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Revision 0

Response Action Report for 200-MG-1 Operable Unit Waste Site 600-65

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

U.S. DEPARTMENT OF ENERGY
Richland Operations Office

P.O. Box 550
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O. A. Farabee
U.S. Department of Energy, Richland Operations Office

O A Farabee — Signature

4/11/11 — Date

Executive Summary

This response action report documents the successful completion of the removal action conducted at the 600-65 waste site, also known as the 607 batch plant drum site. The alternative proposed in DOE/RL-2008-44, *Engineering Evaluation/Cost Analysis for the 200-MG-1 Operable Unit Waste Sites* (EE/CA),[1] and selected in DOE/RL-2009-86, *Action Memorandum for Non-Time-Critical Removal Action for 37 Waste Sites in the 200-MG-1 Operable Unit* (Action Memorandum)[2] was removal, treatment, and disposal (RTD).

The 600-65 waste site was investigated between June 2010 and February 2011 through field observations and sampling to determine the nature and extent of contaminants of potential concern (COPCs) present in the waste site soils as part of the selected removal action alternative of RTD prescribed in the Action Memorandum. This investigation was performed in accordance with DOE/RL-2009-53, *Revision 1, Removal Action Work Plan for 48 Waste Sites in the 200-MG-1 Operable Unit*[3] and DOE/RL-2009-60, *Revision 1, Sampling and Analysis Plan for Selected 200-MG-1 Operable Unit Waste Sites.*[4] Through the investigation summarized in this report, it was found that analytical results from investigative sampling demonstrated that soil conditions at the waste site achieved the removal action levels for all COPCs and met the removal action objectives without implementation of the RTD alternative. Therefore, in accordance with the methodology prescribed in the Action Memorandum, the alternative was changed from RTD to confirmatory sampling/no further action.

The results show that the residual soil concentrations of COPCs support reasonably anticipated future land uses recognized in the EE/CA and Action Memorandum. These results also support reclassification to "interim closed out" status in accordance with the

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[1] DOE/RL-2008-44, 2009, *Engineering Evaluation/Cost Analysis for the 200-MG-1 Operable Unit Waste Sites*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=0096350.

[2] DOE/RL-2009-86, 2010, *Action Memorandum for Non-Time-Critical Removal Action for 37 Waste Sites in 200-MG-1 Operable Unit*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=0084449.

[3] DOE/RL-2009-53, 2010, *Removal Action Work Plan for 48 Waste Sites in the 200-MG-1 Operable Unit*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=0912100290.

[4] DOE/RL-2009-60, 2010, *Sampling and Analysis Plan for Selected 200-MG-1 Operable Unit Waste Sites*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=1003290272.

process described in RL-TPA-90-0001, *Tri-Party Agreement Handbook Management Procedures, Guideline Number TPA-MP-14, "Maintenance of the Waste Information Data System (WIDS)."*[5] No institutional controls were required because no deep zone was associated with the 600-65 waste site.

This waste site and the data obtained from the subject sampling evolution will be included in the risk assessment and remedial investigation/feasibility study for final remedial decisions of the Outer Area.

[5] RL-TPA-90-0001, 2007, *Tri-Party Agreement Handbook Management Procedures*, Guideline Number TPA-MP-14, "Maintenance of the Waste Information Data System (WIDS)," Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www.hanford.gov/hanford/files/TPA-MP14.pdf.

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Terms

BS	biased sample
bgs	below ground surface
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
COPC	contaminant of potential concern
CS/NFA	confirmatory sampling/no further action
DOE	U.S. Department of Energy
DQA	data quality assessment
Ecology	Washington State Department of Ecology
EE/CA	*Engineering Evaluation/Cost Analysis for the 200-MG-1 Operable Unit Waste Sites*
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
FS	focused sample
GPR	ground penetrating radar
GPS	global positioning system
HEIS	Hanford Environmental Information System
N/A	not applicable
NA	not available
NPL	National Priorities List
O&M	operations and maintenance
OU	operable unit
PCB	polychlorinated biphenyl
QA	quality assurance
QC	quality control
RAL	removal action level
RAO	removal action objective
RAWP	*Removal Action Work Plan for 48 Waste Sites in the 200-MG-1 Operable Unit*
RDL	required detection limit

RI/FS	remedial investigation/feasibility study
ROD	record of decision
RTD	removal, treatment, and disposal
SAP	*Sampling and Analysis Plan for Selected 200-MG-1 Operable Unit Waste Sites*
TPH	total petroleum hydrocarbon
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
WIDS	Waste Information Data System

1 Introduction

This report documents the successful completion of a non-time-critical removal action conducted at the 600-65 waste site. The removal action alternative of removal, treatment, and disposal (RTD) was selected for this waste site, as proposed in DOE/RL-2008-44, *Engineering Evaluation/Cost Analysis for the 200-MG-1 Operable Unit Waste Sites* (EE/CA) and authorized by DOE/RL-2009-86, *Action Memorandum for Non-Time-Critical Removal Action for 37 Waste Sites in the 200-MG-1 Operable Unit* (Action Memorandum). Investigative sampling results demonstrated that the waste site achieved compliance with the removal action levels (RALs) without implementation of the RTD alternative. Using the methodology prescribed in the Action Memorandum, based on the investigative sampling results, the alternative was changed from RTD to confirmatory sampling/no further action (CS/NFA).This documentation has been prepared based on U.S. Environmental Protection Agency (EPA) guidance provided in EPA 540-R-98-016, *Close Out Procedures For National Priorities List Sites.*

This report provides a summary of the actions taken and resulting data to support a determination that, through the performance of investigative sampling, conditions remaining at the 600-65 waste site have achieved the established removal action objectives (RAOs) provided in the Action Memorandum without implementation of the RTD alternative. The documentation process is consistent with the U.S. Department of Energy (DOE) *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) Remedial Action Site Closure Guidance.

Statutory authority for the action taken is in accordance with CERCLA; Executive Order 12580, the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al., 1989), also known as the Tri-Party Agreement, and 40 Code of Federal Regulations 300, "National Oil and Hazardous Substances Pollution Contingency Plan."

In February 2011, non-time-critical removal action for the 600-65 waste site was completed in accordance with DOE/RL-2009-53, *Removal Action Work Plan for 48 Waste Sites in the 200-MG-1 Operable Unit* (RAWP). This report provides the following information relative to the completion of the subject removal action:

- Background, historical information, regulatory enforcement history, and environmental setting pertinent to this removal action
- A description of the selected alternative, RAOs, and exposure and land use assumptions provided in the related regulatory documents
- A summary of the completed actions, the resulting data collected in support of completion of that removal action, a comparison of that data against objectives, and demonstration that RAOs have been met

1.1 Site Description

General information on the Hanford Site and the 200-MG-1 Operable Unit (OU) provides a background of the 600-65 waste site and the development of the removal action for the 600-65 waste site and is described in the subsections that follow.

1.1.1 Hanford General Site Information

The Hanford Site, which is part of the DOE nuclear weapons complex, occupies approximately 1,517 km^2 (586 mi^2) and is located along the Columbia River in Benton County, northwest of the City of Richland in the Lower Columbia Basin in southeastern Washington State (Figure 1-1). From the early 1940s to

approximately 1989, the Hanford Site mission included building the world's first large scale plutonium production facility; until the 1980s, the site was used to produce plutonium for nuclear weapons. Other activities included nuclear research, development, and nuclear materials production. These activities created a wide variety of chemical and radioactive wastes that were released into the environment. The Hanford Site mission is now focused on the cleanup of those wastes and ultimate closure of the Hanford Site.

1.1.2 200-MG-1 Operable Unit

The Washington State Department of Ecology (Ecology), DOE, and EPA created the 200-MG-1 OU through the Tri-Party Agreement Milestone M-015-06-02 and Tri-Party Agreement Change Request C-06-02. The 200-MG-1 OU is made up of waste sites in the 200 East Area, 200 West Area, and 600 Area of the Hanford Site. The 600 Area encompasses those areas south of the Columbia River that are not part of another designated area (i.e., 300 Area, 200 East Area, and 100-K) and are not specifically identified (Figure 1-1). The 200-MG-1 OU waste sites consist of French drains, trenches, cribs, ditches, and retention basins with shallow contamination (generally less than 4.6 m [15 ft] deep) where chemical and radioactive contaminants were released during material transfers (i.e., unplanned release sites). Additionally, some 200-MG-1 OU sites were produced by airborne dissemination of radioactive particles or biodegradation and dispersion of plant or animal matter. For those sites containing radionuclides, the radionuclide inventory for this conceptual model group does not include transuranic isotopes greater than or equal to 100 nCi/g.

