be an outlier to the other duplicate/split samples collected at this interval. Mean concentration from all samples collected at this interval (nine samples) is below the 90th percentile background and cleanup levels presented in Table 2.

bgs = below ground surface

Table 13. Well 199-N-182 Groundwater Sample Data for Metals

Sample Date	Arsenic (µg/L)	Barium (µg/L)	Cadmium (µg/L)	Hexavalent Chromium (µg/L)	Lead (µg/L)	Mercury (µg/L)	Selenium (µg/L)	Silver (µg/L)
4/3/2012	1.46 (BD)	70	4 (U)	2 (U)	0.1 (UD)	0.1 (UD)	2 (UD)	4 (U)
8/23/2012	—	68.7	4 (U)	—	—	—	—	4 (U)
9/25/2013	—	60.3	4 (U)	—	—	—	—	4 (U)
9/15/2014	1.8 (U)	59.4	0.34 (U)	—	—	—	—	0.99 (U)
9/8/2015	1.7 (U)	57.1	0.11 (U)	—	0.5 (U)	—	1.5 (U)	0.2 (U)

Note: Laboratory qualifiers associated with the sample results are provided in parentheses following the reported result. Laboratory qualifiers include the following:

B = INORGANICS and WETCHEM: The analyte was detected at a value less than the contract required detection limit but greater than or equal to the instrument detection limit/method detection limit (as appropriate).

D = INORGANICS/WETCHEM: Analyte was identified in an analysis at a secondary dilution factor (i.e., dilution factor different than 1.0).

U = Analyzed for but not detected above limiting criteria.

Table 14. Well 199-N-183 Groundwater Sample Data for Metals

Sample Date	Arsenic (µg/L)	Barium (µg/L)	Cadmium (µg/L)	Hexavalent Chromium (µg/L)	Lead (µg/L)	Mercury (µg/L)	Selenium (µg/L)	Silver (µg/L)
4/18/2011	6.56 (B)	214 (D)	1 (U)	2 (U)	4.09 (D)	0.1 (UD)	10 (U)	5 (U)
4/19/2011	1.67 (BD)	155 (DN)	0.2 (UD)	2 (U)	0.459 (BD)	0.1 (UD)	0.65 (BD)	0.2 (UD)
4/19/2011	0.8 (UD)	149 (DN)	0.2 (UD)	2 (U)	0.643 (BD)	0.1 (UD)	0.6 (UD)	0.2 (UD)
4/20/2011	0.8 (UD)	115 (D)	0.2 (UD)	2 (U)	0.866 (BD)	0.1 (UD)	0.6 (UD)	0.2 (UD)
4/20/2011	1.03 (BD)	81.8 (D)	0.2 (UD)	2 (U)	0.818 (BD)	0.1 (UD)	0.799 (BD)	0.2 (UD)
4/25/2011	0.8 (UD)	65.5 (D)	0.2 (UD)	2 (U)	0.2 (UD)	0.1 (UD)	0.617 (BD)	0.2 (UD)
4/26/2011	0.8 (UD)	56.4 (D)	0.2 (UD)	2 (U)	0.2 (UD)	0.1 (UD)	0.655 (BD)	0.2 (UD)
4/13/2012	4.76 (D)	216	4 (U)	4.8 (BN)	0.42 (BD)	0.1 (UDX)	2 (UD)	4 (U)
8/24/2012	—	195	4 (U)	2 (U)	—	—	—	4 (U)
6/20/2013	6.49 (B)	226	1 (U)	—	3.3 (U)	—	6 (U)	1 (U)
9/19/2013	—	234	4 (U)	7.2	—	—	—	4 (U)
12/17/2013	7.8 (B)	205	1 (U)	—	3.3 (U)	—	7.94 (B)	1 (U)
6/17/2014	5 (U)	187	1 (U)	—	3.3 (U)	—	6 (U)	2.6 (B)
9/16/2014	8.9 (U)	188	1.7 (U)	8 (U)	—	—	—	5 (U)
1/21/2015	1.7 (U)	177	0.11 (U)	—	0.5 (U)	—	1.5 (U)	0.2 (U)
7/28/2015	3.36 (B)	173	0.11 (U)	—	0.5 (U)	—	1.5 (U)	0.2 (U)
9/16/2015	2.4 (B)	185	0.18 (B)	3.9 (B)	0.65 (BC)	—	1.6 (U)	0.82 (U)
2/17/2016	3.29 (B)	213 (D)	0.11 (U)	—	0.5 (U)	—	1.5 (U)	0.2 (U)
7/24/2016	3.2 (B)	199	0.11 (U)	—	0.5 (U)	—	1.5 (U)	0.2 (U)
9/30/2016	2.3	200	0.099 (U)	6.8	0.71 (B)	—	0.66 (U)	0.039 (U)
12/28/2016	2.82 (B)	178	0.3 (U)	—	0.5 (U)	—	2 (U)	0.4 (U)
7/11/2017	2.63 (B)	215	0.351 (B)	—	2.62	—	2 (U)	0.392 (B)
11/9/2017	4.8 (BD)	209 (D)	0.2 (UD)	6.5	3.4 (D)	—	2 (UD)	0.9 (UD)
6/22/2018	1.1 (B)	207	0.27 (U)	—	0.63 (B)	—	0.7 (U)	0.36 (B)