All the waste sites contained in the 200-MG-1 OU are located within the Central Plateau, as described in the EE/CA and Action Memorandum. The 600-65 waste site is located west of the 200 East Area and north of the Environmental Restoration Disposal Facility (ERDF), near an unmarked dirt road (Figure 1-2).

1.2 Regulatory and Enforcement History

As discussed in Section 1, statutory authority for this removal action is taken in accordance with CERCLA. Further governing requirements for compliance with CERCLA and the *Resource Conservation and Recovery Act of 1976* activities at Hanford are in accordance with the Tri-Party Agreement. The Hanford Site was proposed for inclusion in 53 FR 23988, "National Priorities List for Uncontrolled Hazardous Waste Sites – Update 7," hereafter referred to as the National Priorities List (NPL), and was placed on the NPL on November 3, 1989 (54 FR 41015, "National Priorities List for Uncontrolled Hazardous Waste Sites – Final Rule 10/04/89") by the EPA. The EPA placed the four aggregate areas (i.e., the 100, 200, 300, and 1100 Areas) on the NPL. The 200 Area NPL site consists of the 200 West Area and 200 East Area, which contain waste management facilities and inactive irradiated fuel reprocessing facilities. The site also includes the 200 North Area, formerly used for interim storage and staging of irradiated fuel, and the waste sites assigned to the 200-MG-1 OU.

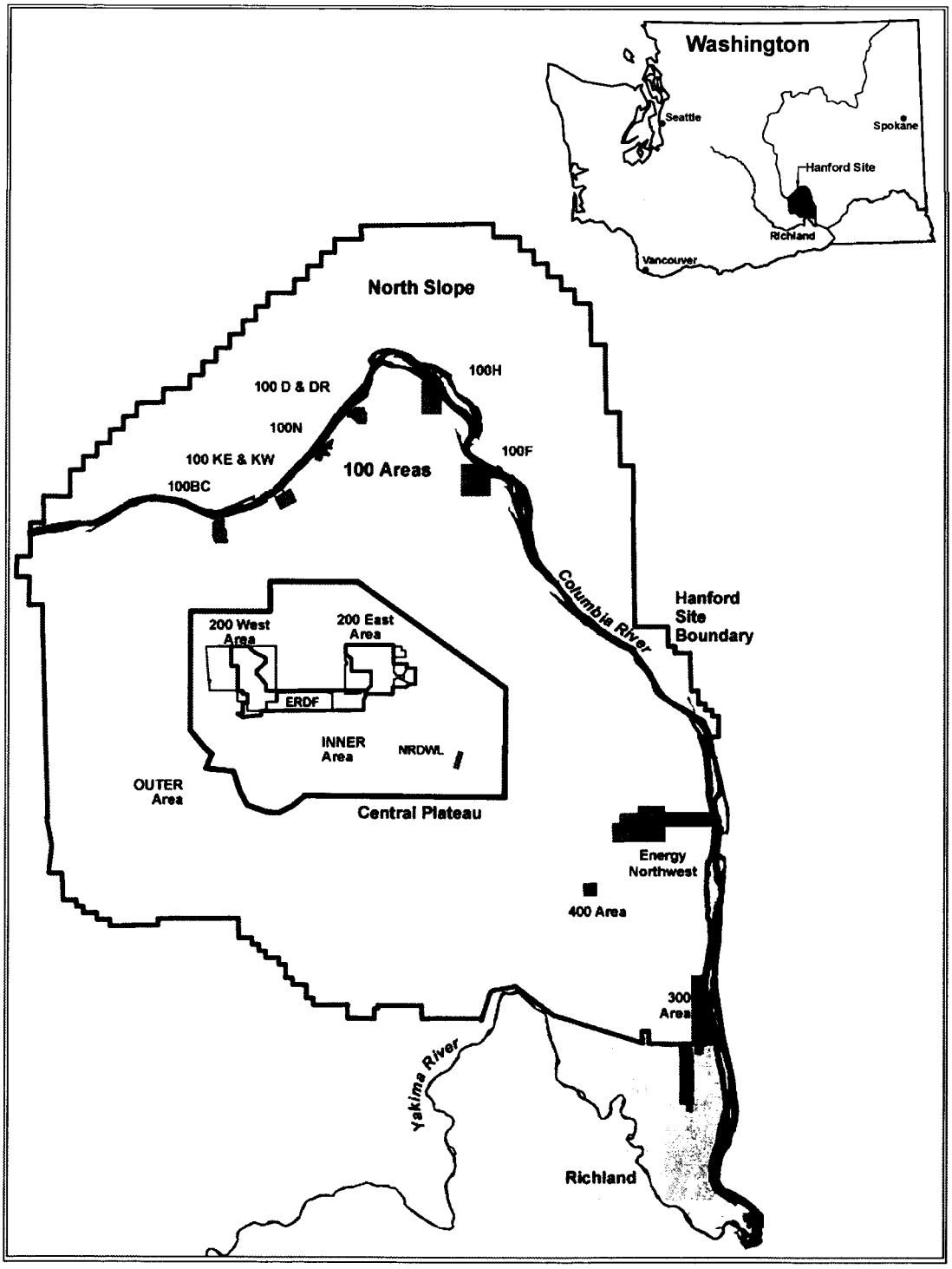

Figure 1-1. Location of the Hanford Site in Washington State

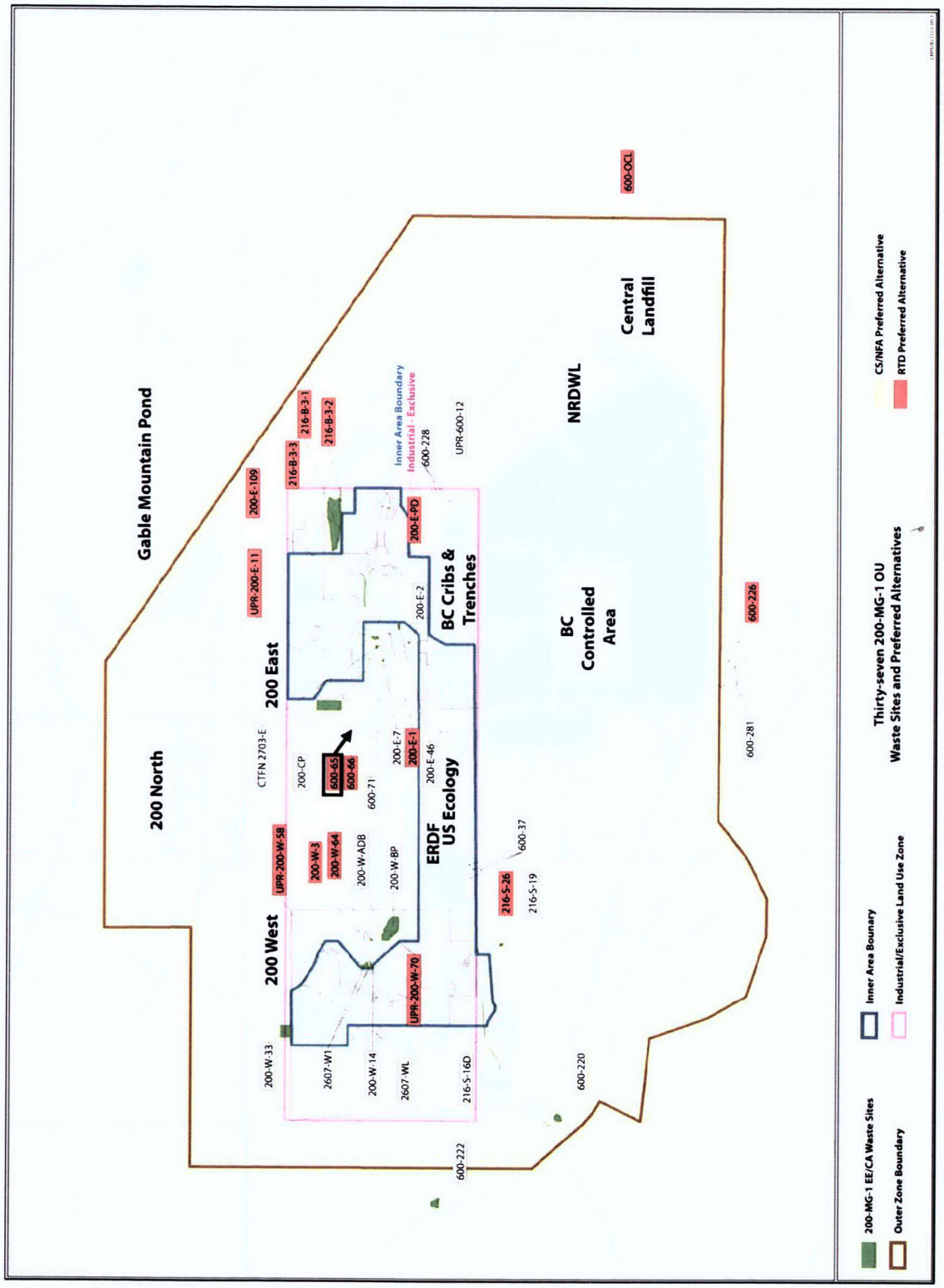

Figure 1-2. 200-MG-1 Operable Unit and 600-65 Waste Site

1.3 Environmental Setting

The Hanford Site is located within the semiarid Pasco Basin in the northern portion of the Columbia Plateau. Normal annual precipitation is 17.7 cm (7 in.). According to PNL-10285, *Estimated Recharge Rates at the Hanford Site*, approximately 2.6 to 17.3 mm (0.1 to 0.7 in.) per year recharge is estimated in the 100 Area. Bedrock beneath the site is basalt of the Columbia River Basalt Group.

The Ringold Formation and the Hanford formation cover the basalt throughout the Central Plateau. Poorly consolidated, river-deposited, well-drained sands, gravels, cobbles, and boulders dominate these units. The Ringold Formation is an interstratified sequence of unconsolidated clay, silt, sand, and gravel-to-cobble sediment deposited by the ancestral Columbia River. The Hanford formation consists of uncemented gravels, sands, and silts deposited by Pleistocene cataclysmic floodwaters. Groundwater from the Hanford Site discharges to the Columbia River, which is the dominant surface water body of the Hanford Site. The direction of groundwater flow beneath the Central Plateau is toward the east-northeast. The uses of the Columbia River include the production of hydroelectric power, irrigation, drinking water, recreation, and natural resources.

The average depth from ground surface to groundwater beneath the 200 Area ranges from 50 m (164 ft) to greater than 100 m (328 ft). Additional details on the geology and hydrogeology underlying the 200 Area and the 200-MG-1 OU are not provided in the base removal action documents, because the 200-MG-1 OU was created for shallow zone (less than 4.6 m [15 ft] in depth) waste sites, which are assumed not to be a threat to groundwater quality. This assumption is based on historical and process knowledge regarding volumes of liquids discharged, lack of mobility of contaminants, and shallow depth of the discharge(s).

The nearest natural surface water body to the 600-65 waste site is the Columbia River, located approximately 10.5 km (6.2 mi) north-northwest of the waste site. The potential for natural groundwater recharge within the 200 North Area is limited to precipitation infiltration. Estimates of recharge from precipitation at the Hanford Site range from 0 to 10 cm (0 to 4 in.) per year.

2 Waste Site Background

This section provides a description of the 600-65 waste site, information on process and background, describes the selected alternative, and delineates the RAOs and cleanup standards applicable to this removal action as prescribed in the Action Memorandum.

2.1 Waste Site 600-65 Background

The 600-65 waste site is located west of the 200 East Area and north of ERDF, near an unmarked dirt road, adjacent to an aboveground drainage pipe and soil berm (Figure 2-1). The waste site was identified and entered into the Waste Information Data System (WIDS) in April 1995 and was characterized in WIDS as a dumping area for miscellaneous debris, approximately 12 m^2 (130 ft^2) in area. Observations made during a site evaluation in August 1995 indicated the presence of debris including two drums, an oil filter, and a concrete block, but there was no evidence of spilled materials or waste within the area. Global positioning system (GPS) coordinates of the drums were collected during the site evaluation.

Figure 2-1. 600-65 Waste Site

The release mechanism for this site is documented as miscellaneous dumping of debris, and the waste matrix is solid in nature. No evidence exists (historical or present) that chemical or radiological processes involving sustained release of materials are associated with this site. Potential contaminants are nonradiological and solid (in their current forms) in nature.

2.2 Description of the Selected Alternative

As stated in the EE/CA and Action Memorandum, the selected alternative for the subject waste site was RTD. This alternative was selected because, based on the types of debris present, concentrations of contaminants of potential concern (COPCs) had the potential to exceed the RALs. Investigative sampling and analysis demonstrated that soil concentrations of COPCs were less than or equal to the RALs without

the need for further action. As a result, in accordance with the Action Memorandum, the alternative was changed to CS/NFA. Activities involved in the CS/NFA action set forth in the RAWP and DOE/RL-2009-60, *Sampling and Analysis Plan for Selected 200-MG-1 Operable Unit Waste Sites* (SAP) included soil sampling to confirm that the remaining in situ soil contaminant concentrations are less than or equal to established RALs, and that no additional removal action is required. The general sampling design criteria are provided in this section followed by a summary of removal action history, specific sampling design and methodology, and analytical results for the 600-65 waste site.

The following key features relevant to the 600-65 waste site were considered during development of a sample design:

- Direct visual inspection of the site surface was performed, using available site information as a guide for visual cues such as staining, discoloration, absence of vegetation, and other anomalies.
- Radiological field screening was performed at the surface of the waste site to provide an indication of the presence of radiological COPCs.
- Both focused sampling and random sampling were considered appropriate for the investigative sampling evolution, conducted in accordance with the methodology prescribed in the SAP.

Based on these key design features, soil samples were collected from the 600-65 waste site and analyzed for COPC concentrations. Evaluation of analytical results from the investigative sampling evolution demonstrated that residual concentrations of COPCs in soil were less than or equal to the established RALs for COPCs applicable to 600-65 waste site, resulting in the implementation of the CS/NFA alternative. Table 5-2 provides the maximum concentrations for each COPC from the investigative sampling analytical data. Table A-1 provides a detailed summary of all analytical data results for sampling conducted at the 600-65 waste site (Appendix A).

Personnel with current training and qualifications performed field radiological surveying of the samples and sampling locations during the sampling evolution. Survey methods and practices were performed in accordance with established contractor methods and protocols. Of the radiological surveys performed for the 600-65 waste site, no radiological dose readings were greater than the measured background, and no radiological contamination was found.

2.2.1 Removal Action Objectives

The removal action alternatives for the 200-MG-1 OU waste sites were evaluated based on their overall ability to protect human health and the environment and their effectiveness in maintaining both short-term and long-term protection. The selected alternative must meet the following RAOs established in the Action Memorandum:

- **RAO 1**—Prevent unacceptable risk to human health and ecological receptors from exposure to soils and/or debris contaminated with nonradiological constituents to 4.6 m (15 ft) below ground surface (bgs) at concentrations above the appropriate RALs.
- **RAO 2**—Prevent unacceptable risk to human health and ecological receptors from exposure to soils and/or debris contaminated with radiological constituents to 4.6 m (15 ft) bgs at concentrations above the appropriate RALs.
- **RAO 3**—Control the sources of groundwater contamination to minimize impacts to groundwater resources, protect the Columbia River from adverse impacts, and reduce the degree of groundwater cleanup that may be required under future action.

- **RAO 4**—Prevent adverse impacts to cultural resources and threatened or endangered species and minimize wildlife habitat disruption.

The RALs for the waste sites identified in the Action Memorandum are based on the RAOs described above. These RALs are based on attainment of acceptable levels of human health, ecological risk, and protection of groundwater, but are not less than background levels or detection limits for waste sites. Attainment of RALs is intended to meet the first three RAOs and is expected to satisfy the remedial action objectives established in the final record of decision (ROD). The fourth RAO is met through cultural and ecological reviews performed before starting removal action activities. Table 2-1 lists the RALs applicable to the 600-65 waste site. Attainment of the established RALs and corresponding RAOs is described in Section 5 of this report.