Note: Laboratory qualifiers associated with the sample results are provided in parentheses following the reported result. Laboratory qualifiers include the following:

B = INORGANICS and WETCHEM: The analyte was detected at a value less than the contract required detection limit but greater than or equal to the instrument detection limit/method detection limit (as appropriate).

D = INORGANICS/WETCHEM: Analyte was identified in an analysis at a secondary dilution factor (i.e., dilution factor different than 1.0).

N = Spike sample recovery is outside control limits.

U = Analyzed for but not detected above limiting criteria.

X = Other specific flags and notes required to properly qualify the result are described in the hardcopy sample data summary package and/or case narrative.

Table 15. Well 199-N-184 Groundwater Sample Data for Metals

Sample Date	Arsenic (µg/L)	Barium (µg/L)	Cadmium (µg/L)	Hexavalent Chromium (µg/L)	Lead (µg/L)	Mercury (µg/L)	Selenium (µg/L)	Silver (µg/L)
9/8/2011	2.7 (B)	69.9	1 (U)	3.7 (U)	10 (U)	0.06 (UN)	3.9 (B)	5 (U)
9/13/2011	1.2 (B)	70.8	0.1 (U)	2 (U)	1.5 (B)	0.19 (BN)	1.6 (U)	0.04 (U)
9/14/2011	1.6 (B)	104	0.1 (U)	2 (U)	2.3 (B)	0.06 (UN)	1.6 (U)	0.04 (U)
9/15/2011	2.7 (U)	71.2	0.91 (U)	2 (U)	1.5 (U)	0.21	5 (U)	6 (U)
9/16/2011	2.7 (U)	46.8 (B)	0.91 (U)	2 (U)	1.5 (U)	0.2	5 (U)	6 (U)
4/3/2012	1.98 (BD)	68 (D)	4 (U)	2 (U)	0.1 (UD)	0.1 (UD)	2 (UD)	4 (U)
8/23/2012	—	35.5	4 (U)	—	—	—	—	4 (U)
9/26/2013	—	56.6	4 (U)	—	—	—	—	4 (U)
9/9/2014	2.3 (B)	47.4 (B)	0.34 (U)	—	—	—	—	0.99 (U)
9/16/2015	1.73 (B)	53.7	0.11 (U)	—	0.5 (U)	—	1.5 (U)	0.2 (U)

Note: Laboratory qualifiers associated with the sample results are provided in parentheses following the reported result. Laboratory qualifiers include the following:

B = INORGANICS and WETCHEM: The analyte was detected at a value less than the contract required detection limit but greater than or equal to the instrument detection limit/method detection limit (as appropriate).

D = INORGANICS/WETCHEM: Analyte was identified in an analysis at a secondary dilution factor (i.e., dilution factor different than 1.0).

N = Spike sample recovery is outside control limits.

U = Analyzed for but not detected above limiting criteria.