Table 2-1. Nonradiological Removal Action Levels

Contaminant of Potential Concern	Background Concentration[a] (mg/kg)	Direct Exposure[b] (mg/kg)	Groundwater Protection[c] (mg/kg)	Required Detection Limit (mg/kg)	Removal Action Levels (mg/kg)
Antimony	5	32	5.4	0.6	5.4
Arsenic	6.5	6.5[d]	6.5[d]	1.0	6.5[d]
Barium	132	16,000	1,650	2	1,650
Beryllium	1.51	160	63.2	0.5	63.2
Boron	NA	16,000	210	2	210
Cadmium	0.81	80	0.81[d]	0.5	0.81[d]
Chromium (Total)	18.5	120,000	2,000	1	2,000
Chromium (VI)	NA	240	--[e]	0.5	--[e]
Cobalt	15.7	24	15.7[d]	2	15.7[d]
Copper	22.0	3,200	284	1	284
Lead	10.2	250	3,000	5.0	250
Lithium	33.5	160	192	2.5	160
Manganese	512	3,760	512[d]	5	512[d]
Mercury	0.33	24	2.09	0.2	2.09
Nickel	19.1	1,600	130	4	130
Selenium	0.78	400	5.2	1	5.2
Silver	0.73	400	13.6	0.2	13.6
Strontium	NA	48,000	2,920	1	2,920
Tin	NA	48,000	48,000	10	48,000
Uranium (Soluble Salts)	3.21	240	3.21[d]	1	3.21[d]
Vanadium	85.1	560	2,240	2.5	560

Table 2-1. Nonradiological Removal Action Levels

Contaminant of Potential Concern	Background Concentration[a] (mg/kg)	Direct Exposure[b] (mg/kg)	Groundwater Protection[c] (mg/kg)	Required Detection Limit (mg/kg)	Removal Action Levels (mg/kg)
Zinc	67.8	24,000	5,970	1	5,970
PCB Aroclor 1016	NA	0.5	0.094	0.017	0.094
PCB Aroclor 1221	NA	0.5	0.017[d]	0.017	0.017[d]
PCB Aroclor 1232	NA	0.5	0.017[d]	0.017	0.017[d]
PCB Aroclor 1242	NA	0.5	0.039	0.017	0.039
PCB Aroclor 1248	NA	0.5	0.039	0.017	0.039
PCB Aroclor 1254	NA	0.5	0.066	0.017	0.066
PCB Aroclor 1260	NA	0.5	0.72	0.017	0.5
Acenaphthene	NA	4,800	98	0.33	98
Acenaphthylene	NA	4,800	98	0.33	98
Anthracene	NA	24,000	2,270	0.33	2,270
Benzo(a)anthracene	NA	1.37	0.86	0.33	0.86
Benzo(a)pyrene	NA	0.137	0.233[f]	0.33	0.33[d]
Benzo(b)fluoranthene	NA	1.37	2.95[f]	0.33	1.37
Benzo(g,h,i)perylene	NA	2,400	25,700	0.33	2,400
Benzo(k)fluoranthene	NA	1.37	2.95[f]	0.33	1.37
Chrysene	NA	13.7	9.56	0.33	9.56
Dibenz(a,h)anthracene	NA	1.37	4.29	0.33	1.37
Fluoranthene	NA	3,200	631	0.33	631
Fluorene	NA	3,200	101	0.33	101
Indeno(1,2,3-cd) pyrene	NA	1.37	8.33	0.33	1.37
Naphthalene	NA	1,600	4.46	0.33	4.46
Phenanthrene	NA	24,000	1,140	0.33	1,140
Pyrene	NA	2,400	655	0.33	655
Carbon Tetrachloride[g]	N/A	7.69	0.0031	0.005	0.005
Xylene[h]	N/A	16,000	14.6	0.01	14.6
Nitrate (as Nitrogen)	11.8	128,000	40	0.75	40
TPH-Diesel	NA	2,000	2,000	5	2,000
TPH-Kerosene	NA	2,000	2,000	5	2,000

Table 2-1. Nonradiological Removal Action Levels

Contaminant of Potential Concern	Background Concentration[a] (mg/kg)	Direct Exposure[b] (mg/kg)	Groundwater Protection[c] (mg/kg)	Required Detection Limit (mg/kg)	Removal Action Levels (mg/kg)
Fluoride[i]	N/A	4,800	16	5	16
Asbestos	N/A	N/A[j]	N/A[j]	N/A[j]	1 %[j]

a. If Hanford Site-specific background data are not available, values are then taken from Ecology Publication 94-115, *Natural Background Soil Metals Concentrations in Washington State*. Hanford Site background values are available from nonradiological background data in DOE/RL-92-24, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, Table D9-2.

b. Direct contact values were calculated based on WAC 173-340-740, "Model Toxics Control Act—Cleanup," "Unrestricted Land Use Soil Cleanup Standards," using method B methodology and assumptions.

c. The groundwater protection values were obtained using equations provided in WAC 173-340-747(4), "Model Toxics Control Act—Cleanup," "Deriving Soil Concentrations for Ground Water Protection," with the physical parameters obtained from the Washington State Department of Ecology website.

d. Where cleanup levels are less than background or RDLs, cleanup levels default to background or RDLs in accordance with WAC 173-340-700(6)(d), "Model Toxics Control Act—Cleanup," "Overview of Cleanup Standards," and WAC 173-340-707(2), "Model Toxics Control Act—Cleanup," "Analytical Considerations," respectively.

e. Based on process knowledge, chromium (VI) is not expected to be present at 200-MG-1 OU waste sites. The following values are given to help guide cleanup:

- 0.2 mg/kg is a calculated value using K_d=0, based on PNNL-13895, *Hanford Contaminant Distribution Coefficient Database and Users Guide*, and WAC 173-340-747, equation 747-1.
- 2.1 mg/kg is based on DOE/RL-96-17, *Remedial Design Report/Remedial Action Work Plan for the 100 Area.*
- 18.4 mg/kg is based on Ecology, 2007, Cleanup Levels and Risk Calculations (CLARC) database.

f. The soil concentration for protection of groundwater values for benzo(a)pyrene and benzo(k)fluoranthene were incorrectly reported in DOE/RL-2009-48, *Action Memorandum for Non-Time-Critical Removal Action for 11 Waste Sites in 200-MG-1 Operable Unit*, and have been corrected.

g. Carbon tetrachloride is applicable to 11 waste sites authorized by DOE/RL-2009-48.

h. Xylene is applicable only to the 200-W-3, 216-S-19 and 216-S-26 waste sites.

i. Fluoride is added as a COPC for select sites, such as 216-S-19 and 216-S-26, based on process history.

j. The removal action level for asbestos in soil is 1 percent by weight (measured using polarized light microscopy). EPA has used this value for determining if response actions for asbestos should be undertaken (*Clarifying Cleanup: Goals and Identification of New Assessment Tools for Evaluating Asbestos at Superfund Cleanups*, OSWER 9345.4-05 [EPA, 2004]). Further evaluation of removal actions for asbestos will be conducted as needed on a site-specific basis in the Outer Area RI/FS.

Ecological screening values, which are based on WAC 173-340-900 "Model Toxics Control Act—Cleanup," "Tables," Table 749-3, are used for screening purposes only and are not considered cleanup levels for this CERCLA removal action (described more fully in Section 5 of the Action Memorandum). If analytical results exceed the ecological values, the results will be further evaluated during the final ecological risk assessment in accordance with the remedial investigation/feasibility study (RI/FS) for the Central Plateau in order to make final cleanup decisions.

2.2.2 Exposure and Land-Use Assumptions

The 600-65 waste site is located within the Central Plateau, as discussed in more detail in the EE/CA and Action Memorandum for the 200-MG-1 OU. Land use for the Central Plateau is designated for reasonably anticipated future uses described in the EE/CA and Action Memorandum (for the purposes of this interim action, RAOs were selected that would support unrestricted land use).

2.2.3 Design Summary

The RTD action alternative was the selected alternative for the 600-65 waste site; however, investigative sampling and analysis were conducted which confirmed that residual concentrations of COPCs in soil is less than or equal to the RALs. The investigative sampling objectives for the 600-65 waste site included visual inspection and focused and random sampling of the waste site soil matrix as described in Section 3.1 of this report. Key features of the site-specific sampling design for the 600-65 waste site included the following:

- Direct visual inspection of the site surface was performed, using available site information as a guide for visual cues such as staining, discoloration, absence of vegetation, and other anomalies.
- Radiological field screening was performed at the surface of the waste site to provide an indication of the presence of radiological COPCs.
- Both focused sampling and random sampling were considered appropriate for the investigative sampling evolution and were conducted in accordance with the methodology prescribed in the SAP.