Table 16. Well 199-N-185 Groundwater Sample Data for Metals

Sample Date	Arsenic (µg/L)	Barium (µg/L)	Cadmium (µg/L)	Hexavalent Chromium (µg/L)	Lead (µg/L)	Mercury (µg/L)	Selenium (µg/L)	Silver (µg/L)
3/22/2011	10 (U)	32.4	1 (U)	3.7 (U)	10 (U)	0.1 (UD)	10 (U)	5 (U)
3/23/2011	0.8 (UD)	43.1 (D)	0.2 (UD)	2 (U)	0.605 (BD)	0.1 (UD)	0.754 (BD)	0.2 (UD)
3/24/2011	0.8 (UD)	42.9 (D)	0.2 (UD)	2 (UN)	0.514 (BD)	0.1 (UD)	1.84 (BD)	0.2 (UD)
3/25/2011	0.8 (UD)	55.2 (D)	0.453 (BD)	2 (U)	1.26 (BD)	0.1 (UD)	1.76 (BD)	0.2 (UD)
3/28/2011	1.6 (BD)	46.2 (D)	0.2 (UD)	2 (UN)	1.62 (BD)	0.1 (UD)	1.22 (BD)	0.2 (UD)
4/26/2012	1.4 (B)	26.1	4 (U)	2 (U)	0.1 (UD)	0.1 (UD)	2 (UD)	4 (U)
8/27/2012	—	23.6	4 (U)	—	—	—	—	4 (U)
11/13/2013	—	28	4 (U)	—	—	—	—	4 (U)
3/26/2014	25 (U)	28.6	4 (U)	—	25 (U)	—	—	5 (U)
6/3/2014	5 (U)	27.8	1 (U)	—	3.3 (U)	—	—	1 (U)
6/3/2014	10.7 (B)	28	1 (U)	—	3.3 (U)	—	—	1 (U)
9/11/2014	5 (U)	34.5	1 (U)	—	3.3 (U)	—	—	1 (NU)

Table 16. Well 199-N-185 Groundwater Sample Data for Metals

Sample Date	Arsenic (µg/L)	Barium (µg/L)	Cadmium (µg/L)	Hexavalent Chromium (µg/L)	Lead (µg/L)	Mercury (µg/L)	Selenium (µg/L)	Silver (µg/L)
9/14/2015	2.2 (B)	31.3	0.1 (U)	—	0.19 (B)	—	1.6 (U)	0.82 (U)

Note: Laboratory qualifiers associated with the sample results are provided in parentheses following the reported result. Laboratory qualifiers include the following:

B = INORGANICS and WETCHEM: The analyte was detected at a value less than the contract required detection limit but greater than or equal to the instrument detection limit/method detection limit (as appropriate).

D = INORGANICS/WETCHEM: Analyte was identified in an analysis at a secondary dilution factor (i.e., dilution factor different than 1.0).

N = Spike sample recovery is outside control limits.

U = Analyzed for but not detected above limiting criteria.

6 2016 Groundwater Assessment

In December 2016, groundwater samples were collected from the 100-N Area RCRA unit monitoring networks to analyze for the constituents identified in Ecology Publication 97-407, *Chemical Test Methods For Designating Dangerous Waste WAC 173-303-090 & -100*, Appendix 5; and the metals identified in 40 CFR 265, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," Appendix III. The sampling results were documented in 17-AMRP-0157, "Evaluation of Assessment Samples for 1301-N, 1325-N, and 1324-N and 1324-NA."

The groundwater quality assessment sampling identified 23 potentially dangerous waste/dangerous waste constituents in the December 2016 samples. Each of the elevated results was evaluated and determined not to be associated with the 100-N Area RCRA units based on a comparison to background, laboratory quality control data limits, and spatial distribution in relationship to past and present groundwater flow direction.

7 Conclusions

Identified RCRA metals were sporadically detected in the vadose zone within and adjacent to the 1301-N and 1325-N. DWMUs. The detections do not indicate sources of contamination from 1301-N or 1325-N based on an evaluation that identified the results as outliers based on duplicate sample data, or estimated values below the laboratory practical quantification limit based on laboratory qualifiers. The soil concentration for all metals were below soil cleanup criteria for protection of groundwater and the Columbia River established in the 100-N Area RD/RAWP (DOE/RL-2005-93) (shown in Table 2). The data from samples collected within the former crib and trench locations at the 1301-N LWDF and the former crib location at the 1325-N LWDF from 4.6 m (15 ft) bgs down to the water table support closure of the units as provided in 15-AMRP-0088 and 05-AMRC-0214. The data are consistent with earlier CVP sampling results provided for both units for the upper portion of the soil column (0 to 4.6 m [0 to 15 ft] bgs).

The concentration of the RCRA metals detected in groundwater samples from the remedial investigation wells (listed in Table 3) were all below the 90th percentile Hanford Site background or drinking water criteria, except for one sample for arsenic from well 199-N-185, where the sample result for the duplicate sample was below detection. The groundwater quality assessment for December 2016 sampling determined that the detection of regulated constituents was not associated with the 100-N Area RCRA units based on a comparison to background, laboratory quality control data limits, and spatial distribution in relationship to past and present groundwater flow direction.

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