2.3 Decision Document Amendments, Significant Differences, or Waivers

No amendments to the EE/CA or Action Memorandum, or technical impracticability waivers were associated with this removal action. A Tri-Party Agreement change (TPA-CN-350) has been approved for the Action Memorandum to add sites to the scope of the removal action and had no affect on the previously authorized action or cleanup levels for this waste site.

3 Response Activity Summary

As stated in the EE/CA and Action Memorandum, the selected alternative for the 600-65 waste site was RTD. Under this alternative, investigative sampling and analysis was performed to determine waste site conditions prior to conducting RTD activities. Analytical results from the investigative sampling evolution showed COPC concentrations were less than the RALs at the 600-65 waste site, thereby demonstrating achievement of the RAOs. According to the provisions of the Action Memorandum, the CS/NFA alternative was implemented, and no further action was required.

3.1 Summary of Activities

The removal action at the 600-65 waste site was conducted between June 2010 and February 2011 and included the collection of focused and random samples from locations both within the boundaries of the waste site and in surrounding areas, as specified in Section 2.2, per the methodologies prescribed in the SAP. The following key activities were pertinent to the removal action at the 600-65 waste site:

- Collection of random samples and focused samples (FSs) or biased samples (BSs) based on visual indicators
- Laboratory analysis for COPCs and comparison of analytical data against established RALs

3.1.1 600-65 Waste Site Investigative Sampling

A site evaluation was performed on June 16, 2010, prior to performance of the investigative sampling evolution. This evaluation served to support job planning as well as completion of the visual inspection component of the RTD activities described in the SAP. The visual inspection incorporated observational indicators and historical information to identify sampling locations. Observations made during visual inspection indicated that soils had been pushed north to provide a level surface for construction of a pipeline located adjacent to the southern edge of the 600-65 waste site. The location at which the drums were previously observed appeared to have been covered by overburden most likely associated with construction of the pipeline, along with metal and concrete debris, which were observed east of the waste site. No visual indicators of contamination, such as stained soils or devegetated areas, were observed during site evaluation in the areas surrounding the approximate former location of the drums.

A ground penetrating radar (GPR) scan and metal detector survey performed at the last known location of the drums and oil filter (utilizing GPS coordinates) identified one anomaly within the WIDS boundary of the 600-65 waste site approximately 1 m (3 ft) bgs. A second anomaly was identified within a mound of overburden located northeast of the WIDS boundary. Based on observations made during site evaluation, one FS location and two BS locations were identified at the 600-65 waste site (Figure 3-1).

For radiological field screening at the 600-65 waste site, survey methods and practices were performed in accordance with established contractor methods and protocols by personnel with current training and qualifications. No radiological postings were present at the waste site. Of the radiological surveys performed during removal action activities, no radiological readings were greater than the measured background, and no radiological contamination was found. The site was confirmed to be a nonradiological site, and the radiological COPCs were eliminated from the list of analytes to be included in laboratory analysis.

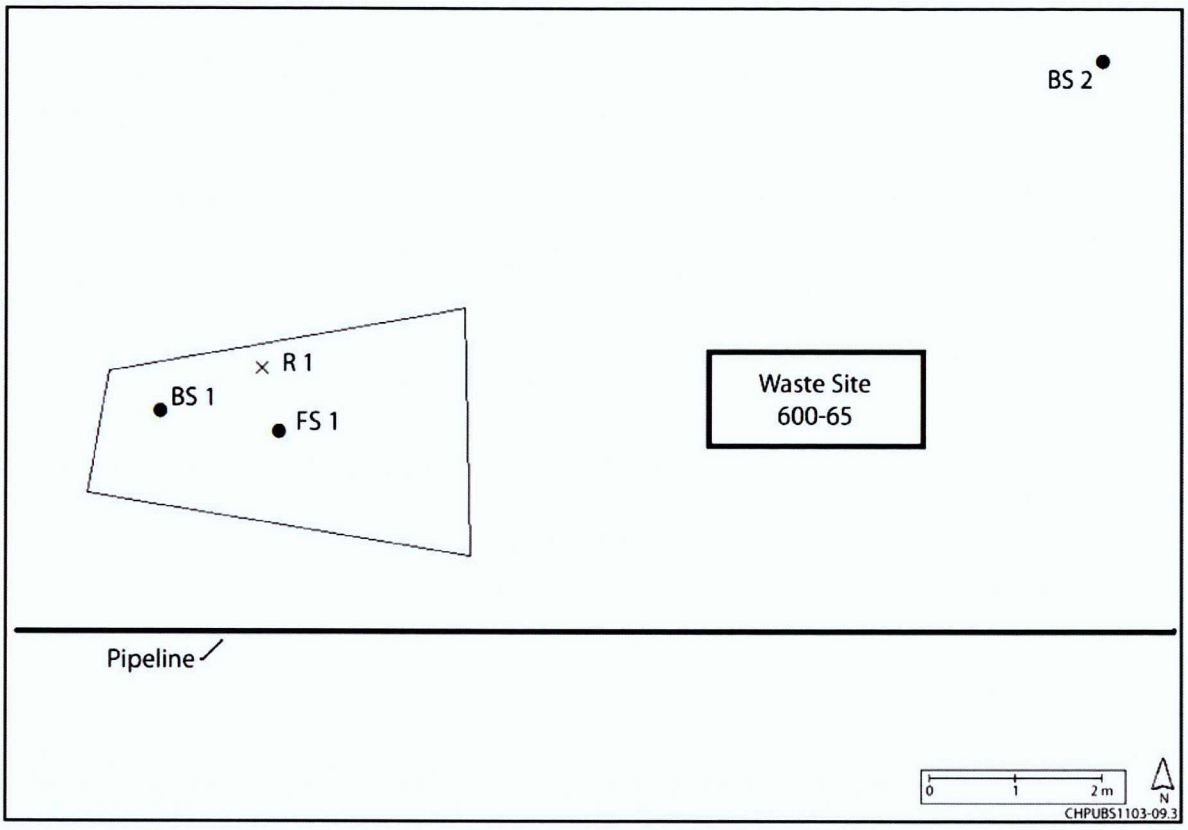

Figure 3-1. Investigative Sample Locations at the 600-65 Waste Site

Investigative sampling was conducted on January 19, 2011 at the 600-65 waste site. Two samples were collected from the last known location of the debris (FS 1) from 0.6 m (2 ft) bgs and from 1.2 m (4 ft) bgs. One additional surface sample (defined as 0 to 0.3 m [0 to 1 ft] bgs) was selected randomly (location R 1) using Visual Sample Plan[6] (VSP) software to further characterize the surface soils within the WIDS boundaries.

Two additional shallow sample locations (BS 1 and BS 2) were identified to further investigate the nature of the two geophysical anomalies detected during the surface geophysical investigation. Sample location BS 1 was located approximately 1.6 m (5 ft) west of FS 1 and sample location BS 2 was located northeast of FS 1. The geophysical anomalies identified during site evaluation activities were encountered during the investigative sampling evolution and were consistent with the debris identified during historical site inspections. A metal barrel was removed from sampling location BS 1, and a metal barrel, along with miscellaneous debris were removed from sampling location BS 2. Soil samples were collected from directly beneath the debris, at depths of approximately 1 to 1.2 m (3 to 4 ft) bgs from BS 1 and 0.6 to 0.75 m (2 to 2.5 ft) bgs from BS 2.

Laboratory analysis results for the investigative samples are provided in Table A-1 (Appendix A). Comparison of the analytical results against the RALs (as identified in Table 5-2) confirmed the

[6] PNNL-16939, *Visual Sample Plan, Version 5.0 User's Guide.* Visual Sample Plan is a registered trademark of Pacific Northwest National Laboratory, Richland, Washington.

successful completion of the removal action at the 600-65 waste site based on the results of analytical data reported.

3.1.2 600-65 Waste Site Excavation

Analytical results from the investigative sampling evolution at the 600-65 waste site showed that concentrations of COPCs were less than or equal to RALs, thereby demonstrating compliance with the established RAOs. As a result, excavation was not required at the 600-65 waste site.

3.1.3 Backfill and Revegetation

As described in Sections 2.1 and 5.5.1 of the RAWP backfill and/or contouring may take place at 200-MG-1 waste sites upon concurrence by the signing parties that the RAOs have been attained. The 600-65 waste site achieved the established RAOs without implementation of the RTD alternative; therefore, backfill, contouring, and revegetation activities are not required at this waste site.

3.1.4 Statement of Protectiveness

In accordance with the SAP, the soil at the 600-65 waste site has been sampled, analyzed, and evaluated. The analytical results obtained through investigative sampling demonstrate that contaminant concentrations in the soil at the 600-65 waste site are less than RALs. These results also indicate that residual concentrations will support reasonably anticipated future land use recognized in the EE/CA and Action Memorandum, and demonstrate that residual concentrations of COPCs in soil throughout the site are unlikely to affect groundwater or the Columbia River. As summarized in Section 5, a review of the sampling results shows that the removal action at the 600-65 waste site has demonstrated achievement of the RAOs established in the Action Memorandum and identified in the RAWP.

4 Chronology of Events

A chronology of major events associated with sampling at the subject waste site is presented in Table 4-1. The chronology includes approval of the regulatory documents that form the basis of the removal action and key fieldwork activities associated with the removal action.

Table 4-1. Removal Action Chronology

Date	Event
June 5, 2009	DOE/RL-2008-44, *Engineering Evaluation/Cost Analysis for the 200-MG-1 Operable Unit Waste Sites*, approved
April 15, 2010	DOE/RL-2009-86, Rev. 0, *Action Memorandum for Non-Time-Critical Removal Action for 37 Waste Sites in 200-MG-1 Operable Unit*, approved
April 21, 2010	Draft of DOE/RL-2009-53, Rev. 1, *Removal Action Work Plan for 48 Waste Sites in the 200-MG-1 Operable Unit*, completed and routed for approval
May 20, 2010	Draft of DOE/RL-2009-60, Rev. 1, *Sampling and Analysis Plan for Selected 200-MG-1 Operable Unit Waste Sites,* completed and routed for approval
June 16, 2010	Site evaluation completed
October 7, 2010	DOE/RL-2009-53, Rev. 1 approved
January 10, 2011	DOE/RL-2009-60, Rev. 1 approved
January 19, 2011	Investigative sampling of 600-65 completed
February 15, 2011	Laboratory analytical data evaluation completed

5 Demonstration of Completion

This section addresses the process for demonstrating achievement of performance standards, which include attaining RALs and RAOs and maintaining the required quality control (QC) during removal activities.

5.1 Attainment of Performance Standards

Investigative sampling and analysis confirms that the 600-65 waste site meets the RAOs identified in the Action Memorandum, and residual levels of COPCs remaining in the soil are less than or equal to RALs. As shown in Table 5-1, RAOs 1 and 2 are achieved by preventing unacceptable risk through direct exposure to soils and debris because the soil concentration of COPCs is less than or equal to the RALs. RAO 3 is achieved by preventing migration and/or leaching of radiological and nonradiological contamination to groundwater because the soil concentration of COPCs is less than or equal to the RALs. RAO 4 is met through cultural and ecological evaluation, performed in January 2010, and by the implementation of considerations and recommendations during work activities. Demonstration that soil concentrations of COPCs are less than or equal to RALs (Table 5-2) meets RAOs 1, 2, and 3. Per the methodology prescribed in the RAWP and SAP, investigative sampling of the 600-65 waste site consisted of visual inspection and soil sampling performed in January 2011. The results, provided in Table A-1 (Appendix A), demonstrate that there are no chemical COPCs at concentrations greater than the RALs remaining in soil at the 600-65 waste site, thus meeting the RAOs.

5.1.1 Reported Background Values for Arsenic

Concentrations of arsenic were reported which were greater than the established RAL at FS 1, although arsenic was not considered a COPC for this waste site based on historical information and process knowledge. The reported concentration of 11.1 mg/kg is less than twice the background value of 6.5 mg/kg and does not indicate a source of contamination as illustrated by the variation being within background range (generally defined as a value less than twice the established 90th percentile value); therefore, the concentration is considered consistent with natural background variation, and demonstrates protection of groundwater.

Table 5-1. Summary of Attainment of Cleanup Objectives

Regulatory Requirement	Results	Removal Action Objectives Attained?
RAO 1—Prevent unacceptable risk to human health and ecological receptors from exposure to soils and/or debris contaminated with nonradiological constituents to 4.6 m (15 ft) bgs at concentrations above the appropriate RALs.	Achieved through investigative soil sampling, which demonstrated that all individual COPC concentrations are less than the RALs.	Yes
RAO 2—Prevent unacceptable risk to human health and ecological receptors from exposure to soils and/or debris contaminated with radiological constituents to 4.6 m (15 ft) bgs at concentrations above the appropriate RALs.	Achieved through the radiological survey of soils, conducted during the sampling evolution, which demonstrated that all individual COPC concentrations are less than the RALs as indicated by no measured dose rates greater than background established for the waste site, and no detectable radiological contamination.	Yes

Table 5-1. Summary of Attainment of Cleanup Objectives

Regulatory Requirement	Results	Removal Action Objectives Attained?
RAO 3—Control the sources of groundwater contamination to minimize impacts to groundwater resources, protect the Columbia River from adverse impacts, and reduce the degree of groundwater cleanup that may be required under future actions.	Achieved through investigative soil sampling, which demonstrated that concentrations of COPCs in soil were less than established RALs.	Yes
RAO 4—Prevent adverse impacts to cultural resources and threatened or endangered species, and minimize wildlife habitat disruption.	Achieved through cultural and ecological evaluation and the implementation of considerations during removal activities to minimize wildlife habitat and cultural artifact disruption.	Yes

5.1.2 Performance Standard Documentation

This report addresses the individual 600-65 waste site and not an OU; therefore, this section is not applicable.

5.1.3 Response Action Objectives Verification

RAO performance standard attainment involves comparison of soil analytical data to RALs. The RALs, identified in the Action Memorandum and RAWP, are a direct comparison to the maximum results from the analytical data (Table 5-2). The full set of analytical results from all samples collected is provided in Appendix A.

5.1.4 Contaminant Identification

Table 5-2 provides a direct comparison of investigative sample analytical results for each nonradiological COPC against the established RALs for the 600-65 waste site.

Table 5-2. Comparison of Investigative Sample Results Against Removal Action Levels for Nonradiological Contaminants of Potential Concern

Contaminant of Potential Concern	Background Concentration[a] (mg/kg)	Removal Action Level (mg/kg)	Maximum Concentration in Soil (mg/kg)	Does the Maximum Exceed Removal Action Levels?
Metals				
Antimony	5	5.4	U	No
Barium	132	1,650	83.7	No
Beryllium	1.51	63.2	0.35	No
Boron	NA	210	5.18	No
Cadmium	0.81	0.81[b]	U	No
Chromium (Total)	18.5	2,000	8.29	No
Chromium (VI)[c]	NA	2.1[c]	U	No
Cobalt	15.7	15.7[b]	7.56	No
Copper	22.0	284	14	No
Lead	10.2	250	9.2	No
Lithium	33.5	160	6.5	No
Manganese	512	512[b]	328	No
Mercury	0.33	2.09	U	No
Nickel	19.1	130	9.72	No
Selenium	0.78	5.2	1.57	No
Silver	0.73	13.6	U	No
Strontium	NA	2,920	43.1	No
Thallium	0.1	1.59	U	No
Tin	NA	48,000	0.353	No
Uranium (Soluble Salts)	3.21	3.21[b]	0.511	No
Vanadium	85.1	560	43.6	No
Zinc	67.8	5,970	39.7	No
Polychlorinated Biphenyls				
Aroclor 1016	NA	0.094	U	No
Aroclor 1221	NA	0.017[b]	U	No
Aroclor 1232	NA	0.017[b]	U	No
Aroclor 1242	NA	0.039	U	No

Table 5-2. Comparison of Investigative Sample Results Against Removal Action Levels for Nonradiological Contaminants of Potential Concern

Contaminant of Potential Concern	Background Concentration[a] (mg/kg)	Removal Action Level (mg/kg)	Maximum Concentration in Soil (mg/kg)	Does the Maximum Exceed Removal Action Levels?
Aroclor 1248	NA	0.039	U	No
Aroclor 1254	NA	0.066	U	No
Aroclor 1260	NA	0.5	U	No
Polynuclear Aromatic Hydrocarbons				
Acenaphthene	NA	98	U	No
Acenaphthylene	NA	98	U	No
Anthracene	NA	2,270	U	No
Benzo(a)anthracene	NA	0.86	U	No
Benzo(a)pyrene	NA	0.33[b]	U	No
Benzo(b)fluoranthene	NA	1.37	U	No
Benzo(g,h,i)perylene	NA	2,400	U	No
Benzo(k)fluoranthene	NA	1.37	U	No
Chrysene	NA	9.56	U	No
Dibenz(a,h)anthracene	NA	1.37	U	No
Fluoranthene	NA	631	U	No
Fluorene	NA	101	U	No
Indeno(1,2,3-cd)pyrene	NA	1.37	U	No
Naphthalene	NA	4.46	U	No
Phenanthrene	NA	1,140	U	No
Pyrene	NA	655	U	No
Anion				
Nitrate (as Nitrogen)	11.8	40	28.2	No
Volatile Organic Analyte				
Carbon Tetrachloride	NA	0.005	0.001	No
Total Petroleum Hydrocarbons				
Diesel	NA	2,000	U	No
Kerosene	NA	2,000	U	No

Table 5-2. Comparison of Investigative Sample Results Against Removal Action Levels for Nonradiological Contaminants of Potential Concern

Contaminant of Potential Concern	Background Concentration[a] (mg/kg)	Removal Action Level (mg/kg)	Maximum Concentration in Soil (mg/kg)	Does the Maximum Exceed Removal Action Levels?

a. If Hanford Site-specific background data are not available, values are then taken from Ecology Publication 94-115, *Natural Background Soil Metals Concentrations in Washington State*. Hanford Site background values are available from nonradiological background data in DOE/RL-92-24, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, Table D9-2.

b. Where cleanup levels are less than background or RDLs, cleanup levels default to background or RDLs in accordance with WAC 173-340-700(6)(d), "Model Toxics Control Act—Cleanup," "Overview of Cleanup Standards," and WAC 173-340-707(2), "Model Toxics Control Act—Cleanup," "Analytical Considerations," respectively.

c. Based on process knowledge, chromium (VI) is not expected to be present at 200-MG-1 OU waste sites. The following values are given to help guide cleanup:

- 0.2 mg/kg is the calculated value using K_d=0, based on PNNL-13895, *Hanford Contaminant Distribution Coefficient Database and Users Guide*, and WAC 173-340-747, "Model Toxics Control Act—Cleanup," "Deriving Soil Concentrations for Groundwater Protection," equation 747-1.
- 2.1 mg/kg is based on DOE/RL-96-17, *Remedial Design Report/Remedial Action Work Plan for the 100 Area.*
- 18.4 mg/kg is based on Ecology, 2007, Cleanup Levels and Risk Calculations database.

U = Analyzed for but not detected above laboratory detection limit.

This waste site and the data obtained from the subject investigative sampling evolution will be included in the risk assessment and RI/FS for final remedial decisions of the Outer Area.

5.2 Construction Quality Assurance/Quality Control

No construction related aspects were implemented as part of the selected remedy for the 600-65 waste site; therefore, this section is not applicable.

5.3 Cleanup Verification Quality Assurance/Quality Control

A data quality assessment (DQA) review was performed to compare the sampling approach and analytical data with the sampling and data requirements specified by the SAP. This review involves evaluation of the data to determine if they are of the right type, quality, and quantity to support the intended use (EPA/540-R-00-007, *Soil Screening Guidance for Radionuclides: User's Guide*). The assessment review completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality process.

Level C data validation as defined in the contractor's validation procedures, which are based on EPA functional guidelines (e.g., Bleyler, 1988a, *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses*, Bleyler, 1988b, *Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses*), was performed for the entire sampling and analysis data package for the investigative samples collected for the 600-65 waste site. Level C validation is a review of the QC data and specifically requires verification of deliverables and requested versus reported analyses and qualification of the results based on analytical holding times, method blank results, matrix spikes/matrix spike duplicates, surrogate recoveries, duplicates, and analytical method blanks.

Specific data quality objectives for the site are found in the SAP.

All of the sampling and analysis data generated from the investigative sampling of the 600-65 waste site are tracked through the following Hanford Environmental Information System (HEIS) identification numbers: B28P03/B28NY3, B28P05/B28NY5, B28P06/B28NY6, B28P08/B28NY8, B28P10/B28P00, B28P04/B28NY6, B28P13, and B28P14.

All of the 600-65 waste site sampling and analysis data were found to be useable for decision making purposes as provided in the following summary:

HEIS Identification Numbers—B28P03/B28NY3, B28P05/B28NY5, B28P06/B28NY6, B28P08/B28NY8, and B28P10/B28P00.

Blanks—Equipment blank (B28P13) and field transfer blank (B28P14) were received intact to the laboratory, and holding times were acceptable.

Field Duplicates—The duplicate (B28P04/B28NY6) results were acceptable.

Data Completeness—Analytical reports were submitted for validation and verified for completeness based on the percentage of data determined to be valid (i.e., not rejected). The completion percentage was 100 percent. The data have been determined to be useable for decision making purposes. The final results, narrative supporting the sampling analysis activities and findings, and copies of chains of custody were transmitted in letter reports from the laboratory.

Field Screening—Relative to analytical data in sample media, physical data, and/or field screening results are of lesser importance in making inferences of risk. Because of the secondary importance of such data, no validation for physical property data and/or field screening results was performed. However, field quality assurance (QA)/QC was reviewed to ensure that the data are useable. Field instrumentation, calibration, and QA checks were performed in accordance with the following:

- Calibration of radiological field instruments (such as Geiger-Mueller and portable alpha meters) on the Hanford Site is performed under contract by Pacific Northwest National Laboratory, as specified in their program documentation.
- Daily calibration checks are performed and documented for each instrument used in support of waste site sampling and investigation. These checks are made on standard materials that are sufficiently like the matrix under consideration that direct comparison of data can be made. Daily calibration checks of radiological field instruments were performed by trained and qualified radiological control technicians in accordance with established program requirements.

The review and approval of completed field radiation surveys by the radiological controls organization represents the data validation and usability review for handheld field radiological measurements.

The DQA review for the 600-65 waste site found the analytical results to be accurate within the standard errors associated with the methods, including sampling and sample handling. The data are of the correct type, quality, and quantity to support the intended use. Detection limits, precision, accuracy, and sampling data group completeness were assessed to determine if any analytical results should be rejected because of QA/QC deficiencies. All analytical data were found to be acceptable for decision making purposes. All of the sampling analytical data are stored in HEIS.

5.4 Regulatory Oversight

This document provides a summary of the removal action taken at the 600-65 waste site; it shows a comparison of the data collected to RALs authorized in approved regulatory documents and provides the basis to reclassify the waste site status (see Section 9). Though this report does not require approval by

Ecology or the EPA, concurrence of those agencies is necessary under CERCLA, Section 120, and the Tri-Party Agreement, for determinations concerning follow-on remedial actions. This report is, therefore, provided to the agency(ies) for review, in accordance with the approval process for waste site reclassification, as supporting documentation. Upon approval of the waste site reclassification, a copy of this report shall be maintained in the Administrative Record. No additional regulatory oversight was required for the investigative sampling of the 600-65 waste site.

6 Final Inspection and Certifications

There were no final inspections or certification required in the implementation of the selected alternative for the 600-65 waste site; therefore, this section is not applicable.

7 Operations and Maintenance Activities

This section discusses the operations and maintenance (O&M) for the 600-65 waste site.

7.1 Remedy-Related Operations and Maintenance or Monitoring

There are no O&M activities or monitoring requirements for the 600-65 waste site; therefore, this section is not applicable.

7.2 Institutional Controls

Based on the analyses performed and presented in this report, there are no waste site specific institutional controls required at the 600-65 waste site.

7.3 Five-Year Reviews

Five-year reviews are required by CERCLA for post-ROD remedial actions but do not apply to the 600-65 waste site. This waste site and the data obtained from the subject sampling evolution will be included in the risk assessment and RI/FS for final remedial decisions of the Outer Area.

8 Summary of Project Costs

For the purposes of reporting costs of removal action for the 600-65 waste site, costs are pro rated utilizing an activity/schedule-based methodology (Table 8-1). This method is not considered to be audit quality data. Actual costs for waste site cleanup will continue to be collected for each OU or closure area in accordance with the current cost tracking methodology. These costs will then be included, in accordance with CERCLA requirements, in the response action report for the final remedial action of the OU or closure area.

Table 8-1. Cost Summary

Cost Item	Actual Cost Fiscal Year 2010 ($)	Actual Cost Fiscal Year 2011 ($)	Actual Total Cost ($)
Remedial Action Capital (Construction) Costs	0	0	0
Remedial Action Operating Costs	0	61,500	61,500
Total Remedial Action Cost	0	61,500	61,500
Projected Yearly Operations and Maintenance Cost	0	0	0

9 Waste Site Reclassification

The waste site reclassification form for the subject waste site is proposed and processed in accordance with the procedures and definitions described in TPA-MP-14. Reclassification form 2011-026 for the 600-65 waste site proposes the status of this waste site be changed to "Interim Closed Out." In accordance with RL-TPA-90-0001, *Tri-Party Agreement Handbook Management Procedures*, Guideline Number TPA-MP-14, "Interim Closed Out" status indicates that a site meets the cleanup standards specified in the approved 200-MG-1 Action Memorandum (i.e., the interim removal action decision document). This site will be evaluated under the cleanup standards established for the final ROD for this area.

10 Observations and Lessons Learned

There were no observations or lessons learned applicable for inclusion in this report.

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Appendix A

Sampling Results for the 600-65 Waste Site

A1 Introduction

This appendix contains laboratory analytical results, provided in Table A-1, from the investigative sampling conducted at the 600-65 waste site. Depths provided in the table are below ground surface. Sample numbers are from the Hanford Environmental Information System database.

Table A-1. Analytical Results for Investigative Sampling for Nonradiological Contaminants

Contaminant	Removal Action Level[a] (mg/kg)	Required Detection Limit (mg/kg)	Maximum Reported Laboratory Detection Limit (mg/kg)	Background Concentration[b] (mg/kg)	B28P03 B28NY3 FS 1 0.6 to 0.8 m (2 to 2.5 ft)[c] (mg/kg)	B28P05 B28NY5 FS 1 1.2 to 1.4 m (4 to 4.5 ft)[c] (mg/kg)	B28P06 B28NY6 BS 1 1 to 1.2 m (3 to 4 ft)[c] (mg/kg)	B28P08 B28NY8 BS 2 0.6 to 0.8 m (2 to 2.5 ft)[c] (mg/kg)	B28P10 B28P00 Sample R 1 Surface[c] (mg/kg)
Metals									
Antimony	5.4	0.6	0.295	5	U	U	U	U	U
Arsenic	6.5[d]	1	0.393	6.5	2.47	11.1[e]	2.59	3.65	1.94
Barium	1,650	2	0.196	132	42	82.4	69.2	83.7	56.4
Beryllium	63.2	0.5	0.0491	1.51	U	0.35	0.265	0.28	0.197
Boron	210	2	1.9	NA	4.61	4.75	5.18	4.85	4.95
Cadmium	0.81[d]	0.5	0.0982	0.81	U	U	U	U	U
Chromium (Total)	2,000	1	0.491	18.5	4.48	8.29	8.16	7.69	5.71
Chromium (VI)	NA	0.5	0.47	NA	U	U	U	U	U
Cobalt	15.7[d]	2	0.0491	15.7	4.49	5.89	6.52	7.56	4.14
Copper	284	1	0.0982	22	8.95	11.4	11.8	14	8.07
Lead	250	5	0.0982	10.2	4.16	4.39	9.2	4.86	3.65
Lithium	160	2.5	0.4	33.5	4.2	6.5	5.51	5.49	5.47
Manganese	512[d]	5	0.0982	512	216	263	280	328	223
Mercury	2.09	0.2	0.0491	0.33	U	U	U	U	U
Nickel	130	4	0.196	19.1	5.34	8.83	8.74	9.72	7.18
Selenium	5.2	1	0.295	0.78	1.32	1.21	1.24	1.57	0.696
Silver	13.6	0.2	0.0982	0.73	U	U	U	U	U

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Strontium	2,920	1	0.0982	NA	25.6	43.1	27.8	31	30.6
Thallium	1.59	1	0.0982	0.1	U	U	U	U	U
Tin	48,000	10	0.0491	NA	0.219	0.277	0.353	0.321	0.178
Uranium	3.21[d]	1	0.0491	3.21	0.335	0.511	0.377	0.42	0.275
Vanadium	560	2.5	0.196	85.1	26.5	29.5	39.1	43.6	22.2
Zinc	5,970	1	0.786	67.8	25.9	32.7	39.7	36.6	26.2
Anion									
Nitrate-N	40	0.75	1.5[f]	11.8	U	28.2	U	10.7	U
Polynuclear Aromatic Hydrocarbons									
Acenaphthene	98	0.33	0.036	NA	U	U	U	U	U
Acenaphthylene	98	0.33	0.036	NA	U	U	U	U	U
Anthracene	2,270	0.33	0.036	NA	U	U	U	U	U
Benzo(a)anthracene	0.86	0.33	0.036	NA	U	U	U	U	U
Benzo(a)pyrene	0.33[d]	0.33	0.036	NA	U	U	U	U	U
Benzo(b)fluoranthene	1.37	0.33	0.036	NA	U	U	U	U	U
Benzo(k)fluoranthene	1.37	0.33	0.036	NA	U	U	U	U	U
Benzo(g,h,i)perylene	2,400	0.33	0.34[f]	NA	U	U	U	U	U
Chrysene	9.56	0.33	0.036	NA	U	U	U	U	U

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Dibenzo(a,h)anthracene	1.37	0.33	0.35[f]	NA	U	U	U	U	U
Fluoranthene	631	0.33	0.036	NA	U	U	U	U	U
Fluorene	101	0.33	0.036	NA	U	U	U	U	U
Indeno(1,2,3-cd)pyrene	1.37	0.33	0.35[f]	NA	U	U	U	U	U
Naphthalene	4.46	0.33	0.036	NA	U	U	U	U	U
Phenanthrene	1,140	0.33	0.036	NA	U	U	U	U	U
Pyrene	655	0.33	0.036	NA	U	U	U	U	U
Polychlorinated Biphenyls									
Aroclor 1016	0.094	0.017	0.0059	NA	U	U	U	U	U
Aroclor 1221	0.017[d]	0.017	0.0059	NA	U	U	U	U	U
Aroclor 1232	0.017[d]	0.017	0.0059	NA	U	U	U	U	U
Aroclor 1242	0.039	0.017	0.0059	NA	U	U	U	U	U
Aroclor 1248	0.039	0.017	0.0059	NA	U	U	U	U	U
Aroclor 1254	0.066	0.017	0.0066	NA	U	U	U	U	U
Aroclor 1260	0.5	0.017	0.0066	NA	U	U	0.021	U	U
Volatile Organic Analyte									
Carbon Tetrachloride	0.005	0.005	0.001	NA	U	U	U	0.001	0.001

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Total Petroleum Hydrocarbons									
Diesel	2,000	5	3.4	NA	U	U	U	U	U
Kerosene	2,000	5	3.4	NA	U	U	U	U	U

a. Removal action levels are from DOE/RL-2009-53, *Removal Action Work Plan for 48 Waste Sites in the 200-MG-1 Operable Unit* (RAWP).

b. If Hanford Site-specific background data are not available, values are then taken from Ecology Publication 94-115, *Natural Background Soil Metals Concentrations in Washington State*. Hanford Site background values are available, and nonradiological background data are from DOE/RL-92-24, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, Table D39-2.

c. Surface is 0 to 0.3 m (0 to 1 ft) below ground surface.

d. Where cleanup levels are less than background or required detection limits, cleanup levels default to background or required detection limits per Ecology (1996), WAC 173-340-700(6)(d), "Model Toxics Control Act—Cleanup," "Overview of Cleanup Standards," and WAC 173-340-707(2), "Model Toxics Control Act—Cleanup," "Analytical Considerations," respectively.

e. Arsenic was not considered a contaminant of potential concern for the 600-65 waste site based on process and historical knowledge. Values obtained are consistent with recorded background values for arsenic at the Hanford Site (refer to Section 5.1.1 in the main text of this document).

f. Maximum reported laboratory detection limit is greater than the required detection limit per the RAWP; however, analytical results are less than the established RALs and meet the corresponding RAOs.

NA = not available

U = Analyzed for but not detected above laboratory method detection limit